

Semantic Composition and Presupposition Projection in Subjunctive Conditionals

Michela Ippolito

Received: 29 August 2006 / Accepted: 29 August 2006 / Published online: 20 March 2007
© Springer Science+Business Media B.V. 2007

Abstract The goal of this paper is to offer a compositional semantics for subjunctive and indicative *will* conditionals, and to derive the projection properties of the types of conditionals we consider and in particular those of counterfactual conditionals. It is argued that subjunctive conditionals are “bare” conditional embedded under temporal and aspectual operators, which constrain the interpretation of the modal operators in the embedded conditional. Furthermore, it is argued that a theory of presupposition projection à la Heim together with the present proposal about their logical form explains the projection facts.

Keywords Subjunctive conditionals · Counterfactuals · Tense · Perfect · Presuppositions · Presupposition projection

1 Introduction

The goal of this paper is to provide a compositional semantics for subjunctive conditionals that explains their presupposition projection properties. I take the label ‘subjunctive conditionals’ to refer to those conditionals marked by past or past perfect in the antecedent and *would* or *would have* in the consequent.¹ In order to account for the projection properties of presuppositions in conditionals, Karttunen (1973) proposed a filtering condition according to which any presupposition in the consequent that is entailed by the antecedent is filtered out. The presuppositions that are not filtered out are said to project, i.e. they become presuppositions of the whole conditional sentence.

M. Ippolito (✉)
Department of Linguistics,
University of Toronto,
130 St. George Street, room 6076,
Toronto, Ontario
Canada M5S 3H1

¹ Iatridou (2000) showed that, crosslinguistically, the marker of counterfactuality is not the subjunctive mood but the past morphology.

- (1) Filtering Condition for *if* φ , ψ :
Filter out any presupposition of ψ that is entailed by φ .

The facts that motivated the Filtering Condition are illustrated in the examples below.

- (2) a. If John₁ has children, his₁ children are asleep.
b. If John's₁ children are asleep, it will be quiet.
c. If it is quiet, John₁'s children are asleep.

In (2-a), the presupposition that John has children, triggered by the possessive adjective *his*, occurs in the consequent. Since it is entailed by the proposition expressed by the antecedent, the Filtering Condition requires that it be filtered out, correctly explaining the fact that the presupposition that John has children is not a presupposition of the whole conditional. In (2-b), the same presupposition (triggered this time by the possessive phrase *John's*) occurs in the antecedent: the Filtering Condition correctly predicts that this presupposition will project. Finally, since the presupposition that John has children in (2-c) is not entailed by the antecedent, the Filtering Condition correctly predicts that it will project. No distinction is made by the theory between indicative and subjunctive conditionals: in both cases, the only presuppositions that are filtered out are the presuppositions in the consequent entailed by the antecedent. Presuppositions in the antecedent of a subjunctive conditional always project.

Conceptually, filtering conditions such as (1) explain the projection of presuppositions in the arguments of an operator Op, but are not connected with the truth conditional meaning of Op. To see this, consider the case of conjunction: as (3) shows, presuppositions in conjoined sentences behave like presuppositions in conditional sentences.

- (3) a. John₁ has children and his₁ children are asleep.
b. John's₁ children are asleep and the light is off.
c. The light is off and John₁'s children are asleep.

Therefore, in Karttunen's theory the operators *if ... then* and *and*, which have different truth conditional meanings, share the same filtering rule in (1). ((4) shows the Filtering Conditions for *and*.)

- (4) Filtering Condition for φ and ψ :
Filter out any presupposition of ψ that is entailed by φ .

Heim's context change semantics addresses precisely the issue of the connection between truth conditions and presupposition projection and to a great extent succeeds in deriving the latter from the former.² Elaborating ideas first proposed in Stalnaker (1973, 1974, 1978), Heim (1983) argues that the meaning of a sentence is its context change potential (ccp), a function from contexts to contexts. A context (set) c is the set of worlds compatible with all that the participants in the conversation assume to be true (a state of information). Therefore, updating the context by

² But see Soames (1989) for more on this point.

uttering a sentence S means to add the proposition φ expressed by S to the initial context set, thus eliminating all the worlds in c incompatible with φ . To illustrate how her proposal works, consider first the case of conjunction.

$$(5) \quad c + \varphi \wedge \psi = (c + \varphi) + \psi$$

Successfully updating the context c with the proposition $\varphi \wedge \psi$ means to perform the following operations on the context set c : first, add φ to c so as to eliminate all the $\neg\varphi$ worlds from c ; second, add ψ to $(c + \varphi)$, thus eliminating all the $\neg\psi$ worlds from $(c + \varphi)$. The result is a context set (a state of information) that entails φ and ψ , as predicted by the familiar truth table for \wedge . Now, for any proposition φ , since the operation $c + \varphi$ is only defined if the presuppositions in φ ($\text{ps}(\varphi)$) are entailed by c , the predictions of Heim's theory coincide with those of Karttunen's filtering condition for *and*. Given $(c + \varphi) + \psi$, (i) $\text{ps}(\varphi)$ must be entailed by the main context c (i.e. they project); (ii) $\text{ps}(\psi)$ must be entailed by the intermediate context $c + \varphi$ (if they are entailed by φ , they are satisfied by the intermediate context $c + \varphi$ and do not project).

Let us go back to the case of conditionals. Like with conjunction, the ccp of indicative conditionals generates the right truth conditions while making the same predictions as Karttunen's filtering condition. The following ccp is from Heim (1992).

$$(6) \quad c + (\varphi \rightarrow \psi) = \{w \in c : \text{Sim}_w(c + \varphi) + \psi = \text{Sim}_w(c + \varphi)\}$$

Since φ is added to c , the ccp above captures Stalnaker's idea that the antecedent of an indicative conditional must be compatible with the context set (i.e. what is assumed to be true by the participants in the conversation).³ As for presupposition projection, since φ is added to c , the $\text{ps}(\varphi)$ (if any) will have to be entailed by c (i.e. they project); since the $\text{ps}(\psi)$ must be entailed by the intermediate context $\text{Sim}(c + \varphi)$, if they are not entailed by φ , they must be entailed by c (i.e. they project only if they are not entailed by φ).

Counterfactuals are trickier.⁴ The presuppositions in the antecedent must be entailed by the context to which the conditional is added. Suppose that John had been training to run the Boston marathon for several months when he died. Suppose his trainer, who knew him well, were to utter (7).

$$(7) \quad \text{If John ran the Boston marathon next spring, he would win.}$$

In the context just described, (7) would be infelicitous. Following Musan (1997), I will assume that most predicates carry the presupposition that the subject of

³ See Stalnaker (1975, 1999, 2002) for a discussion of the nature of the context set.

⁴ As for the relation between counterfactuals and subjunctive conditionals, I will assume here what is commonly assumed, that is that counterfactuals are a subset of subjunctive conditionals. There are, however, two types of conditionals that seem to be exceptions in that they are counterfactual but morphologically indicative conditionals. The first exception is indicative conditionals like (i), where the antecedent must be clearly understood to be counterfactual.

(i) If that is a real diamond, I am the Easter Bunny.

The second exception is instantiated by a type of Italian conditionals discussed in Ippolito (2004), which obligatorily use the imperfect indicative in both antecedent and consequent clauses but have a counterfactual meaning nevertheless.

predication is alive or in existence at the time when the predicate is said to be true of the subject. Therefore, the antecedent in (7) presupposes that John will be alive next spring at the time when he is supposed to run the Boston marathon. Karttunen's filtering condition accounts for the infelicity of (7) in the scenario described above, since it requires that the presuppositions in the antecedent be entailed by the context. What about Heim's context change semantics? It does, but with a stipulation.

- (8) For any context c , LF φ :
 $rev_\varphi(c)$, the revision of c for φ , is $\bigcup \{X \subseteq W: c \subseteq X \text{ and } \underline{X + \varphi \text{ is defined}}\}$
- (9) Context change potential for counterfactuals:
 $c + \text{if } \varphi, \text{ would } \psi = \{w \in c : Sim_w(rev_\varphi(c) + \varphi) + \psi = Sim_w(c + \varphi)\}$

Since φ is counterfactual (i.e. it is known or assumed to be false), it cannot be added to c because their intersection would be empty and the whole ccp undefined. In order for the ccp of a counterfactual conditional to be defined, φ must be added to a *revision* of c ($rev_\varphi(c)$), i.e. a superset of c obtained by dropping the assumption(s) in c incompatible with φ (the definition is given in (8)). However, in order to ensure that the $ps(\varphi)$ are entailed by c , we need to add the underlined clause in (8), which stipulates that the $ps(\varphi)$ must be entailed by the revision of c (and consequently by c itself). This stipulation ensures that the revision of the context set will be large enough to be compatible with φ but small enough to entail $ps(\varphi)$. It is because the projection properties of presuppositions in the argument of a certain operator Op should follow from the truth conditional meaning of Op, that counterfactuals raise a problem in Heim's context change semantics. And, the tension between the counterfactuality of the antecedent and the requirement that the presuppositions in it (if any) be part of the common ground, did not seem to be solvable without the stipulation in (8).

Should we abandon the attempt to derive the projection properties of a conditional sentence from its truth conditions and go back to Karttunen's filtering condition in (1)? The problem in doing so is that, although Karttunen's condition accounts for (7), it does not account for the felicity of (10), first discussed in connection with the issue of presupposition satisfaction in Ippolito (2003). Recall our previous scenario: John had been training seriously to win a marathon but he died before he could accomplish his goal. Now, in this context, were John's trainer to utter (10) instead of (7), he would felicitously express his conditional thought.

- (10) If John had run the Boston marathon next spring, he would have won.

I will call counterfactuals like (7) *one-past counterfactuals*, and counterfactuals like (10) (discussed in Dudman (1983, 1984), Ogihara (2002), Ippolito (2003)) *mismatched two-past counterfactuals* ('mismatched' because the past perfect cooccurs with a future adverb). Even though it works for one-past counterfactuals, Karttunen's filtering condition for conditionals does not work for two-past counterfactuals: as observed in Ippolito (2003), despite the incompatibility between the presupposition in the antecedent (that John will be alive next spring) and c , the conditional is felicitous. It would not be correct to explain the infelicity of (7) in the above scenario by claiming that one-past subjunctive conditionals—differently from two-past subjunctive conditionals—cannot be counterfactuals: as (11-a) shows, one-past subjunctive conditionals *can* be counterfactual.

- (11) John is dead.
- a. If John were alive, he would be a hundred years old.
 - b. If John came to Mary's graduation next Sunday, she would be happy.
 - c. If John had come to Mary's graduation next Sunday, she would have been happy.

Since both one-past and two-past subjunctive conditionals can be counterfactual, the difference between one-past and two-past counterfactuals must have to do with presupposition projection.⁵ In one-past counterfactuals, if the antecedent carries any presuppositions, these presuppositions cannot be taken to be false (in the actual world) as shown in (11-b). However, in two-past counterfactuals, the presuppositions in the antecedent (if any), can be known to be false in the actual world, as shown in (11-c).

The contrast between (7) and (10) when uttered in the same context, or the similar contrast between (11-b) and (11-c), shows that not all conditionals obey Karttunen's filtering condition. Furthermore, it shows that the Heimian revision of *c* in (8) is too strong for mismatched two-past counterfactuals. These observations raise the question, central to this paper, of *why* some conditionals seem to obey Karttunen's filtering condition and some don't.⁶

⁵ On why two-past subjunctive conditionals *must* be counterfactual, see Sect. 5 in this paper. For alternative views, see Ippolito (2003), and Ogihara (2002).

⁶ The data in (11-a), and (35) and (36) later in the text, show that one-past subjunctive conditionals can be counterfactual. Speakers, however, find more natural to utter (i-b) rather than (i-a) in a context where it is known that John is well but will not run the marathon:

- (i) John is alive and well, but he has decided not to run the marathon next spring.
 - a. If he ran the marathon next spring, he would win.
 - b. If he [did]_F run the marathon next spring, he would win.

Does this mean that, at least for these speakers, one-past subjunctive conditionals cannot be counterfactual per se (as shown by the fact that they wouldn't utter (i-b) in the above scenario) and that (i-a) is felicitous because focus somehow turns the conditional into a counterfactual? I do not think so, for the following reason.

Focus in the antecedent of a conditional does not require one of the salient alternatives to be true (Rooth, 1992):

- (ii) John is allowed to eat spinach or kale, but if John ate spinach, he would feel sick, and if he ate[kale]_F he would feel worse. So, he will not eat either.

On the other hand, focus does not require the antecedent proposition that John will not eat kale to be counterfactual, as shown in the following example:

- (ii') If John ate spinach, he would feel sick, but if he ate [kale]_F, he would feel well. So, he will probably eat kale.

Now, if any alternative to John's eating kale is salient in the discourse, focus is required, plausibly because, when an alternative is salient, there is a general tendency (maybe a requirement) to presuppose that it is (see the discussion of the "Maximize Presuppositions" principle in Heim (1991) and in Sect. 6.3 in this paper):

- (iii) The doctor decided that John will eat (only) spinach, because if he ate [kale]_F, he would not feel well.
- (iv) The doctor decided that John will not eat kale, because if he [did]_F, he would not feel well.

In (iii), the salient set of alternatives includes the proposition that John will eat spinach. In (iv), it includes the proposition that John will not eat kale (suppose that the set of alternatives includes the propositions that John will eat kale and that John will not eat kale). Now, going back to our original examples in (i), since focus does not require the alternative that John will not run the marathon next spring to be true, it is not focus what makes (i-b) felicitous in a context where it is known that the antecedent is counterfactual. Subjunctive conditionals can be counterfactual independently of focus. However, just like in (iii) and (iv), since the alternative that John will not run the marathon is true, and we are required to presuppose so, focus is required to occur.

To sum up, Karttunen's projection rule for conditionals accounts for indicative conditionals and one-past subjunctive conditionals, but does not cover two-past subjunctive conditionals, for which we would need a new projection rule. Heim's ccp for counterfactuals accounts (even though with a stipulation) for one-past counterfactuals, but cannot be extended to two-past counterfactuals, for which we would need a new ccp (different from the ccp of indicative conditionals and the ccp of one-past counterfactuals).

Like Heim's proposal, the goal of the analysis that I present in this paper is to derive the projection properties of one-past and two-past subjunctive conditionals (and counterfactuals specifically) from their truth conditions, and I will couch my final proposal in context change semantics. I will argue that the differences in the projection properties of indicative conditionals, one-past and two-past subjunctive conditionals depend upon which layers of temporal structure occur above the modal operator: a present tense in indicative conditionals; a present perfect in one-past subjunctive conditionals; a past perfect in two-past subjunctive conditionals. Once we unveil this extra temporal structure, we will be able to (i) claim that these three types of conditionals share a common structure (what I will call a "bare" conditional); (ii) attribute their differences to the different temporal operators that embed this bare structure in each type; (iii) provide a ccp for one-past subjunctive conditionals without the stipulation in (8).

2 The structure of a conditional

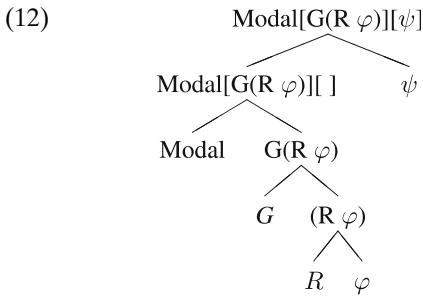
I will first work out the truth conditions of subjunctive conditionals compositionally in possible world semantics since I think this will make the proposal more accessible. Then, I will translate these truth conditions in context change semantics and directly address the issue of presupposition projection. Following Kratzer's work on conditionals, I will assume the following.⁷ First, a conditional forms a tripartite structure where the antecedent (φ) is in the restriction of a (possibly) covert modal operator, and the consequent (ψ) is its nuclear scope.⁸ Second, modality is doubly relative, that is to say, a modal sentence is interpreted relative to two parameters, a *modal base* and an *ordering source*. The modal base is the set of worlds (relevantly) accessible from the evaluation world (the actual world).⁹ The ordering source is a function that ranks the worlds in the modal base where the antecedent is true according to how close they are to some 'ideal' world (i.e. the set of all propositions which are true in it). In order to be as clear as possible about the semantic composition of a conditional (and to make the parallel with the context change potential of a conditional as explicit as possible), I will adopt the architecture in (12) where I have represented the modal base R and the ordering source G as overt variables. The modal operator first combines with $G(R \varphi)$ —its restriction—and then with ψ —its nuclear scope.¹⁰

⁷ Kratzer (1981, 1986, 1991).

⁸ This idea originates in Lewis (1975)'s treatment of adverbs of quantification.

⁹ In this paper, I will use accessibility relations instead of Kratzer's conversational backgrounds (Kratzer 1981, 1991). However, one can be translated into the other. For example, for any conversational background f , we can define the corresponding accessibility relation R_f as in Fintel and Heim (2000): $R_f := \lambda w'. \forall p [f(w)(p) = 1 \rightarrow p(w') = 1]$

¹⁰ Later in the paper and in the Appendix, I spell out the composition rules that are needed for the interpretation of the structures that will be discussed.



If we now reconsider Heim’s ccp for an indicative conditional, we can see that there is a fairly transparent relation between the structure in (12) and Heim’s ccp for indicative conditionals, which I repeat below.

$$(13) \quad c + (\varphi \rightarrow \psi) = \{w \in c : \text{Sim}_w(c + \varphi) + \psi = \text{Sim}_w(c + \varphi)\}$$

In Heim’s proposal for indicative conditionals, the modal base R is c , the context set. The modal base c intersects with φ directly. The ordering source G is Sim , the similarity function: Sim ranks the worlds in $c + \varphi$ according to how similar they are to the evaluation world. Sim combines with its argument $(R \cap \varphi)$ and returns the set of φ -worlds in c that are maximally similar to the actual world (all this will be spelled out formally below). Before I present my proposal, I will review two earlier proposals about the interaction of tense and modals, Ippolito (2003) and Condoravdi (2001), both relevant for the present discussion.

2.1 The time parameter of accessibility relations and previous theories of the interaction of tense and modals

I have used the term *modal base* to refer to the set of accessible worlds, i.e. the set of worlds denoted by an *accessibility relation* interpreted relative to some evaluation parameter. Following Condoravdi (2001) and Ippolito (2003),¹¹ I will assume that, besides a world parameter, accessibility relations also have a time parameter: the set of accessible worlds is the set of worlds w' (relevantly) accessible from the evaluation world w at the evaluation time t . The time parameter is determined by what aspectual and temporal operators the modal operator is immediately in the scope of. I will assume that in subjunctive conditionals, the accessibility relation is *historical*; let us call it HIST . In this model, possible worlds instantiate possibilities and possibilities get foreclosed as time goes by: for any two times t and t' where $t < t'$, the set of possible worlds accessible at t' is a subset of the set of worlds accessible at t . For any foreclosed possibility there is a time in the past when this possibility was open. A world w' is historically accessible from w at t just in case w' shares the same history as w up to (and including) t . For any two worlds w and w' , sharing the same history up to a time t means that all the

¹¹ Some of the ideas developed by these authors go back to Thomason (1984).

facts that occurred in w at any time before and including t occurred in w' too.¹² The meaning of HIST is given in (14).

$$(14) \quad \text{[HIST]}^{c,g,t,w} = \lambda p \in D_{(st)}. \lambda w'. w' \text{ has the same history as } w \text{ up to } t \\ \text{and } p(w') = 1.$$

Therefore, the modal base is the set of worlds w' such that w' has the same history as the evaluation world w at the evaluation time t . When the modal base combines with the antecedent φ , only those worlds w' in the set of accessible φ -worlds will be selected.¹³

Theories of the interaction between modals and tense have been proposed by Condoravdi (2001) and Ippolito (2003), and it will be useful to overview both analyses to see in what ways the present proposal relates to and differs from them. Let us begin with Ippolito (2003), which explicitly connects her analysis of mismatched two-past counterfactuals to the question of presupposition projection in counterfactuals which we raised in the introduction. The present paper builds directly on some of the ideas argued for in Ippolito (2003), but differs from it in some important respects.

Consider again the contrast between a one-past and a mismatched two-past subjunctive conditional.

- (15) a. If John ran the Boston marathon next spring, he would win.
 b. If John had run the Boston marathon next spring, he would have won.

As we pointed out above, if John is dead, (15-a) is not felicitous, whereas (15-b) is. However, if John is still alive, the situation is reversed: (15-b) is not felicitous, whereas (15-a) is. Ippolito (2003)'s proposal goes essentially as follows:

1. In mismatched two-past counterfactuals, the modal is in the immediate scope of a past operator (the second layer of past that we see in two-past subjunctive conditionals such as (15-b) as opposed to the one layer in (15-a)), which binds the value of the time parameter of a metaphysical accessibility relation:¹⁴ $MET(w_c)(t_1)$ will denote the set of historical alternatives to w_c at t_1 , where t_1 is a time earlier than the speech time. The skeletal logical form of a two-past subjunctive conditional is $(\text{PAST}_1(\text{MODAL}(\text{SIM}_{w_c}(\text{MET}_{w_c}(\mathbf{t}_1)(\varphi))))(\psi))$. The conditional asserts that all worlds w that share the same history as w_c up to t_1 , that are maximally similar to w_c , and such that φ is true in w , are ψ worlds.

¹² Among the facts, I include the natural laws: if a natural law L (e.g. the law of gravity) became effective in w at t , then all the worlds historically accessible from w at t (the historical alternatives of w at t) are worlds where L holds. Now, consider w at some time t' before t : since at t' L did not hold yet in w , the set of historical alternatives of w at t' includes worlds where L does not hold at t . Intuitively, if a law L becomes effective in a world w at a time t , those worlds where L does not hold are inaccessible from w at t (and at any time later than t).

¹³ A further restriction is performed by the similarity function. See below.

¹⁴ Note that Ippolito (2003) and Condoravdi (2001) use a time-dependent *metaphysical* accessibility relation which, as far as I can tell, is not different from my historical accessibility relation.

2. In one-past subjunctive conditionals such as (15-a), the modal is not in the scope of a past operator and the value of the time parameter of the accessibility relation is the speech time by default. The logical form is (MODAL (SIM_{w_c}(MET_{w_c}(t_c)(φ)))(ψ)). The conditional asserts that all worlds *w* that share the same history as *w_c* up to *t_c*, that are maximally similar to *w_c*, and such that φ is true in *w*, are ψ worlds.
3. The time that is relevant for the presupposition (felicity condition) of a counterfactual such as (15-a) or (15-b) is *identical* to the value of the time argument of the accessibility relation. Here are the felicity conditions for counterfactuals: (i) the felicity condition of one-past subjunctive conditional requires that the presuppositions in the antecedent be *compatible* with the context set at the *speech time*; (ii) the felicity condition of a two-past subjunctive conditional requires that the presuppositions in the antecedent be *compatible* with the context set at a (salient) *past time*.
4. The fact that (15-b) can only be uttered felicitously when the presupposition that John will be alive next spring does not hold, is explained as a conversational scalar implicature arising from a competition between the presuppositions of (15-a) and (15-b). As we said in part 3, the presupposition of a one-past subjunctive conditional is (A) $ps(\varphi) \cap c_{t_c} \neq \emptyset$ (i.e. the $ps(\varphi)$ must be compatible with the context set at *t_c*—the set of worlds where all the propositions in the common ground at *t_c* are true); the presupposition of a two-past subjunctive conditional is (B) $ps(\varphi) \cap c_{t_{[past]}} \neq \emptyset$ (i.e. the $ps(\varphi)$ must be compatible with the context set at some time before the speech time). Assuming that a context set is the set of propositions *known* to be true by the speaker, and since knowledge is monotonic, it follows that (A) asymmetrically entails (B). Exploiting a principle that requires speakers to maximize presuppositions in their utterances (Hawkins, 1991; Heim, 1991), Ippolito derives that if a speaker S chooses to utter a two-past subjunctive conditional whose presupposition (B) is weaker than (A), the hearer H will infer that S was not in a position to presuppose (A), i.e. that S knows that $ps(\varphi) \cap MET_{w_c, t_c} = \emptyset$.

I will maintain the central idea in Ippolito (2003) that the temporal and aspectual operators that occur in conditionals enter into scopal relations with the modal operator, manipulating the time parameter of the accessibility relation. However, the analysis presented here is different from Ippolito (2003) in several respects.

First, the view in point 2 above is too simplistic, as it does not capture correctly the felicity condition for one-past subjunctive conditionals and does not distinguish between one-past subjunctive conditionals and indicative conditionals. Here is why. Since the time parameter of MET is the speech time, the modal base will be the set of worlds that share the same history as the actual world up to the speech time. Now, if φ—the antecedent—is counterfactual, there cannot be any φ-world in the modal base, and, therefore, the restriction of the modal base will be the empty set. As a result, a subjunctive conditional whose antecedent is counterfactual is incorrectly predicted to be false or vacuously true. To illustrate this problem, consider the counterfactual below and its truth conditions according to Ippolito (2003).¹⁵

¹⁵ For our present purposes, we can ignore the issue of how to interpret the second argument of the comparative morpheme *-er*.

- (16) a. If my father were taller (than he is), I might be taller
 b. $\llbracket \text{If my father were taller (than he is), I might be taller} \rrbracket^{c,g} = 1$ iff
 $\exists w' \in W$ [w' is metaphysically accessible from w_c at t_c and my father is taller (than he is in w_c) in w' and w' resembles w_c no less than any other world metaphysically accessible from w_c at t_c where my father is taller (than he is) \wedge I am taller (than I am) in w']

There is no world metaphysically (i.e. historically) accessible at the speech time where my father is taller than he actually is: this is because in all worlds that share the same history as the actual world up to t_c my father has his actual height. Therefore, the conditional is incorrectly predicted to be infelicitous (or vacuously true).

Second, following Stalnaker's work, it is generally assumed that a context set is not the set of worlds where all the information that is *known* by both S and H and that is part of the common ground is true, but it is the set of worlds where all the information believed by S and H to be true and that is part of the common ground is true. Therefore, according to this standard view, a context set is not knowledge-based but belief-based and, as such, it is not monotonic. In the proposal that I develop in this paper, I will capture Ippolito's idea of monotonicity (necessary to point 5 above) without making the assumption that context sets are knowledge-based. Doing so will allow me to argue for a Gricean account of the contrast between indicative and subjunctive conditionals, while keeping the Stalnakerian view of the context as a doxastic set of alternative. Furthermore, the relation between the time parameter of the accessibility relation and the time relevant for the satisfaction of the presuppositions in the conditional will not have to be stipulated.

To conclude, we cannot maintain Ippolito (2003)'s account of one past subjunctive conditionals since it makes the incorrect prediction that they cannot be counterfactual.

Condoravdi (2001)'s proposal, which I will outline below, is about matrix *might V* and *might have V* sentences and not about counterfactuals. If we extend her proposal for *might V* matrix sentences to those *might V* sentences that occur as consequents of subjunctive conditionals, we see that her analysis turns out to be very similar (in the relevant respects) to Ippolito (2003), and, therefore, is subject to some of the same criticisms we raised for Ippolito's analysis of one-past subjunctive conditionals.¹⁶ Condoravdi (2001) proposes a theory of the interaction of tense and modals in matrix modal sentences to account for the "present perspective" of the conditional in (17) and the "past perspective" of the counterfactual sentence in (18).

- (17) John might win the game.
 (18) At that point, John might (still) have won the game (but he didn't in the end).

According to her proposal, the past perspective of (18) arises when the order between the modal *might* and the perfect *have* is reversed and the perfect has scope

¹⁶ If we do not extend Condoravdi's proposal to *might V* and *would V* consequents of subjunctive conditionals, then her proposal is not subject to the same criticism in that it makes no claims about counterfactuals. The proposals in Condoravdi (2001) and Ippolito (2003) were developed independently.

over the modal. The present perspective in (17) follows from the fact that there is no *have* taking scope over the modal. The logical forms of the two sentences above are represented below in (19) and (20) respectively.¹⁷

- (19) MIGHT(John win the game)
- (20) PERF(MIGHT(John win the game))

These different logical forms will have different truth conditions. Following Mondadori (1978), Condoravdi argues that the sequence *might have*, with the order of heads in (20), is interpreted as the future of a *past*, whereas the sentence with just *might* and the order of heads in (19), is interpreted as the future of a *present*. According to Condoravdi, the accessibility relation R is metaphysical: $R(w)(t)$ is the set of historical alternatives of w at t . Abstracting away from the details of her analysis that do not concern us here, the crucial difference between (19) and (20) lies in the value of t : since there is no PERF in (19) manipulating the time argument of R , t is interpreted as the speech time; in (20), however, since *might* occurs in the scope of PERF, PERF manipulates the time parameter of R and, since PERF is interpreted as a *past tense* (see (22-b) below), t is interpreted as a past time. The meaning of (19) is given in (21). $[t, -)$ designates an interval whose left boundary is t and with no right boundary; $\tau(e, w)$ denotes the “temporal trace” of an eventuality e in w .

- (21) John might win the game.
 $\lambda w \exists w' \exists t' [t' = \text{now} \wedge w' \in R(w)(t') \wedge \exists e$ [[he win the game]
 $(w')(e) \wedge \tau(e, w') \subseteq [t', -)]$

According to (21), *John might win the game* is true just in case there is a world w' that is an historical alternative of the evaluation world w at the speech time such that there is an eventuality of John winning the game in w' whose temporal trace is included in an interval that is open to the right and whose left boundary is now. Since the time parameter of the accessibility relation is now, the modal base is the set of worlds that share the same history as the actual world up to now, i.e. worlds that diverge only in their futures. Now considers (22).

- (22) John might have won the game.
 - a. $\lambda w \exists w' \exists t' [t' \prec \text{now} \wedge w' \in R(w)(t') \wedge \exists e$ [[he win the game]
 $(w')(e) \wedge \tau(e, w') \subseteq [t', -)]$
 - b. **[[PERF]]** = $\lambda P. \lambda w. \lambda t \exists t' [t' \prec t \ \& \ AT(t', w, P)]$

The truth conditions in (22) differ from those in (21) in the value of the time parameter of the accessibility relation: since Condoravdi interprets PERF as a past (see the definition in (22-b)), when the modal is in the scope of PERF, the value of the time parameter is a *past* time. Therefore, (20) is true just in case there is a world w' in the set of historical alternatives of w at some past time t' where there is an eventuality of John’s winning the game included in an interval whole left boundary is t' . This guarantees that the eventuality is located to the future of t' . Suppose we were

¹⁷ As for the embedded propositions, Condoravdi assumes they are tenseless and purports to derive the temporal interpretation of the sentence from the temporal interpretation of the modals; see Condoravdi (2001) for details.

to apply Condoravdi’s analysis to conditionals. Then, her proposal would run into the same objection we raised to Ippolito (2003): since the antecedent acts as the restriction of *might* and the worlds in the modal base must be identical to the actual world up to and including the speech time, it follows that the proposition expressed by the antecedent clause cannot be counterfactual, since there cannot be counterfactual worlds in the modal base. Consider (16) again, where both the antecedent and the consequent clauses are clearly counterfactual. There is no world where my father is now taller than he actually is in the set of worlds that are identical to the actual world up to now. Therefore, Condoravdi incorrectly predicts that this counterfactual conditional should be false.

Before we move to the proposal of this paper, here are some definitions that I will be using in the discussion to follow. I will work in an intensional framework and I will make use of the semantic ontology and modes of composition listed in the Appendix. In counterfactuals, the accessibility relation HIST (of type $\langle\langle st \rangle, \langle st \rangle\rangle$) and the similarity relation SIM (of type $\langle\langle st \rangle, \langle st \rangle\rangle$) have the meanings in (23) and (24). The formula $w'' <_w w'$ in the definition of SIM reads as follows “ w'' is more similar to w than w' ”. The modal operator WOLL (of type $\langle\langle st \rangle, \langle\langle st \rangle, t \rangle\rangle$) is a universal quantifier over worlds whose meaning is shown in (25).

$$(23) \quad [\mathbf{HIST}]^{c,g,t,w} = \lambda p \in D_{\langle st \rangle} . \lambda w' . w' \text{ has the same history as } w \text{ up to } t \text{ and } p(w') = 1.$$

$$(24) \quad [\mathbf{SIM}]^{c,g,t,w} = \lambda p \in D_{\langle st \rangle} . \lambda w' . p(w') = 1 \wedge \neg \exists w'' [p(w'') = 1 \wedge w'' <_w w']$$

$$(25) \quad [\mathbf{WOLL}]^{c,g,t,w} = \lambda p \in D_{\langle st \rangle} . \lambda q \in D_{\langle st \rangle} . \forall w' [p(w') = 1 \rightarrow q(w') = 1]$$

3 One-past subjunctive conditionals

Let us begin with one-past subjunctive conditionals. The basic fact that we want to account for is the following: while the antecedent can be counterfactual, its pre-suppositions (if any) and those in the consequent not entailed by the antecedent (if any) must be (known to be) true in the actual world.

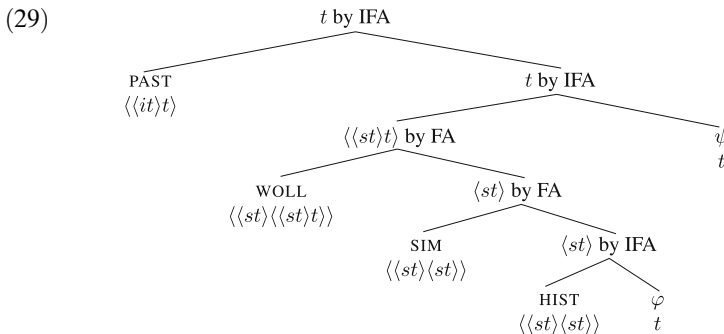
$$(26) \quad \text{John is dead. \#If John ran the Boston marathon next spring, he would win.}$$

This paper has two goals: (i) to tie together the projection properties of one-past subjunctive conditionals and their truth conditions; (ii) to account for the obligatory temporal and aspectual morphology marking subjunctive conditionals in English (and crosslinguistically, as argued at length in Iatridou (2000)). The first two possibilities that I will consider are the ones in (27) and (28), according to which the modal operator occurs in the scope of a PRES and PAST tense, respectively, and I will argue that neither (27) nor (28) is correct.

$$(27) \quad \text{PRES(WOLL(SIM(HIST}(\varphi)))\psi)$$

$$(28) \quad \text{PAST(WOLL(SIM(HIST}(\varphi)))\psi)$$

In (27)—along the lines of Ippolito (2003) and, arguably, Condoravdi (2001)—*would* is analyzed as the abstract modal WOLL and a present tense (PRES) so that the time of the accessibility relation is the speech time. As usual, let φ be the antecedent and ψ the consequent.¹⁸ The higher tense manipulates the evaluation time of HIST, as well as the evaluation times of the antecedent φ and the consequent ψ . On the other hand, in (28) the modal operator WOLL is interpreted in the scope of a past tense.¹⁹ The temporal morphology that obligatorily marks one-past subjunctive conditionals in English and that appears in both the antecedent and the consequent clauses of the conditional, is the morphological reflex of a PAST tense binding the time argument of *hist*, φ and ψ .²⁰



For simplicity’s sake, let us define the PAST as follows.

$$(30) \quad \llbracket \text{PAST} \rrbracket^{c,g,t,w} = \lambda P_{(it)} . \exists t' \prec t : P(t') = 1$$

Neither (27) nor (28) work. We already mentioned why (27) does not work in our discussion of Ippolito’s and Condoravdi’s proposals, but I will repeat here the core of the objection for the reader’s convenience. Since the tense above the modal is PRES, the evaluation time of the accessibility relation, as well as of the antecedent and the consequent clauses, is the evaluation time of the whole structure, i.e. the speech time.

$$(31) \quad \llbracket \text{PRES} \rrbracket^{c,g,t,w} = \lambda P_{(it)} . P(t) = 1$$

Therefore, the truth conditions for (26) will informally say that all worlds historically accessible from the actual world at the speech time, where John will run the Boston marathon next spring, and that are maximally similar to the actual world, are worlds where he will win.²¹

¹⁸ We will see in a moment that both clauses contain a non-past operator NP_{\geq} which manipulates the eventuality time of the proposition.

¹⁹ To the best of my knowledge, nobody proposed the structure in (28) for one-past subjunctive conditionals. The closest proposal that I know of is Iatridou (2000), who suggested that the past morphology that marks “subjunctive conditionals” is not a quirk of their morphology but a necessary ingredient of their interpretation expressing an exclusion feature.

²⁰ The labels FA and IFA stand for Functional Application and Intensional Functional Application respectively. See the Appendix for the relevant definitions.

²¹ According to the truth conditions given below, the evaluation times in the antecedent and consequent are bound by the higher PRES operator, so that both the running and the winning are located to the future of the speech time, independently of each other. For why the eventuality time of the consequent in most cases cannot precede the eventuality time of the antecedent, i.e. why *back-tracking* counterfactuals are generally not possible, see Lewis (1979).

- (32) a. PRES(WOLL(SIM(HIST(NP_≥(λ*t*.John run the Boston marathon next spring at *t*))))(NP_≥(λ*t*.he win at *t*))
 b. **[[If John ran the Boston marathon next spring, he would win]]^{c,g,t_c,w_c}**
 = 1 iff $\forall w' [\exists t' \succeq t_c$ [John will run the Boston marathon in w' at t' and $t' \subseteq$ next spring $\wedge w'$ has the same history as w_c up to t_c and is as similar to w_c as any other accessible world in which John will run the Boston marathon next spring $\rightarrow \exists t'' \succeq t_c$ [he will win in w' at t''].

I need to spend a few words on the temporal interpretation of the antecedent φ and the consequent ψ . Two times play a role in the temporal interpretation of the antecedent and the consequent clauses: the eventuality time and the evaluation time. The eventuality time is the time when the eventuality described by the predicate occurs; this time is bound by the tense in the sentence, which locates the eventuality time with respect to the evaluation time. Take the proposition that John will run the Boston marathon next spring expressed by the antecedent in (26): the eventuality time is the time of the running and this time must be located in the future of the evaluation time, which is the speech time. In order to do this, we postulate a temporal operator in the proposition which manipulates the eventuality time in both the antecedent and consequent clauses. NP_≥—this operator—is a *non-past* operator locating the eventuality in the antecedent (and consequent) in the present or future of the evaluation time. In the structure in (32), since the higher tense is PRES, the evaluation time of NP_≥ in both the antecedent and the consequent clauses is the speech time, so that the time of the running and the time of the winning are located in the future of the speech time.

$$(33) \quad \llbracket \text{NP}_{\geq} \rrbracket^{c,g,t,w} = \lambda P_{(i,t)} . \exists t' [t' \succeq t \text{ and } P(t') = 1]$$

Now, many have argued that sentences with quantifiers presuppose that the restriction of the quantifier is not empty.²² If this presupposition is not met by the context of utterance, then the sentence is infelicitous.

- (34) **No Empty Restriction.** The restriction of a quantifier cannot be empty.

Since a conditional sentence is a quantified structure where the modal operator is the universal quantifier over possible worlds, the presupposition above requires that there be some antecedent world accessible at the speech time, i.e. it requires that the antecedent not be counterfactual. However, as we saw above, this is too strong: one past subjunctive conditionals can be counterfactual.

- (35) If John ran the Boston marathon next spring – which he won't – he would finally win.
 (36) If John were awake now – which he is not – he would be watching the baseball game.

Both conditionals above are felicitous despite the fact that there is no antecedent world historically accessible at the speech time (i.e. antecedent worlds are

²² Fintel (1994), Beaver (1995), and others. I will leave open for the time being the question of whether I take this presupposition to be a semantic or merely a pragmatic presupposition.

foreclosed at the speech time).²³ What (27) does seem to capture are the truth and felicity conditions of *indicative* conditionals, which indeed cannot be counterfactual, but clearly this is not correct for subjunctive conditionals. This rules out the simple view of one-past subjunctive conditionals in (27).²⁴

Let us now turn to (28), where the modal operator occurs in the scope of a past operator which binds the time argument of the accessibility relation. The truth conditions for the logical form in (37-a) are given in (37-b).

- (37) a. PAST(WOLL(SIM(HIST(NP_≥(λ*t*. John run the Boston marathon next spring at *t*)))(NP_≥(λ*t*. he win at *t*)))
- b. **[If John ran the Boston marathon next spring, he would win]**^{*c, g, t_c, w_c*}
 = 1 iff ∃*t'* < *t_c* [∀*w'* [∃*t''* ≥ *t'* [John will run the Boston marathon in *w'* at *t''* and *t''* ⊆ next spring ∧ *w'* has the same history as *w_c* up to *t'* and is as similar to *w_c* as any other accessible world where John will run the Boston marathon next spring → ∃*t'''* ≥ *t'* [he will win in *w'* at *t'''*]]].

There are two problems with this analysis. The first problem is that since the evaluation time is past and the eventuality times of the antecedent and the consequent clauses are only required to be non-past relative to the evaluation time, the eventuality time is in principle allowed to be non-past relative to the evaluation time but past relative to the speech time. This semantics incorrectly predicts that a past adverbial should be able to occur in a one-past subjunctive conditionals (**If Jack were alive yesterday, he would come to the ceremony*). The second problem is that this analysis does not account for the contrast between the felicity of the counterfactual in (38) and the infelicity of the counterfactual in (39) because it cannot derive the fact that the presuppositions in the antecedent must not be known to be false, even when the antecedent itself is known to be counterfactual.

- (38) John is alive.
 If John ran the Boston marathon next spring—which he won't—he would win.
- (39) John is dead.
 # If John ran the Boston marathon next spring, he would win.

Consider first the unproblematic counterfactual in (38). *If John ran the Boston marathon next spring, he would win* is true in *w_c* at *t_c* just in case at some past time *t'* the conditional [If John runs the Boston marathon at some time after *t'* next spring, he wins at some time after *t'*] was true in *w_c*. By hypothesis at the speech time the possibility that John will run the Boston marathon next spring is (taken to be) already foreclosed (cf. the phrase *which he won't*); therefore, for the sentence to satisfy (34) (or for it not to be vacuously true), the domain of the modal operator must be the set of worlds historically accessible at some past time when it was still

²³ See footnote 6.

²⁴ Note that, assuming historical accessibility, even if we were not to make the assumption in (34), we would still get the odd prediction that modal sentences whose antecedent is false are vacuously true. Regardless of what the consequent is, a conditional with a counterfactual antecedent would always be true.

possible that John would run the Boston marathon next spring. Therefore, let us suppose that the past time t' is some time just before the time when the possibility of him running the Boston marathon next spring got foreclosed. Because the time parameter of HIST is determined by PAST, the operation of semantically combining φ (the proposition that John will run the Boston marathon next spring) with $\text{HIST}_{w_c, t'}$ (the set of worlds metaphysically accessible at the past time t') is only defined if the presupposition of φ is entailed by $\text{HIST}_{w_c, t'}$. This amounts to requiring that φ 's presuppositions be true in all worlds that are historically accessible from w_c at t' . Therefore, for the conditional to be felicitous, it is required that it is true at t' that John will be alive next spring.

A short digression is in order here. Given the definition of historical accessibility that we are using, unless its truth is determined by the past facts, a proposition that is about a time later than t' cannot be entailed by the set of worlds historically accessible at t' . This is because the 'future' in our model is by definition the representation of all possibilities compatible with that history: so, unless a proposition p or its negation are determined by the past, both p and $\neg p$ are instantiated in the future of t' .²⁵ Therefore, unless the presuppositions in φ are completely determined by the actual history up to t' , the requirement that they be entailed by $\text{HIST}_{w_c, t'}$ can be satisfied only through accommodation. But there are restrictions on what can be accommodated. In particular, because the goal of accommodation is to be able to interpret a discourse, it makes sense to suppose that a proposition p can be accommodated into a given context c (a set of worlds) only if p is compatible with that context. That is, p can be accommodated into c only if $c \cap p \neq \emptyset$. Going back to (38), there were worlds historically accessible at t' where John is alive today but die, for example, tomorrow: therefore, technically the presupposition that John will be alive next spring is not entailed (in fact, as we said, it could not be) by the set of worlds accessible at t' . This, however, does not seem to cause the sentence to be infelicitous: this world (where John dies tomorrow, for example) is simply 'ignored' to ensure that the modal base $\text{HIST}_{w_c, t'}$ has the right entailments. We do that by locally accommodating φ 's presuppositions into $\text{HIST}_{w_c, t'}$.²⁶ But accommodation is only possible if φ 's presuppositions are at least compatible with $\text{HIST}_{w_c, t'}$.

Now, back to (39). $\text{HIST}_{w_c, t'}$, where t' is the past time just before the possibility that he would run the Boston marathon was foreclosed, must contain worlds where John runs the Boston marathon next spring. Intuitively, with the truth-conditions given in (37-b), and since we must allow local accommodation to account for (38), we have no explanation for the infelicity of (39): we locally accommodate the presupposition

²⁵ Put differently, a proposition is entailed by the set of worlds historically accessible at t if that proposition is about a time before t or if it is completely determined by the actual history up to t , since all the worlds historically accessible at t are by definition worlds that share the same history up to t .

²⁶ Incidentally, notice that this is true for *will* indicative conditionals too, and it is not a quirk of subjunctive conditionals. Consider the following example, where the presupposition in the antecedent is that you will be a smoker at some time immediately before the time when you are supposed to quit.

- (i) If you quit smoking in 10 years, your lungs will not be able to recover.

When I utter (i), neither is it required that it is now true that you will be a smoker in 10 years from now, nor is it required to be entailed by the common ground that you will be a smoker then. Indeed, I may be uttering (i) in order to convince you that you should quit smoking now or as early as possible, so I cannot be presupposing that you will smoke for 10 more years. All that is required is that it is possible now that you will keep smoking for 10 more years. Accommodation does the rest.

that John will be alive next spring, and incorrectly predict that the counterfactual should be felicitous. In other words, we have no account for why the presuppositions in the antecedent of a one past subjunctive conditional must not be (known to be) incompatible with the actual world at the *speech time*.

To conclude, we have found problems with the theory according to which *would* in a one-past subjunctive conditional is to be analyzed as PRES(WOLL) and with the theory according to which it should be decomposed into PAST(WOLL). In one-past subjunctive conditionals the time argument of the historical accessibility relation can neither be the speech time nor a past time.

4 The modal in the scope of the PERFECT

We need a slightly more complex theory. My proposal is that in a one-past subjunctive conditional the modal operator WOLL occurs in the scope of a *present perfect*, more specifically a universal present perfect (UPP). Following current research, I will adopt a clausal architecture where tense, perfect and aspect are functional heads and where an occurrence of a universal perfect must be decomposed into the following three pieces: a tense, a perfect and an aspect.²⁷

According to the classical Extended Now analysis of the perfect (Dowty, 1979, 1982; McCoard, 1978), the perfect locates a certain eventuality within a certain interval, the Extended Now interval. More formally, the perfect introduces an interval whose final subinterval is given by the c-commanding tense (the present in the case of the present perfect, the past in the case of the past perfect) and predicates a property of time of this interval. The aspect below—either universal or existential—quantifies over the interval introduced by the perfect. I will follow the Dowtian Extended Now tradition, and I will adopt the version of the definition of PERF in (40).²⁸ The logical form for a universal perfect sentence will be PRES(PERF(\forall_{\subseteq} (VP))), where PRES is the tense, PERF is the perfect, and \forall_{\subseteq} is the aspect.²⁹

$$(40) \quad [\mathbf{PERF}]^{c,g,t,w} = \lambda P \in D_{(it)}. \lambda t'. \exists t'' [XN(t'', t') \wedge P(t'') = 1]$$

XN(t'', t') means that t' is a final subinterval of t'' .

$$(41) \quad [\forall_{\subseteq}]^{c,g,t,w} = \lambda P. \lambda t'. \forall t'' \subseteq t' : P(t'') = 1.$$

For reasons that will become clear in the discussion of two-past subjunctive conditionals, I interpret tense as referential, according to the proposals advocated by Partee (1973), Enç (1986), and Kratzer (1998). In particular, I will adopt Heim’s presuppositional version of the referential analysis of tense, according to which tense refers to a contextually salient time satisfying the presupposition encoded in its

²⁷ See A. Alexiadou, M. Rathert and A. von Stechow *Perfect Explorations* for a very recent collection on the semantics of the perfect.

²⁸ (40) is an intensional version of the Dowtian definition of the perfect in Alexiadou, Rathert, von Stechow (2003). Alexiadou, Rathert, von Stechow (2003)’s definition of the perfect, as well as its intensional version in (40), are very close to Dowty’s original definition of the operator, but they simplify it slightly. Other implementations of the Extended Now idea, e.g. Iatridou, Anagnostopoulou, and Izvorski (2001) and Fintel and Iatridou (2002), would work as well.

²⁹ For example, the universal perfect sentence *John has been living in Boston* has the logical form PRES(PERF(ING(John lives in Boston))). Given the meanings in (40), (41) and (42), the truth conditions will be: $\exists t'(XN(t', t_c) \wedge \forall t'' \subseteq t' (John \text{ lives in Boston at } t''))$.

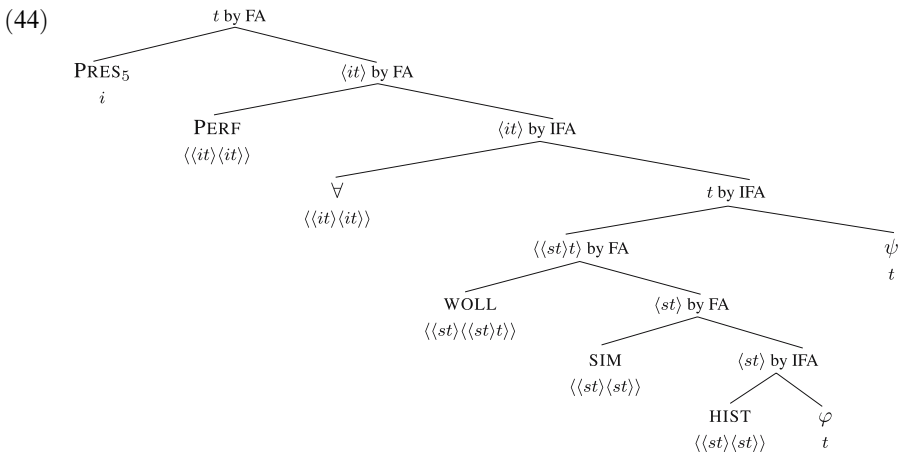
feature (Heim, 1994). The meaning of the present tense will be as follows (‘O’ means ‘overlaps’).

$$(42) \quad \llbracket \text{PRES}_5 \rrbracket^{c,g,t,w} \text{ defined only if } g(5) \text{ O } t; \text{ if defined, } \llbracket \text{PRES}_5 \rrbracket^{c,g,t,w} = g(5)$$

The logical form of a one-past subjunctive conditional is (43): the modal structure is embedded under a UPP, where the tense is PRES, the perfect is PERF, and the aspect is \forall_{\subseteq} .

$$(43) \quad \text{PRES(PERF}(\forall_{\subseteq}(\text{WOLL}(\text{SIM}(\text{HIST}(\varphi))))(\psi)))$$

The universal quantifier \forall_{\subseteq} that quantifies over the subintervals of the perfect interval binds the time parameter of the historical accessibility relation (and the evaluation times of φ and ψ). As shown in (44) one-past subjunctive conditional is a (bare) conditional under the structure of a UPP.



Given the structure above, the truth-conditions for the subjunctive conditional *If John ran the Boston marathon next spring, he would win* will be as in (45).³⁰

$$(45) \quad \llbracket \text{If John ran the Boston marathon next spring, he would win} \rrbracket^{c,g,w_c,t_c} \text{ defined only if } g(5) \text{ O } t_c; \text{ if defined, } \llbracket \text{If John ran the Boston marathon next spring, he would win} \rrbracket^{c,g,w_c,t_c} = 1 \text{ if } \exists t': \text{XN}(t', g(5)) \wedge \forall t'' \subseteq t' [\forall w' [w' \text{ is historically accessible from } w_c \text{ at } t'' \wedge \exists t''' \supseteq t'' \text{ s.t. John will run the Boston marathon at } t''' \text{ in } w' \text{ and } t''' \subseteq \text{next spring} \wedge \neg \exists w'' : [w'' \text{ has the same history as } w_c \text{ up to } t'' \text{ and } \exists t'''' \supseteq t'' \text{ s.t. John will run the Boston marathon at } t'''' \text{ in } w'' \text{ and } t'''' \subseteq \text{next spring } w'' \text{ is overall more similar to } w_c \text{ than } w'] \rightarrow \exists t'''' \supseteq t'' \text{ s.t. he will win at } t'''' \text{ in } w']]$$

There is an interval t' whose final subinterval is the speech time (the evaluation parameter of the whole structure) such that at each of its subinterval t'' the following holds: all possible worlds w' (i) sharing the same history as the actual world w_c up to t''

³⁰ In the Appendix, I give a derivation of the truth-conditions given in (45) and the modes of composition used.

and (ii) where it is true that there will be a time later than t'' , and within next spring, when John will run the Boston marathon and (iii) that are maximally similar to w_c , are worlds where there is a time later than t'' when John will win the Boston marathon. The evaluation time of the historical accessibility relation (as well as the evaluation time of the future operator in the antecedent and consequent clauses) is bound by the universal quantifier \forall_{\subseteq} , which quantifies over the subintervals of the perfect operator.

Recall that one of the objections we raised in Sect. 3 against having only a past operator above the modal operator in a one-past subjunctive conditional is that that analysis incorrectly predicts that a past adverbial could occur in a one-past subjunctive conditional.

- (46) *If Jack were alive yesterday, he would come/have come to the ceremony.

The *perfect* analysis does not run into this problem and explains the ungrammaticality of (46). How? To evaluate the truth of a one-past subjunctive conditional *if* φ , *would* ψ is to evaluate the truth of the bare conditional *if* φ , ψ at each subinterval of a perfect interval abutting the speech time. For example, the one-past subjunctive conditional in (46) is true just in case at each subinterval t in the perfect interval, the bare conditional *if there is a time later than t within yesterday when Jack is alive, there is a time later than t when Jack comes to the ceremony* is true at t . Since one of these subintervals is the speech time t_c , that conditional will have to be true at t_c , i.e. it will have to be true that *if there is a time later than t_c and within yesterday when Jack is alive, there is a time later than t_c when Jack comes to the ceremony*. But the proposition expressed by the antecedent is contradictory, since there cannot be a time that occurs after the speech time and that is contained within yesterday. Therefore, the short answer to the question about the ungrammaticality of (46) is that an indexical past adverbial cannot occur in a one-past subjunctive conditional because, since the speech time is the right boundary of XN and the antecedent is evaluated with respect to each subinterval of XN, the eventuality time of the antecedent must be non-past with respect to the whole XN, including t_c .³¹

To sum up, a one-past subjunctive conditional *if* φ , *would* ψ is true in w at t just in case for all subintervals t'' of the perfect interval t' , the bare conditional *if* φ , ψ is true at t'' . Contrary to Ippolito (2003), I have argued that a one-past subjunctive conditional should be decomposed into (i) a bare modal structure (WOLL(. . .)) and (ii) a UPP (in turn decomposable into three pieces: PRES, PERF, \forall_{\subseteq}) above it. In light of this change and in light of the presupposition facts to be discussed in Sect. 6, the analysis of two-past subjunctive conditionals should also be changed as well, as I argue in the next section.

³¹ That the contradiction is generated by an indexical past adverbial (that is, an adverbial referring to some time before the speech time) and not simply a relative past adverbial (that is, an adverbial referring to a time before some other salient time), is shown by the following contrast:

- (i) John will leave in seven days, but
- a. *if he left two days ago, he would save/have saved a hundred dollars.
 - b. if he left two days before, he would save a hundred dollars.

5 Two-past subjunctive conditionals

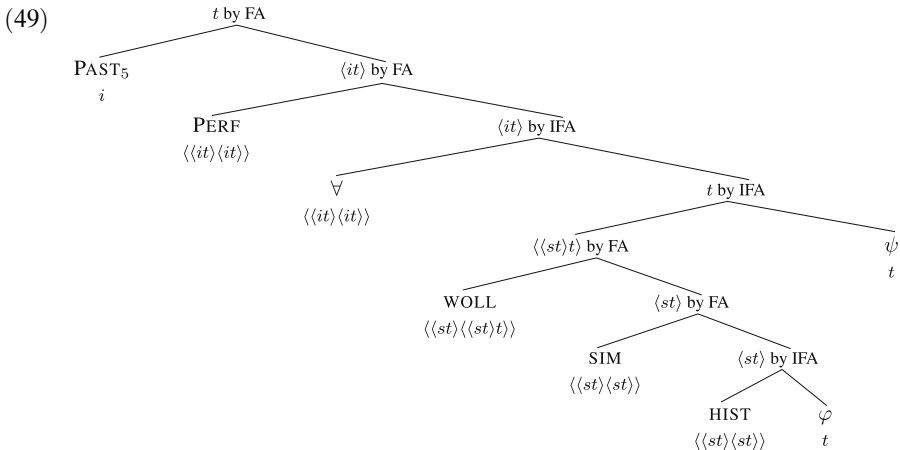
Consider our earlier example.

- (47) If John had run the Boston marathon next spring, he would have finally won.

The logical form of (47) is the following.

- (48) $PAST(PERF(\forall_{\subseteq}(WOLL(SIM(HIST(\varphi))))(\psi)))$

The sentence is analyzed as a bare conditional structure in the scope of a universal *past perfect*. The difference between one-past subjunctive conditionals and two-past subjunctive conditionals lies in the right boundary of XN, i.e. the speech time in the former, a past time in the latter. Because the right boundary of XN in a two-past subjunctive conditional is a past time, the whole interval lies in the past of the speech time. The structure that we need to assume to compute the meaning of (47) is (49).



For reasons that I will spell out shortly, the occurrence of the past tense in (mismatched) two-past subjunctive conditionals must be interpreted as a referential occurrence of tense. The past tense presupposes that there is a contextually salient past time and it denotes it, as shown in (50).

- (50) $[[PAST_5]]^{c,g,t,w} = \text{defined only if } g(5) < t; \text{ if defined, } [[PAST_5]]^{c,g,t,w} = g(5)$

A two-past subjunctive conditional is a bare conditional embedded under the structure of a universal past perfect, i.e. a bare conditional evaluated at each sub-interval of this past interval. The truth conditions are given in (51).

- (51) **[[If John run the Boston marathon next spring, he would have won]]**^{c,g,w_c,t_c} defined only if $g(5) < t_c$; if defined, **[[If John had run the Boston marathon next spring, he would have won]]**^{c,g,w_c,t_c} = 1 if $\exists t' : XN(t', g(5)) \wedge \forall t'' \subseteq t' [\forall w' [w' \text{ is historically accessible from } w_c \text{ at } t'' \wedge \exists t''' \supseteq t'' \text{ s.t. John will run the$

Boston marathon at t''' in w' and $t''' \subseteq \text{next spring} \wedge \neg \exists w''$: [w'' has the same history as w_c up to t'' and $\exists t''' \succeq t''$ s.t. John will run the Boston marathon at t''' in w' and $t''' \subseteq \text{next spring} \wedge w''$ is overall more similar to w_c than w'] $\longrightarrow \exists t''' \succeq t''$ s.t. he will win at t''' in w']

There is an interval t' whose final subinterval is a contextually salient past time (the evaluation parameter of the whole structure) such that at each of its subinterval t'' the following holds: all possible worlds w' (i) with the same history as the actual world w_c up to t'' and (ii) where it is true that there will be a time later than t'' , and within next spring, when John will run the Boston marathon and (iii) that are maximally similar to w_c , are worlds where there is a time later than t'' when John will win the Boston marathon.

The function of the past tense is to provide a contextually salient past time that will act as the right boundary of the XN interval. A two-past subjunctive conditional is not felicitous out of context. In particular, as (52) and (53) show, it is felicitous when the context entails that the antecedent is counterfactual.

- (52) (Context: John had always wanted to meet his father Jack, from whom he was separated at birth.)
 A: John died last month.
 B: How terrible. If (only) he had come to my graduation next summer, he would have finally met his father after all these years.
- (53) #I don't know whether John will play next week, but if he had played then, we would have certainly won.

In (52), the context has made salient the past time of John dying, when the possibility that he would come to the speaker's graduation next summer got foreclosed. We can assume that, by making this eventuality salient, we made salient the interval when the change of state occurred, including both the time immediately preceding John's death as well as the onset of the state of John's being dead. Now, the proposal is that the past tense denotes the past time immediately preceding John's death, a time that is made contextually salient by mentioning John's death. It is this past time that will act as the right boundary of the XN interval, an interval within which φ -worlds were still historically accessible. The fact that a two-past subjunctive conditional is felicitous only in contexts where the counterfactuality of the antecedent is salient, can be construed in the referential theory of tense we have adopted as a presupposition associated with the past tense requiring it to denote a past time immediately before the time when the possibility expressed by the antecedent got foreclosed. This can be implemented rather easily in the present system by adding a "counterfactuality" condition to the definition of the past in (50), as shown in (54).³²

³² It should be noted, however, that the way in which the counterfactuality is presupposed in the present system is different from the way proposed by Ogihara (2002). According to Ogihara, the two-past subjunctive conditional *If John had run the Boston marathon next spring, he would have finally won* presupposes the truth of some salient proposition of the form *John ran the Boston marathon at some time t*, where t is a time before the speech time. This conditional, though clearly does not presuppose the truth of any such proposition. See Ippolito (2003) for a detailed critical discussion of Ogihara's proposal.

- (54) $[[\mathbf{PAST}_5]]^{c,g,t,w}$ = defined only if (i) $g(5) < t$ and (ii) $\exists w_1 [w_1 \in HIST(g(5)) \wedge \varphi$ is true in $w_1] \wedge \exists t_3 [g(5) \ll t_3 \wedge \neg \exists w_2 \in HIST(t_3) \wedge \varphi$ is true in $w_2]$;
if defined, $[[\mathbf{PAST}_5]]^{c,g,t,w} = g(5)$

To sum up the discussion so far, I have proposed that in order to understand the differences between the truth and felicity conditions of different types of subjunctive conditionals, we need to understand how time and modality interact in each type of conditional. I have proposed that subjunctive conditionals are to be analyzed as bare conditionals embedded under the temporal structure of a universal perfect: a present perfect in the case of one-past subjunctive conditionals, a past perfect in the case of two-past subjunctive conditionals. The evaluation time in the accessibility relation, as well as the evaluation time of both the antecedent and the consequent clauses, is bound by the aspectual operator in both cases, and the higher tense determines the value of the right boundary of XN introduced by the perfect operator. Because the bare conditional embedded under this temporal structure is evaluated at each time in XN, and because I am assuming that possibilities get foreclosed as time goes by, different XNs will determine which sets of accessible worlds are selected and, therefore, will determine different truth and felicity conditions for one-past and two-past subjunctive conditionals.

With the truth conditions for one-past and two-past subjunctive conditionals in our hands, let us turn to the presupposition projection facts we discussed at the very beginning, and let us reanalyze the projection puzzles in light of the previous discussion.

6 Quantification over times and presupposition projection

In what follows, I will derive the presupposition facts that we observed at the beginning of this article from the quantificational structure that I have proposed in the preceding sections. Reconsider the contrast between the possibility that the antecedent is counterfactual (example (55)) and the requirement that the presuppositions in the antecedent (if any), be entailed by the context (example (56)).

- (55) John will not run the Boston marathon next spring, but ...
if he did, he would win.
- (56) John is dead, but ...
if he ran the Boston marathon next spring, he would win.

Presuppositions triggered in the nuclear scope of a quantifier cannot act as domain restrictors for the quantifier. This is essentially what the presupposition projection theory in Heim (1983) derives (see below for a summary of Heim's proposal), and what Beaver (1994) and Beaver (2001), among others, discuss at length. The following examples are from Beaver (2001).³³

³³ Beaver (2001) discusses these examples in the context of arguing against the availability of intermediate accommodation, defended by van der Sandt (1992).

- (57) How many team members and cheerleaders will drive to the match?
Few of the 15 team members and none of the 5 cheerleaders can drive, but **every team member will come to the match in her car**. So expect about 4 cars.
- (58) How many of your employees with company cars had problems with their car radiators last year?
Although few of the sales staff had any problems with their cars last year, **all of the management discovered that their car radiators had sprung a leak**. # However, most of the management didn't have a single problem with their car radiator the whole year: they are generally quite conscientious about car maintenance.

The problem with the discourses in (57) and (58) is that, because the presuppositions triggered by the possessive DPs *her car* and *their car radiators* are required to project universally, the only available reading for the sentence in bold in (57) is one where every team member has a car, and the only available reading for the bold sentence in (58) is one where all of the management had problems with their car radiators. Since the contexts do not warrant these presuppositions, the sentences are infelicitous.

However, what is relevant to the present discussion is the observation that the No Empty Restriction requirement discussed above does not behave like a semantic presupposition. Consider the existential presupposition of a universal quantifier in the scope of another universal quantifier, which is the configuration in which the universal quantifier over subintervals and the universal quantifier over worlds are in the modal structure in (44).

- (59) The party for the graduating class this year will be held in the department. Only few graduate students have pets in this department but, for health reasons, it was decided that **every graduate student will leave every pet of his at home for the party**.

The possessive in the lower quantifier, *his*, is bound by the higher quantified phrase *every graduate student*. The felicity of this discourse suggests that the existential requirement of *every pet of his* that there be some pet of x , where x is the bound variable *his*, does act as a domain restrictor of the higher quantifier, which is then interpreted as *every graduate student x such that there is a y that is a pet of x* . If the existential requirement were a semantic presupposition triggered by the lower universal quantifier, we would expect it to behave just like any other presupposition triggered in the nuclear scope of the higher quantifier, and, consequently, we would expect it not to act as a domain restrictor. Therefore, we would expect *every student* not to be restricted to just those students who have pets; we would expect the presupposition in its nuclear scope to project universally; and we would expect the sentence to be infelicitous since the context does not warrant that presupposition. But the felicity of (59) tells us that this existential requirement does not act like a semantic presupposition. If we take this existential requirement to be a mere pragmatic presupposition, the felicity of (59)

is not a mystery: there is simply no semantic existential presupposition in the sentence.

Suppose that it is not an acceptable conversational move to make vacuously true assertions. When an assertion is made, the participants in the conversation are required to make all those assumptions needed in order not to make that assertion vacuously true. Now, given the logical form of the clause in italics in (59), it is sufficient for this purpose that the participants in the conversation will assume that there is at least some graduate student who has at least some pet.

$$(60) \quad \forall x(x \text{ is a graduate student} \rightarrow (\forall y ((y \text{ is a pet} \wedge y \text{ belong to } x) \rightarrow x \text{ will leave } y \text{ at home})))$$

Given the truth-table for the material conditional, for the speaker to be making a non-trivially true assertion when making his utterance, the restrictions of both universal quantifiers must be non-empty. But this requirement is independent of the semantics of quantifiers: it is a pragmatic requirement motivated by the need to make relevant and informative utterances in conversation.³⁴

Now, the fact that in subjunctive conditionals the antecedent itself may be counterfactual (cf. (34)), i.e. the fact that the antecedent does not have to be possible at the speech time, naturally follows from the idea that the existential requirement of quantifiers (cf. (34)) is not a semantic presupposition but merely a pragmatic presupposition. To see this, reconsider the truth conditions we gave for the one-past subjunctive conditional *If John ran the Boston marathon next spring, he would win*. I have underlined the two universal quantifiers which occur in a configuration analogous to the one in (60).

$$(61) \quad \llbracket \text{If John ran the Boston marathon next spring, he would win} \rrbracket^{c,g,w_c,t_c} = 1 \text{ iff } \exists t' : \text{XN}(t', t_c) \wedge \forall t'' \subseteq t' [\forall w' [w' \text{ is historically accessible from } w_c \text{ at } t'' \wedge \exists t''' \succeq t'' \text{ s.t. John will run the Boston marathon at } t''' \text{ in } w' \text{ and } t''' \subseteq \text{next spring} \wedge \neg \exists w'' : [w'' \text{ has the same history as } w_c \text{ up to } t'' \text{ and } \exists t'''' \succeq t'' \text{ s.t. John will run the Boston marathon at } t'''' \text{ in } w'' \text{ and } t'''' \subseteq \text{next spring} \wedge w'' \text{ is overall more similar to } w_c \text{ than } w'] \rightarrow \exists t'''' \succeq t'' \text{ s.t. he will finally win at } t'''' \text{ in } w']]$$

If the requirement that the domain of the modal operator \forall_w not be empty is not a semantic presupposition, it will not be expected to behave according to (59) and to project universally. It follows that, for the sentence to be felicitous, we won't require that at *each* subinterval of XN there be a historically accessible world where it is true that John will ran the Boston marathon next spring. Analogously to (59), what we will require in order not to make a trivially true statement is just that there be (at least) *some* subinterval of XN such that there is some world historically accessible at that time where it is true that John will run the Boston marathon next spring. Crucially, this time does not have to be the speech time, when that possibility may

³⁴ Thanks to Danny Fox and Irene Heim for discussion of this point.

have already been foreclosed, thus explaining why one-past subjunctive conditionals like (55) can be counterfactual.³⁵

As for two-past subjunctive conditionals, the pragmatic presupposition that there is a time in XN at which φ was possible is compatible with the presupposition that φ is foreclosed at the speech time. As for the presuppositions in φ (if any), they are required to be true throughout XN, but since XN entirely precedes the speech time, these presuppositions are *not* required to be true at the speech time.

In the rest of this section, I will reformulate the truth conditions for subjunctive conditionals in context change semantics and show how the proposed ccp accounts for the projection facts that we discussed above. In her concluding remarks in Heim (1983), Heim suggests that her account of presupposition projection in quantified sentences with nominal quantifiers can be extended to other types of quantification, for instance quantification over possible worlds. I will begin with Heim's ccp for the quantifier *every*, and then I will extend her context change semantics to the conditional structures that I have proposed above. In the example below from Heim (1983), the presuppositions in the nuclear scope of the universal quantifier project universally.

- (62) a. Every nation₁ cherishes its₁ king.
b. Presupposition: every nation has a king.

In Heim (1983), a context set is a set of assignment function-world pairs rather than just a set of worlds, and the ccp of a quantified sentence of the form *Every A is B* is (63).

- (63) $c + every_{1,A,B} =$
 $\{\langle g, w \rangle \in c : \forall a \in D_e : \langle g^{1/a}, w \rangle \in c + A \rightarrow \langle g^{1/a}, w \rangle \in c + A + B\}$

In (62), A is the predicate x_1 is a nation, B is the predicate x_1 cherishes x_1 's king. The latter carries the presupposition x_1 has a king.

- (64) a. x_1 is an nation = $\{\langle g, w \rangle \in c : g(1)$ is a nation in $w\}$
b. x_1 cherishes x_1 's king = $\{\langle g, w \rangle \in c : g(1)$ cherishes $g(1)$'s king in $w\}$
c. presupposition in ' x_1 cherishes x_1 's king': x_1 has a king

Once the sentence *every₁ A, B* (for 1 a new index) is added to the context set, the latter will contain only those assignment function-world pairs $\langle g, w \rangle$ such that, if a g is not eliminated by adding A to the context, then g is not eliminated by adding first A and then B to the context. All the 1-variants of g that survive these two update operations will be assignment functions that assign to 1 an individual that is A and B . The point that concerns us here more directly is that the nuclear scope B will be admitted in the context only if (64-c) is satisfied by the context, i.e. only if for every assignment function g in the context, $g(1)$ has a king. It follows that the context to which B is added must entail that every nation has a king, i.e. the presupposition projects universally.

According to Heim's theory, a presupposition bound by a quantifier always projects universally. The same will be true for the presupposition in the following sentence, bound by the indefinite *a fat man*.

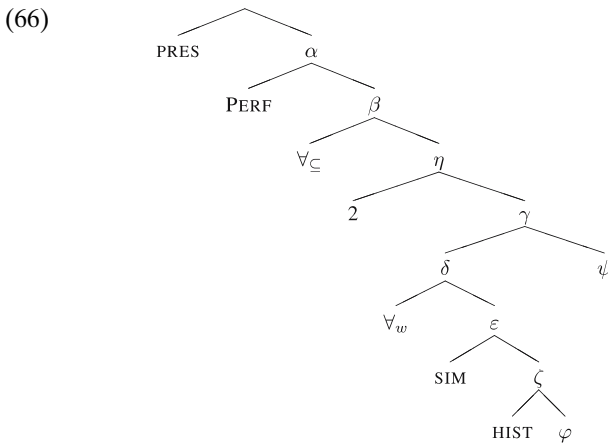
³⁵ In this paper I do not consider *might* subjunctive conditionals. It is often assumed in the semantic literature that *might* is the dual of *would* and that the conditional. *If my father were taller (than he is), I might be taller* is equivalent to the *would*-conditional *it is not the case that if my father were taller (than he is), I would not be taller*. Although simple and attractive, this vies (defended for example in Lewis (1973)) might not be true. For lack of space, I cannot discuss this very interesting issue here, but for some "asymmetricalist" views of *might* and *would*, see Stalnaker (1981), DeRose (1992), and Eagle (2006).

(65) A fat man₁ was pushing his₁ bicycle.

We first update the context with the restriction x_1 is a fat man. To this subset of the initial context (call it c'), we then add x_1 was pushing his bicycle. Now, since this latter predicate carries the presupposition that x_1 has a bicycle, the second update will only be successful if all the assignment functions in c' assign to 1 an individual who has a bicycle: since all the assignment functions in c' assigns to 1 a fat man, the second update will be successful only if all fat men have a bicycle. Now, that (65) presupposes that all fat men have a bicycle seems too strong. Our intuition is that a context to which (65) is added does not have to entail that all fat men have a bicycle. According to Heim, we can reconcile the prediction of the theory with our intuition by appealing to the effect of local accommodation: in contexts that do not entail that all fat men have a bicycle (and where the ccp of (65) would then be undefined), we rescue the sentence by accommodating the presupposition in the scope of the existential.³⁶

6.1 Back to subjunctive conditionals

According to the proposal I developed in this paper, the logical form of a counterfactual conditional involves multiple layers of modal and temporal quantification. Let us look again at the structure of a one-past subjunctive conditional (note that, for sake of clarity, I replaced WOLL with \forall_w).



Ignoring for the time being the details of the quantification over worlds and times, the ccp for a one-past counterfactual is given in (67).

³⁶The ccp would then look as follows:

$$(i) \quad \{ \langle g, w \rangle \in c : \forall a \in D_e(\langle g^{1/a}, w \rangle \in c + A \rightarrow \langle g^{1/a}, w \rangle \in c + A + ps(B) + B) \}$$

According to other scholars, the fact that the prediction of Heim’s theory clashes with our intuition is a sign that the theory should be abandoned altogether. See Beaver (2001) for an interesting alternative. What is important for our paper and for conditionals is the observation that in universally quantified sentences, a bound presupposition projects *universally*. Whatever theory we will choose to explain the facts above will have to predict this universal presupposition. As for existential sentences, whether we adopt Heim’s proposal—which predicts a universal presupposition and then appeals to local accommodation to account for our intuitions—or a theory that does not predict a universal presupposition at all, the observation is that a bound presupposition in an existential sentence should not *in the end* project universally.

$$(67) \quad c + \varphi, \text{ would } \psi = c + [\text{PRES}[\text{PERF}_3[\forall_{\subseteq} 2[\text{WOLL}[\text{SIM}[\text{HIST}_2 \varphi]]\psi]]]] = \{ \langle g, w \rangle \in c : \exists t_3 [\text{XN}(t_3, t_c) \wedge \forall t_2 \subseteq t_3 [(\text{SIM}_w(\text{HIST}_{w,t_2} + \varphi)) + \psi = (\text{SIM}_w(\text{HIST}_{w,t_2} + \varphi))]] \}$$

Notice that the world parameter w for HIST ranges over worlds in the pairs in the context set: for each pair $\langle g, w \rangle$ in c , the antecedent φ is added to the set of pairs $\langle g, w' \rangle$ such that w' has the same history as w up to $g(2)$. Since in context change semantics the $+$ operation is defined only if the argument to the left of the sign entails the presuppositions in the argument that is being added to it, incrementing HIST_{w,t_2} with φ is only possible if $\text{HIST}_{w,t_2} \subseteq \text{ps}(\varphi)$, for t_2 a subinterval of XN. As we pointed out earlier in the paper, if the presupposition in φ is about a time later than t_2 , then the entailment requirement will be satisfied by local accommodation only if the presupposition in φ is compatible with the set of worlds to which φ is added. Let us rewrite (67) as shown in (68): before adding φ and ψ , we locally accommodate $\text{ps}(\varphi)$ and $\text{ps}(\psi)$, respectively (if needed).

$$(68) \quad c + \varphi, \text{ would } \psi = \{ \langle g, w \rangle \in c : \exists t_3 [\text{XN}(t_3, t_c) \wedge \forall t_2 \subseteq t_3 [(\text{SIM}_w(\text{HIST}_{w,t_2} + \text{ps}(\varphi) + \varphi)) + \text{ps}(\psi) + \psi = (\text{SIM}_w(\text{HIST}_{w,t_2} + \text{ps}(\varphi) + \varphi))]] \}$$

Assuming local accommodation, we can keep the strong requirement that the presuppositions of φ must be entailed by the set of worlds historically accessible at t_2 . Note that what we are saying is that $\text{ps}(\varphi)$ can be accommodated in HIST_{w,t_2} , for each t_2 in the perfect interval. As we wrote above, this means that $\text{ps}(\varphi)$ must be (at least) compatible with HIST_{w,t_2} , for each t_2 in the perfect interval. Thus, $\text{ps}(\varphi)$ cannot be false at any time in the perfect interval.

What we want to show next is that, since t_2 is bound by the universal quantifier over subintervals of XN, for each subinterval in the domain of \forall_{\subseteq} , the presuppositions in φ are required to be entailed by the set of worlds accessible at that subinterval. Let us go back to (67). To make the computation a bit more transparent, let me rewrite the ccp in (67) as follows

$$(69) \quad \{ \langle g, w \rangle \in c : \exists t_3 [\text{XN}(t_3, t_c) \wedge \forall t_2 [t_2 \subseteq t_3 \rightarrow \forall w_1 [w_1 \in \text{SIM}_w(\text{HIST}_{w,t_2} + \varphi) \rightarrow w_1 \in \text{SIM}_w(\text{HIST}_{w,t_2} + \varphi) + \psi]]] \}$$

To simplify the exposition, let us replace the restriction of the existential quantifier with the letter P ; the restriction of the universal quantifier over times with the letter Q ; and the restriction and nuclear scope of the universal quantifier over worlds with the letters p and q , respectively. The relevant part in (69) will look as follows: $\exists t_3 [P \wedge \forall t_2 [Q \rightarrow \forall w_1 [p \rightarrow q]]]$. The ccp for a subjunctive conditional is computed in the following steps, beginning from the most embedded quantified structure.

Step 1. The ccp for $[\forall_1, p, q]$ (the bare modal structure) looks as follows. The proposition p is the restriction of the modal operator, i.e. node ε in (66). The proposition q is the consequent ψ . Recall that both the antecedent and the consequent are tensed propositions, whose evaluation time is going to eventually be bound by the universal quantifier over times \forall_{\subseteq} .³⁷

³⁷ Here are the entries for HIST_{w,t_2} and $\text{SIM}_w(p)$, respectively:

- (i) $\text{HIST}_{w,t_2} = w_1$ is historically accessible from w at $t_2 = \{ \langle g, w \rangle \in c : g(1) \text{ is historically accessible from } w \text{ at } g(2) \}$
- (ii) $\text{SIM}_w(p) = w_1$ is as similar overall to w as any other p -world = $\{ \langle g, w \rangle \in c : p \text{ is true in } g(1) \text{ and } g(1) \text{ is as similar overall to } w \text{ as any other } p \text{ world} \}$

In the definition of the ccp in (70) I have skipped these steps.

- (70) a. $c + [\forall_1, p, q] = \{ \langle g, w \rangle \in c : \forall w' \in W : (\langle g^{1/w'}, w \rangle \in c + p \rightarrow \langle g^{1/w'}, w \rangle \in c + p + q) \}$
- b. $p = \{ \langle g, w \rangle \in c : g(1) \in \text{SIM}_w(\text{HIST}_{w,g(2)} + \varphi) \}$
- c. $q = \{ \langle g, w \rangle \in c : g(1) \in \text{SIM}_w(\text{HIST}_{w,g(2)} + \varphi) + \psi \}$

The evaluation time of φ is t_2 : $\varphi = \{w : \varphi \text{ is true in } w \text{ at } t_2\}$. Therefore, $\text{ps}(\varphi)$ must be true at t_2 , i.e. they must be entailed by HIST_{w,t_2} . This means that the update in (70-b) is going to be defined only if all the assignment functions g in c assign to 2 a time such that the set of worlds historically accessible at that time entails $\text{ps}(\varphi)$. If this requirement is not satisfied, local accommodation can apply only if the set of worlds historically accessible at $g(2)$ is at least compatible with $\text{ps}(\varphi)$. If it is not, local accommodation cannot apply, φ cannot be added and the ccp in (70-b) is undefined, causing the ccp of the whole conditional to be undefined. Therefore, the minimum requirement for (70b) to be defined is that all the assignment functions g in c assign to 2 a time such that $\text{HIST}_{w,g(2)} \cap \text{ps}(\varphi) \neq \emptyset$.

Step 2. Now let's look at $[\forall_2, Q, [\forall w_1(p \rightarrow q)]]$ (where \forall_2 quantifies over subintervals of the XN interval).

$$(71) \quad c + [\forall_2, Q, [\forall w_1(p \rightarrow q)]] = \{ \langle g, w \rangle \in c : \forall t \in T : \langle g^{2/t}, w \rangle \in c + Q \rightarrow \langle g^{2/t}, w \rangle \in c + Q + [\forall_1, p, q] \}$$

Q is the restriction of \forall_2 , the universal quantifier over subintervals of the XN interval ($g(2)$).

$$(72) \quad Q = \{ \langle g, w \rangle \in c : g(2) \subseteq g(3) \text{ in } w \}$$

Since the nuclear scope of \forall_2 is the modal sentence with the ccp in (71-a), we can rewrite (71) as shown in (73).

$$(73) \quad \{ \langle g, w \rangle \in c : \forall t \in T : \langle g^{2/t}, w \rangle \in c + Q \rightarrow \langle g^{2/t}, w \rangle \in \{ \langle g, w \rangle \in c + Q : \forall w' (\langle g^{1/w'}, w \rangle \in (c + Q) + p \rightarrow \langle g^{1/w'}, w \rangle \in (c + Q) + p + q) \} \}$$

p is (70-b): as we saw above, it is only defined for those assignment functions that assign to 2 a time such that the set of worlds historically accessible at that time entails $\text{ps}(\varphi)$. Therefore, the update $(c + Q) + p$ is only going to be defined for those assignment functions that assign to 2 a time such that the set of worlds historically accessible at that time entails $\text{ps}(\varphi)$. Since all the assignment functions in $c + Q$ assign to 2 a subinterval of XN, adding p to $c + Q$ is successful only if all the subintervals of XN are such that the sets of worlds historically accessible at those times entail $\text{ps}(\varphi)$. In other words, every pair $\langle g, w \rangle$ in the context must be such that every assignment function that assigns to 2 a subinterval of XN, assigns to 2 a subinterval of XN interval such that all the worlds historically accessible from w at $g(2)$ are worlds where $\text{ps}(\varphi)$ are true. Thus, $\text{ps}(\varphi)$ becomes a universal presupposition of (71). Therefore, in one-past counterfactuals, $\text{ps}(\varphi)$ must be entailed by the set of worlds historically accessible at t_c because t_c is a subinterval of XN; in mismatched two past counterfactuals, they do not.

Furthermore, as I mentioned above, a pragmatic presupposition will be triggered, i.e. $\exists t_2 [t_2 \subseteq t_3 \wedge \exists w' : p(w') = 1]$ or, better, $\exists t_2 [t_2 \subseteq t_3 \wedge \exists w' [w' \in \text{SIM}_w(\text{HIST}_{w,t_2}) + \varphi]]$. That is to say, the presupposition will be that there is *some* subinterval of the perfect interval at which *some* maximally similar φ -world is historically accessible, and this presupposition is merely pragmatic (see discussion in Sect. 6). Because the requirement that the domain of the lower quantifier not be empty is not a semantic presupposition, and therefore does not project universally, the whole structure will not presuppose that at *all* subintervals of the perfect interval there is an accessible

φ -world maximally similar to the actual world. Thus, a counterfactual will be felicitous when uttered in contexts that do not warrant the strong presupposition that for all the subintervals t_2 , there are φ -worlds accessible at t_2 . In particular, it follows that a counterfactual is felicitous even in contexts that entail that there are no φ -worlds accessible at the speech time, i.e. that entail the counterfactuality of φ . This explains the felicity of (55): all that is required is that, in an interval whose right boundary is the speech time, there is some subinterval at which a world where John runs the Boston marathon next spring was still accessible (when the possibility had not been foreclosed yet). This interval does not need to be the speech time. What time will it be? It will be whatever time immediately precedes the time when the possibility of John running the Boston marathon next spring was foreclosed.³⁸

Step 3. The final step is to calculate the ccp of the whole structure, including the PERF operator which existentially quantifies over an XN interval.

$$(74) \quad c + \exists_3, P, [\forall_2, Q, S] = \{ \langle g, w \rangle \in c : \exists t \in T : \langle g^{3/t}, w \rangle \in c + P \text{ and } \langle g^{3/t}, w \rangle \in c + P + [\forall_2, Q, S] \}$$

Since the nuclear scope of \exists_3 is (73), we can rewrite (74) as follows.

$$(74') \quad c + \exists_3, P, [\forall_2, Q, S] = \{ \langle g, w \rangle \in c : \exists t \in T : \langle g^{3/t}, w \rangle \in c + P \text{ and } \langle g^{3/t}, w \rangle \in \{ \langle g, w \rangle \in c + P : \forall t \in T : \langle g^{2/t}, w \rangle \in c + P + Q \rightarrow \langle g^{2/t}, w \rangle \in \{ \langle g, w \rangle \in c + P + Q : \forall w' (\langle g^{1/w'}, w \rangle \in c + P + Q + p \rightarrow \langle g^{1/w'}, w \rangle \in c + P + Q + p + q) \} \} \}$$

After successfully adding the sentence to c , the only 3-variants of g that survive the two update operations in (74) will be assignment functions assigning to 3 an interval XN (i) whose right boundary is the speech time and (ii) whose subintervals t are such that every φ -world historically accessible at t and maximally similar to the evaluation world is a ψ -world.

Reconsider our one-past counterfactual: φ 's presupposition is that John will be alive at the time of the Boston marathon next spring.

$$(75) \quad \text{John is dead.} \\ \# \text{ If John ran the Boston marathon next spring, he would finally win.}$$

Because in a one-past subjunctive conditional the speech time is included in the XN interval (it is its final subinterval), the presupposition that John will be alive at the time of the marathon next spring is required to be entailed by the set of worlds accessible at the speech time. However, since John died at some past time, the set of worlds accessible at the speech time is inconsistent with the proposition that John will be alive next spring. Hence, the sentence is correctly predicted to be infelicitous.³⁹

³⁸As long as there is at least one subinterval of XN at which there are historically accessible φ -worlds, the statement will not be vacuously true. In the beginning we said that a subjunctive conditional is a bare conditional embedded under a universal perfect structure, and that a subjunctive conditional is true in the world and time of evaluation if the bare conditional is true at each subinterval of XN. It is possible that with respect to some subinterval of XN the conditional is going to be vacuously true (if there are no accessible φ -worlds at that subinterval), but again as long as there is one subinterval at which the bare conditional is non-vacuously true, the subjunctive conditional will be felicitous. Like Stalnaker (1975) and Heim (1992), I want to prevent the subjunctive conditional from being a trivial truth, but in order to do so it is sufficient to have the pragmatic requirement that for at least some subinterval t of XN, $\text{HIST}_{w,t} + \varphi \neq \emptyset$ (we don't need to—and in fact we don't want to—stipulate that SIM is undefined for the impossible proposition).

³⁹Notice that this analysis also predicts the infelicity of one-past subjunctive conditionals whose consequents have presuppositions that are false. This is illustrated in (i).

- (i) John died.
#If it were sunny tomorrow, John would train for the Boston marathon.

What about the contrast between a one-past and a two-past counterfactual? Why is (76-b) felicitous when uttered in a context that is incompatible with φ 's presupposition that John will be alive next spring?

- (76) a. John is dead.
 #If John ran the Boston marathon next spring, he would win.
 b. John is dead.
 If John had run the Boston marathon next spring, he would have won.

This contrast now follows from the ccp of these two types of conditionals. In the case of a two-past subjunctive conditional, the whole interval (including its right boundary) is located before the speech time. As before, for each subinterval t_2 of XN, the presuppositions in φ (and those in ψ not entailed by φ) must be entailed by the set of worlds historically accessible at t_2 . However, since the speech time is *not* included in XN (the right boundary of XN lying before t_c), the presuppositions are not required to be entailed by the set of worlds historically accessible at the speech time.⁴⁰

The presupposition in the antecedent of (i)—that John was alive yesterday—is not satisfied by the context of utterance, which entails that John died a month ago, and the theory correctly predicts it should be felicitous.

6.2 A note on accommodation and anaphora

Given the nature of *HIST* and the future that we are assuming, the analysis that I am proposing makes systematic use of local accommodation of the presuppositions in the antecedent of a counterfactual conditional make the 'T' at the beginning lower case. Given a set of worlds historically accessible from w at t — $\text{HIST}_{w,t}$ —and a proposition p whose eventuality time is a time later than t , the requirement that the $\text{ps}(p)$ be entailed by $\text{HIST}_{w,t}$ can be satisfied only by locally accommodating those presuppositions, unless p is entirely determined by the facts occurred before t . This is because t distinguishes its past, which is settled (at t), from its future which is by definition unsettled (at t). In other words, for any proposition p about a time later than t , there will be a p -world and a $\neg p$ -worlds among the worlds historically accessible at t . Therefore, the entailment requirement necessary to compute the ccp of a conditional must be satisfied by locally accommodating the presuppositions in the antecedent (and those in the consequent not entailed by the antecedent). Take the example in (77): we locally accommodate the presupposition that John will be a smoker in 10 years up to the time when he is supposed to quit. By accommodating this presupposition, we make sure to eliminate those worlds accessible at the speech time (since this is the final subinterval of XN) where John smokes now but quits tomorrow, since in these worlds the presupposition in the antecedent is not true.⁴¹

⁴⁰ Notice that counterfactuals with a past perfect but no future adverbial in the antecedent behave like the two-past counterfactuals with a future adverbial with respect to the projection of their presuppositions.

(i) John died a month ago. The Boston marathon took place yesterday.
 If John had run the Boston marathon yesterday, he would have won.

⁴¹ As I mentioned earlier, local accommodation must also be systematically applied in indicative conditionals like *If you quit smoking in 10 years, your lungs will not be able to recover*, as the reader can verify.

- (77) John smokes.
If he quit smoking in ten years, his lungs would not recover.

If we were to stop here, however, our theory would overgenerate and incorrectly predict that the discourse in (ii) should be felicitous. Consider the counterfactual in (78).

- (78) John quit smoking last year, and hasn't smoked since.
#If he quit smoking in ten years, his lungs would not be able to recover.

We could explain the infelicity of (78) if we could argue that there are no worlds historically accessible at the speech time where John will be a smoker in 10 years up until the time when he is supposed to quit. The problem is that there *are* worlds accessible at the speech time that can potentially satisfy the presupposition in the antecedent: for example, worlds where John will start smoking again tomorrow and continue to be a smoker for 10 more years. Since these worlds are in the modal base and since local accommodation can apply, we predict that we could accommodate the presupposition that John will be a smoker in 10 years, thus selecting those worlds where John will start smoking (again) sometime between now and 10 years from now, and where he will continue until the time when he is supposed to quit. Hence, we seem to incorrectly predict that (78) should be felicitous. How can we account for the infelicity of (78) while at the same time allowing local accommodation to apply in good examples like (77)?

Kripke (1990) argues that the presupposition triggered by *to quit* has an anaphoric element.⁴² In our example, this means that the antecedent *If Jack quit smoking next summer* does not carry the *existential* presupposition that there is a habit of smoking by Jack that will continue until a future time immediately adjacent to the time of the hypothetical quitting. Instead, the presupposition in the antecedent must be the singular proposition that some *contextually salient* habit of smoking will continue until the time adjacent to the time of the hypothetical quitting. Initially, Kripke made this point with respect to the presupposition of *too* ((79) is his example).

- (79) Tonight Sam_i is having dinner in New York *too*_i

Uttered out-of-the-blue, (79) sounds odd, but, if the presupposition it carries were existential, it should not, since we all know that tonight many people are having dinner in New York. What the sentence must presuppose is that some contextually salient individual other than Sam is having dinner in New York tonight: thus, when the sentence is uttered out-of-the-blue there is no antecedent that is been made salient and anaphora cannot be resolved. The same point is discussed in Heim (1990). Below is Beaver (2001)'s adaptation of the Heimian admittance condition for a sentence containing *too*.

- (80) **Heimian *too*.** Let $S[i/j]$ represent the sentence S with all instances of NPs indexed i replaced by x_j . Then:
a context σ admits S iff σ satisfies $S[i/j]$ for some index j .

⁴² Several other scholars have advocated a tight connection between presuppositions and anaphora, e.g. Soames (1989), Heim (1990), van der Sandt (1992). For a discussion of Heim's and van der Sandt's theories, see Beaver (2001).

Since too_i is associated with *Sam*, (79) is admitted only in contexts that entail that tonight x_j is having dinner in New York, for some j , different from i . Elaborating on Kripke's and Soames's point, Heim (1990)'s example in (81) illustrates the anaphoricity of the presupposition carried by the lexical presupposition of the verb *to stop*.⁴³

- (81) John is cooking. He will stop (cooking) when tomorrow's football game starts.

The anaphoric nature of this presupposition explains why we are compelled to interpret this sentence in the most pragmatically implausible way: that a single event of John's cooking began some time before now and will continue uninterrupted until tomorrow's football game. We might tentatively represent the anaphoricity of the presupposition as follows.⁴⁴ (\ll means 'immediately precedes'.)

- (82) **[John will stop cooking₁ when tomorrow's football game starts]^{c,g}**
 defined only if $\exists t'' \ll$ the time when tomorrow's football game starts [$t'' \subseteq$ time ($g(1)$) \wedge $g(1)$ is an eventuality of John's cooking];
 if defined, **John will stop cooking₁ when tomorrow's football game starts]^{c,g} = 1** if the time when tomorrow's football game starts $\not\subseteq$ time ($g(1)$).

Since 1 is not existentially closed, the sentence presupposes that a salient eventuality of John cooking included a time immediately before the time when tomorrow's football game starts and asserts that the running time of that eventuality does not include the time when tomorrow's football game starts. Since the first sentence in (81) has made salient an eventuality of John's cooking overlapping the speech time, it is this eventuality which is understood as extending throughout an interval abutting the time when tomorrow's football game starts. With this in mind, let us go back to the felicitous conditional in (77). Suppose that the antecedent now presupposes that John's *contextually salient* habit of smoking will continue until the time adjacent to the time at which he is supposed to quit. At the speech time (the final subinterval of XN in a one-past subjunctive conditional), this presupposition is required to be entailed by the set of worlds accessible then. Hence, it is *this* presupposition that must now be accommodated, so as to satisfy the required entailment. The problem is that the set of worlds historically accessible at the speech time (i.e. what is possible at the speech time) entails that the contextually salient smoking stopped last summer: therefore there is no world where *that* smoking continues until next summer, since all these worlds share the same history up to the speech time. Therefore, worlds where

⁴³ Thanks to Kai von Fintel for reminding me of Heim's example in (81).

⁴⁴ Let us assume that eventualities are part of the linguistic representation of eventive predicates. Following Kratzer (1998), I assume a function *time*($_$) which maps eventualities into their running time. The implementation in (82) is a mere suggestion about how the anaphoric presupposition of *quit* could be formally represented. Whatever the correct representation of this presupposition turns out to be, what is important for the purpose of the present discussion is to show that, once we have a theory of what it means for a presupposition to be anaphoric, then we can explain the facts about conditionals that we are interested in here. Unfortunately, there is currently still much we do not know about how exactly anaphoric presuppositions are computed. See also Kamp (2001), in addition to the references cited in footnote 44.

John starts smoking again tomorrow do not matter for the satisfaction of the anaphoric presupposition.

One more case is worth mentioning before concluding this section. Consider a situation where Jack was never a smoker. Both a one-past and a two-past subjunctive conditional are infelicitous.

- (83) Jack is not a smoker and never was.
- a. #If he quit smoking next summer, his grandmother would be pleased.
 - b. #If he had quit smoking next summer, his grandmother would have been pleased.

The infelicity of (b) is not a counterexample to the claim that the presuppositions in a two-past subjunctive conditional do not have to be entailed by the current context. In the above context, there is no contextually salient habit of smoking by Jack that can be the antecedent for the anaphoric presupposition of *quit*; therefore, the sentence is infelicitous because the anaphoric component of the presupposition cannot be resolved. The same is true for one-past and two-past containing the presupposition trigger *too*. The following example is adapted from Heim (1992).

- (84) Nobody will attend the workshop tomorrow.
- a. #If Jack attended the workshop too, he would learn some syntax.
 - b. #If Jack had attended the workshop too tomorrow, he would have learned some syntax.

Given the admittance condition for *too* above, we expect both conditionals in (84) to be bad, independently of their specific felicity conditions. In the context, where no individual attended the workshop, anaphora cannot be resolved, and the presupposition that somebody other than Jack attended the workshop cannot be computed, let alone satisfied. Other apparent counterexamples to the claim that the presuppositions in two-past subjunctive conditionals can be inconsistent with the context can also be shown to be cases of failure to resolve the anaphoric element of the presupposition triggers.⁴⁵

⁴⁵ Jeff King brought to my attention the presupposition trigger *too*, which I discuss in the text, and the presupposition trigger *even*, to which all I said about *too* can be applied, once we assume that *even*, like *too*, makes reference to a contextually salient group of people (so, roughly, *even_i NP_i VP* presupposes that *i* is the least likely of the members of some contextually salient group of people to V). I argued in the text that these are not counterexamples. As for the presupposition triggered by the universal quantifier *every* (non-empty restriction), King claims that there is no contrast between one-past and two-past subjunctive conditionals. First of all, I have argued in this paper that we should think of the existential presupposition of a universal quantifier as a pragmatic presupposition. Second, there are cases that challenge King's intuition. Consider the following pair, uttered in a context where it is known that there are no dinosaurs.

- (i) #If every dinosaur taller than 15 meters were standing on this old bridge, it would collapse.
- (ii) If every dinosaur taller than 15 meters had been standing on this old bridge, it would have collapsed.

The presupposition that there exist some dinosaurs is not warranted by the context, thus causing the one-past counterfactual to be infelicitous. However, the two-past counterfactual seems felicitous.

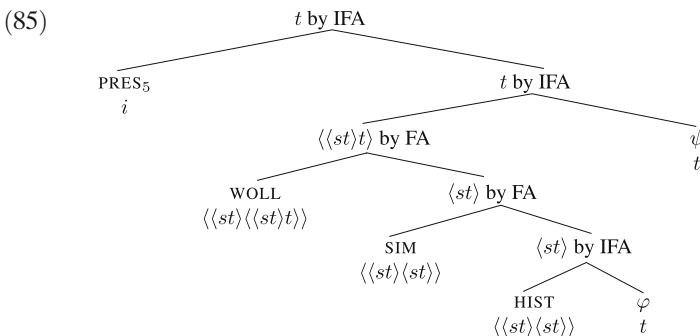
6.3 Pragmatic strength: Indicative *will* conditionals versus one-past subjunctive conditionals; one-past versus two-past subjunctive conditionals

Let me sum up. We have established the following presuppositions (felicity conditions) for one-past and two-past subjunctive conditionals.

- A one-past subjunctive conditional is felicitous only if:
 1. There is a φ -world historically accessible at some subinterval in XN (whose final subinterval is the speech time) but not necessarily at the speech time (pragmatic presupposition);
 2. The presuppositions in the antecedent are entailed by the set of worlds historically accessible at each subinterval of XN, therefore by the set of worlds historically accessible at the speech time too (semantic presupposition).
- A two-past subjunctive conditional is felicitous only if:
 1. There is a φ -world historically accessible at some subinterval in XN (whose final subinterval is a time before the speech time) (pragmatic presupposition);
 2. There is no φ -world historically accessible at the speech time (semantic presupposition);
 3. The presuppositions in the antecedent are entailed by the set of worlds historically accessible at each subinterval of XN; therefore, they are not required to be entailed by the set of worlds accessible at the speech time (semantic presupposition).

In principle, one-past subjunctive conditionals should be felicitous when φ is known to be true. However, we feel that the utterance of a one-past subjunctive conditional suggests that the speaker believes φ to be *unlikely* (when not counterfactual). How can we account for this intuition? In order to answer this question, I need to consider indicative *will*-conditionals.

Inspired by Abusch (1997), and Ogihara (1996), among others, according to whom the difference between *would* and *will* is that the former is the morphological realization of WOLL+past, and the latter WOLL+present, and following ideas developed in Condoravdi (2001) and Ippolito (2003), I argued in this paper that *would* in counterfactuals is the morphological realization of WOLL when embedded under a temporal/aspectual structure. What about WILL in indicative conditionals such as *If John runs the Boston marathon next spring, he will win*? In conditionals, WILL is the morphological realization of WOLL when embedded under a simple PRES. Therefore, the evaluation time of the historical accessibility relation is the speech time. (85) is the structure of an indicative conditional.



Does this view explain the semantic and pragmatic properties of indicative conditionals? What needs to be explained is that indicative conditionals are (i) like one-past subjunctive conditionals in that the $ps(\varphi)$ (and $ps(\psi)$) not entailed by φ must be (known to be) true, as shown in (86); but (ii) unlike one-past subjunctive conditionals in that an indicative conditional cannot be counterfactual, as shown in (87).

(86) John is dead.
 #If John runs the Boston marathon next spring, he will win.

(87) John is dead.
 #If John is alive, he will run the Boston marathon next spring.

The truth conditions for (87) are shown in (88). (What we actually interpret is the following logical form, which corresponds to the structure in (85): [PRES_s[WOLL [SIM [HIST [NP_≥ [John is alive]]]] [NP_≥ [he run the Boston marathon next spring]]]]).

(88) **[[If John is alive, he will run the Boston marathon next spring]]^{c, g, t_c, w_c}**
 defined only if $g(5) \text{ O } t_c$; if defined, **[[If John is alive, he will run the Boston marathon next spring]]^{c, g, t_c, w_c} = 1 if**

$$\forall w' [w' \text{ is historically accessible from } w_c \text{ at } g(5) \wedge \exists t' \succeq g(5) \text{ [John is alive at } t' \text{ in } w' \wedge \neg \exists w'' [w'' \text{ is historically accessible from } w_c \text{ at } g(5) \text{ and s.t. John is alive in } w'' \text{ at } t' \wedge w'' \text{ is overall more similar to } w_c \text{ than } w'] \longrightarrow \exists t'' \succeq g(5) \text{ [he will run the Boston marathon in } w' \text{ at } t'' \text{ and } t'' \subseteq \text{next spring}]]$$

The indicative conditional in (87) is true just in case all worlds historically accessible at the speech time where John is alive next spring and maximally similar to the actual world are worlds where he runs the Boston marathon. The ccp of an indicative conditional is given in (89). Simplifying a little, since the modal structure occurs only in the scope of PRES, the time parameter of SIM and HIST will be t_c , the speech time.

(89) $c + \text{if } \varphi, \psi = \{ \langle g, w \rangle \in c : (\text{SIM}_w(\text{HIST}_{w, t_c}) + \varphi) + \psi = (\text{SIM}_w(\text{HIST}_{w, t_c}) + \varphi) \}$

The reader can verify that, given the proposal presented above, an indicative conditional is felicitous only if (i) there is some φ -world accessible at the speech time; and (ii) the $ps(\varphi)$ (and $ps(\psi)$) not entailed by φ are entailed (by local accommodation) by HIST_{w, t_c} .

(90) An indicative conditional if felicitous only if:
 a. there is a maximally similar φ -world historically accessible at the speech time.
 b. the presuppositions in φ (and those in ψ not entailed by φ) are entailed by HIST_{w, t_c}

The difference between indicative conditional and one-past subjunctive conditionals is the clause (a) in (90). In (87), that John is alive is no longer a possibility. Therefore, there is no worlds accessible at the speech time where that John is alive is true, and the sentence is infelicitous. It also follows that (86) is infelicitous in a context where John already died since the presupposition in φ (that John will be

alive next spring) is incompatible with the set of worlds accessible at the speech time.⁴⁶

On the basis of the examples (91) and (92), Karttunen and Peters (1979) suggested that indicative conditionals are not felicitous if the speaker assumes that the antecedent is *false*, and that subjunctive conditionals are not felicitous if the speaker assumes that the antecedent is *true*.

- (91) A. Jack is not going our way.
 B. # If he is going our way, he will give us a ride.
 C. If he were going our way, he would give us a ride.
- (92) A. Jack is going our way.
 B. # If he were going our way, he would give us a ride.
 C. If he is going our way, he will give us a ride.

This contrast does not immediately follow from the analysis of one past subjunctive conditionals proposed above which allows a one-past subjunctive conditional to be felicitous even when the antecedent is (known to be) possible at the speech time. I believe that the stronger inference that the antecedent of a one-past subjunctive conditional is counterfactual is a conversational scalar implicature stemming from the competition with its indicative counterpart. As we saw above, indicative conditionals presuppose that there is a φ -world accessible at the speech time, whereas one-past subjunctive conditionals presuppose that there is a φ -world accessible at some time during an interval whose final subinterval is the speech time. We also saw that the set of historically accessible worlds shrinks (that is, possibilities are foreclosed) as time goes by. Therefore, the presupposition of an indicative conditional asymmetrically entails the presupposition of a one-past subjunctive conditional: if there is a φ -world accessible at the speech time, then there was a φ -world accessible at some point during an interval that includes the speech time; but not vice versa. I will assume a pragmatic principle, MAXIMIZE PRESUPPOSITIONS, proposed in Heim (1991) and already used by Ippolito (2003) in her analysis of counterfactuals: according to this principle a speaker is required to *presuppose* as much as possible.⁴⁷ We can derive the implicature of falsity of a one past subjunctive conditional as shown in (ii).

- (93) a. If a speaker utters the indicative conditional *if φ , then ψ* , she is epistemically certain that φ is possible at t_c .
 b. If a speaker utters the one-past subjunctive conditional *if φ , would ψ* , she is epistemically certain that φ is possible at some time during XN which abuts t_c .
 c. Since the presupposition of an indicative conditional asymmetrically entails the presupposition of a one-past subjunctive conditional, if the speaker chooses to utter the one-past subjunctive conditional,

⁴⁶ I am not suggesting that all indicative conditionals involve a historical accessibility relation. The present analysis applies to *will* indicative conditionals. My view is, I believe, perfectly compatible with the view (Kratzer, 1986, 1991, among others.) that some other indicative conditionals have different accessibility relations, e.g. epistemic, often expressed by the modal verb *must*, as in the sentence *If the phone is busy, Jack must be home*.

⁴⁷ An idea very similar to Heim's was also proposed by Hawkins (1991), even though the latter did not make explicit reference to presuppositions.

she is violating Maximize Presuppositions and, assuming that the speaker is being cooperative, this must be because she is not epistemically certain that φ is possible at t_c . Assuming that the speaker is knowledgeable about the subject, this might be for two reasons:

1. either because she is epistemically certain that φ is not possible at t_c (strong implicature);
2. or because she has some reason to doubt that φ is still possible at t_c , and thinks that φ is unlikely (weak implicature).

The Karttunen and Peters’ example in (91) and (92) illustrate this point clearly: if it is known that φ is false, then the indicative conditional cannot be uttered (the presupposition is incompatible with the context); if it is known that the antecedent is true, then the one-past subjunctive conditional cannot be uttered, since a one-past subjunctive conditional typically triggers the implicatures that the speaker believes that φ is impossible. Note that it follows from the weak implicature in (93) that a one-past subjunctive conditional will be felicitously uttered even when the antecedent is not taken to be counterfactual, as long as it is taken to be unlikely.

As for two-past subjunctive conditionals, the fact that the antecedent must be understood to be counterfactual follows from the fact presented in Sect. 5 that the past tense carries the counterfactual presupposition that the antecedent got foreclosed at a salient past time and, therefore, is no longer historically accessible at the speech time.

7 Conclusion

This paper proposes a compositional semantics of subjunctive conditionals. Based on earlier work by Ippolito (2003), I distinguish two types of subjunctive conditionals: one-past and two-past. The observation that we started from is that these two types of conditionals have different felicity conditions: the presuppositions in the antecedent (if any) are required to be (known to be) true in the actual world in the case of one-past subjunctive conditionals, but they are not in the case of two-past subjunctive conditionals. We reviewed two influential analyses of presupposition projection in conditionals, on which the present work is based: Karttunen (1973) and Heim (1992). We concluded that both theories could account for the projection properties of two-past subjunctive conditionals only by adding new projection rules.

Like Heim (1992), the present proposal is interested in deriving the projection properties of counterfactuals from their truth conditions. The first part of the paper reviews Condoravdi (2001) and Ippolito (2003) and offers a compositional analysis of subjunctive conditionals. The second part of the paper reconsiders the projection facts in light of the analysis proposed and argues that subjunctive conditionals are bare conditionals embedded under temporal and aspectual operators. A one-past subjunctive conditional has the structure in (94). A two-past subjunctive conditional has the structure in (95).

$$(94) \quad [{}_{Tense}PRES[{}_{Perf}PERF[{}_{Asp}\forall_{\subseteq}[WOLL[. . .]]]]].$$

$$(95) \quad [{}_{Tense}PAST[{}_{Perf}PERF[{}_{Asp}\forall_{\subseteq}[WOLL[. . .]]]]].$$

The temporal structure in whose scope the modal operator occurs has the effect of manipulating the temporal parameter of the historical accessibility relation. In *will* indicative conditionals, on the other hand, the temporal parameter of the historical accessibility relation is always the speech time, as shown below.

$$(96) \quad [{}_{Tense}P^{PRES}[WOLL[...]]]$$

In the second part of the paper, I argued that the projection properties of subjunctive conditionals (and, in particular, of counterfactuals) follow from the quantificational structure that I suggest, and I developed an analysis of presupposition projection in subjunctive conditionals in the framework of context change semantics. As for one-past subjunctive conditionals, I argued that the fact that the presuppositions in the antecedent (and those in the consequent not entailed by the antecedent) must be (known to be) true at the speech time follows from the Heimian's theory of presupposition projection as applied to our proposal about the logical form of a subjunctive conditional.

However, we also argue that the requirement is that there is at least a time in XN at which an antecedent-world is historically accessible is pragmatic. Since this time is not required to be the speech time, a one-past subjunctive conditional is felicitous even if the antecedent is counterfactual (i.e. incompatible with the set of worlds historically accessible at the speech time).

As for two-past subjunctive conditionals, I argued that the higher past tense in the structure denotes a salient past time which functions as the right boundary of the XN interval, and that the counterfactuality of this type of conditional is a presupposition associated to this past tense. The fact that the presuppositions in the antecedent (and those in the consequent not entailed by the antecedent) do not have to be true at the speech time follows from the fact that the speech time is not included at all in the XN interval whose right boundary must lie before it.

Let me conclude on a cross-linguistic note. This proposal could shed light on the fact that, in many genetically unrelated languages, subjunctive conditionals are marked by imperfective morphology, since in many languages standard occurrences of universal perfect are marked by imperfective morphology.⁴⁸ The expected correlation is that in languages that mark standard occurrences of the universal perfect with imperfective morphology, subjunctive conditionals will be marked by imperfective morphology too. This seems true in English, where imperfective morphology occurs in neither, and in Italian, where it occurs in both. But a thorough study of conditionals in light of the present proposal is needed to ascertain whether this correlation holds cross-linguistically.

Acknowledgments

I am very much indebted to the editor and to two anonymous reviewers for extensive and very helpful comments both about form and content that greatly improved this paper. I am very grateful to Bridget Copley, Donka Farkas, Kai von Fintel, Irene Heim, Sabine Iatridou, Bob Stalnaker, and Arnim von Stechow for discussions, and extensive comments at different stages of this work. I wish to thank Jason Stanley,

⁴⁸ Thanks to Sabine Iatridou for discussion on this point.

Richmond Thomason, and all the participants at the *Workshop in Linguistics and Philosophy* held at the University of Michigan (November 2002). In particular, I am indebted to Jeff King and Zoltán Szabó who on that occasion read their comments on an earlier draft of this paper. All mistakes and omissions are mine.

Appendix

The ontology and composition rules assumed in the paper are given below:

$$\begin{aligned}
 (97) \quad \text{ONTOLOGY: } D_t &= \{0, 1\} \\
 D_s &= W \\
 D_{\langle a,b \rangle} &= D_b^{D_a} \\
 D_i &= T \\
 I_a &= D_a^{W \times T}
 \end{aligned}$$

The rules of composition that I will use are Functional Application and Predicate Abstraction:

$$\begin{aligned}
 (98) \quad \text{COMPOSITION RULES:} \\
 \text{a. Functional Application:} \\
 \llbracket \alpha_{\langle a,b \rangle} \beta_a \rrbracket^{c,t,w} &= \llbracket \alpha \rrbracket^{c,t,w} (\llbracket \beta \rrbracket^{c,t,w}) \\
 \text{b. Intensional Functional Application (world-and time-version):} \\
 \text{(i) If } \alpha \text{ is a branching node and } \{\beta, \gamma\} \text{ the set of its daughters,} \\
 \text{then, for any possible world and any assignment a, if } \llbracket \beta \rrbracket^{w,a} \\
 \text{is a function whose domain contains } \lambda w'. \llbracket \gamma \rrbracket^{w',a}, \text{ then} \\
 \llbracket \alpha \rrbracket^{w,a} &= \llbracket \beta \rrbracket^{w,a} (\lambda w'. \llbracket \gamma \rrbracket^{w',a}). \\
 \text{(ii) If } \alpha \text{ is a branching node and } \{\beta, \gamma\} \text{ the set of its daughters, then,} \\
 \text{for any time and any assignment a, if } \llbracket \beta \rrbracket^{t,a} \text{ is a function whose} \\
 \text{domain contains } \lambda t'. \llbracket \gamma \rrbracket^{t',a}, \text{ then } \llbracket \alpha \rrbracket^{t,a} &= \llbracket \beta \rrbracket^{t,a} (\lambda t'. \llbracket \gamma \rrbracket^{t',a}).
 \end{aligned}$$

The truth-conditions for the sentence (99) are given below. φ is the antecedent, ψ is the consequent.

$$\begin{aligned}
 (99) \quad & \llbracket \text{If Jack quit smoking next summer, he would lose the marathon} \rrbracket^{c,g,w_c,t_c}. \\
 1. & \llbracket \text{PRES}_5 [\text{PERF} [\forall_{\subseteq} [\text{WOLL} [\text{SIM} [\text{HIST} \varphi] \psi]]]] \rrbracket^{c,g,t_c,w_c} \\
 & \text{defined only if } g(5) \text{ O } t_c; \text{ if defined, } \llbracket \text{PRES}_5 [\text{PERF} \\
 & [\forall_{\subseteq} [\text{WOLL} [\text{SIM} [\text{HIST} \varphi] \psi]]]] \rrbracket^{c,g,t_c,w_c} = \\
 2. & \llbracket \text{PERF} [\forall_{\subseteq} [2 [\text{WOLL} [\text{SIM} [\text{HIST} t_2] [\varphi t_2]]] [\psi t_2]]]] \rrbracket^{c,g,t_c,w_c} (g(5)) = 1 \\
 & = \text{by PERF} \\
 3. & [\lambda P_{(it)}. \lambda t. \exists t' [XN(t', t) \wedge P(t')] = 1] (\llbracket \forall_{\subseteq} [\text{WOLL} [\text{SIM} [\text{HIST} \varphi] \psi]] \rrbracket^{c,g,t_c,w_c} (g(5))) \\
 & = 1 = \text{by two } \lambda\text{-conversions}
 \end{aligned}$$

4. $\exists t' [XN(t', g(5)) \wedge [\forall \subseteq [\mathbf{WOLL}[\mathbf{SIM}[\mathbf{HIST}\phi]]\psi]]^{c.g.t_c, w_c}(t') = 1]$
 = by entry of $\forall \subseteq$
5. $\exists t' [XN(t', g(5)) \wedge [\lambda P_{(it)}. \lambda t. \forall t'' \subseteq t (P(t'') = 1)]([\mathbf{WOLL}[\mathbf{SIM}[\mathbf{HIST}\phi]]\psi]^{c.g.t_c, w_c}(t') = 1)] = \text{by IFA}$
6. $\exists t' [XN(t', g(5)) \wedge [\lambda P_{(it)}. \lambda t. \forall t'' \subseteq t (P(t'') = 1)](\lambda t. [\mathbf{WOLL}[\mathbf{SIM}[\mathbf{HIST}\phi]]\psi]^{c.g.t, w_c}(t') = 1)] = \text{by three } \lambda\text{-conversions}$
7. $\exists t' [XN(t', g(5)) \wedge \forall t'' \subseteq t' [[\mathbf{WOLL}[\mathbf{SIM}[\mathbf{HIST}\phi]]\psi]^{c.g.t'', w_c} = 1]]$
 = by entry for **WOLL**
8. $\exists t' [XN(t', g(5)) \wedge \forall t'' \subseteq t' [[\lambda p. \lambda q. \forall w' [p(w') = 1 \rightarrow q(w') = 1]]([\mathbf{SIM}[\mathbf{HIST}\phi]]^{c.g.t'', w_c}([\psi]^{c.g.t'', w_c}))]]$
 = by two λ -conversions
9. $\exists t' [XN(t', g(5)) \wedge \forall t'' \subseteq t' [\forall w' [[\mathbf{SIM}[\mathbf{HIST}\phi]]^{c.g.t'', w_c}(w') = 1 \rightarrow [\psi]^{c.g.t'', w_c}(w') = 1]]]$
 since: $[\mathbf{SIM}[\mathbf{HIST}\phi]]^{c.g.t'', w_c} = [\lambda p. \lambda w'. p(w') = 1 \wedge \neg \exists w'' [p(w'') = 1 \wedge w'' <_{w_c} w']]$
 ($[\mathbf{HIST}\phi]^{c.g.t'', w_c} = \text{by } \lambda\text{-conversion}$
 $\lambda w'. [\mathbf{HIST}\phi]^{c.g.t'', w_c}(w') = 1 \wedge \neg \exists w'' [[\mathbf{HIST}\phi]^{c.g.t'', w_c}(w'') = 1 \wedge w'' <_{w_c} w']$
 = by entry for **HIST**
 $\lambda w'. [\lambda p. \lambda w'. w'$
 has the same history as w_c up to t'' and $p(w') = 1]$ $[\phi]^{c.g.t'', w_c}(w')$
 = $1 \wedge \neg [[\lambda p. \lambda w'. w'$
 has the same history as w_c up to t'' and
 $p(w') = 1]$ $[\phi]^{c.g.t'', w_c}(w'') = 1 \wedge w'' <_{w_c} w']$

= by four λ -conversions and two applications of IFA

$\lambda w'. w'$ has the same history as w_c up to t'' and $[\lambda w. [\phi]^{c.g.t'', w'}](w')$
 $= 1 \wedge \neg \exists w'' [w'' \text{ has the same history as } w_c \text{ up to } t'' \text{ and}$
 $[\lambda w. [\phi]^{c.g.t'', w'}](w'') = 1 \wedge w'' <_{w_c} w']$

= by four λ -conversions

$\lambda w'. w'$ has the same history as w_c up to t'' and $[\phi]^{c.g.t'', w'} = 1 \wedge \neg \exists w'' [w'' \text{ has the same history as } w_c \text{ up to } t'' \text{ and}$
 $[\phi]^{c.g.t'', w'} = 1 \wedge w'' <_{w_c} w']$

by IFA and λ -conversion, we can write line 10 as follows:

10. $\exists t' [XN(t', g(5)) \wedge \forall t'' \subseteq t' [\forall w' [w' \text{ has the same history as } w_c \text{ up to } t'' \text{ and}$
 $[\phi]^{c.g.t'', w'} = 1 \wedge \neg \exists w'' [w'' \text{ has the same history as } w_c \text{ up to } t'' \text{ and}$
 $[\phi]^{c.g.t'', w'} = 1 \wedge w'' <_{w_c} w'] \rightarrow [\lambda w. [\psi]^{c.g.t'', w'}](w') = 1]]]$
 = by λ -conversion
11. $\exists t' [XN(t', g(5)) \wedge \forall t'' \subseteq t' [\forall w' [w' \text{ has the same history as } w_c$
 up to t'' and $[\phi]^{c.g.t'', w'} = 1 \wedge \neg \exists w'' [w'' \text{ has the same history as } w_c \text{ up to}$

t'' and $[\varphi]^{c,g,t'',w''} = 1 \wedge w'' <_{w_c} w' \rightarrow [\psi]^{c,g,t'',w'} = 1]$
 since:
 $[\varphi]^{c,g,t'',w'}$ defined only if p^{49} ; if defined, $[\varphi]^{c,g,t'',w'} = 1$ if $\exists t > t''$ s.t. $t \subseteq$
 next summer and Jack does not
 smoke at t in w' .
 and: $[\psi]^{c,g,t'',w'} = 1$ iff $\exists t > t''$ s.t. Jack loses the marathon in w' at t
 we have:

12. **[If Jack quit smoking next summer, he would lose the marathon]** ^{c,g,w_c,t_c}
 defined only if $g(5) \text{ O } t_c$; if defined,
[If Jack quit smoking next summer, he would lose the marathon] ^{c,g,w_c,t_c}
 $= 1$ if $\exists t' [\lambda N(t', g(5)) \wedge \forall t'' \subseteq t' [\forall w' [w'$ has the same history as w_c up to
 t'' and $\exists t > t''$ s.t. $t \subseteq$ next summer and Jack does not smoke at t
 in $w' \wedge \neg \exists w'' [w''$ has the same history as w_c up to t'' and $\exists t > t''$ s.t.
 $t \subseteq$ next summer and Jack does not smoke at t in $w'' \wedge w'' <_{w_c} w'] \rightarrow \exists t > t''$
 s.t. Jack loses the marathon in w' at $t]\forall t'' \subseteq t' [\forall w' [w'$
 has the same history as w_c up to $t'' \rightarrow p(w') = 1]$.

References

Abusch, D. (1997). Sequence of tense and temporal de re. *Linguistics and Philosophy*, 20, 1–50.
 Alexiadou, A., Rathert, M. & von Stechow A. (Eds.). (2003). *Perfect explorations*. Berlin: Mouton de Gruyter.
 Beaver, D. (1994). When variables don't vary enough. In M. Harvey & L. Santelman (Eds.), *Semantics and linguistics theory* (4th ed.). (Ed.), Cornell: CLC Publisher.
 Beaver, D. (1995). Presupposition and assertion in dynamic semantics. Ph.D. thesis, University of Edinburgh.
 Beaver, D. (2001). *Presupposition and assertion in dynamic semantics*. CSLI Publications and FoLLI.
 Condoravdi, C. (2001). Temporal interpretation of modals. In D. Beaver, S. Kaufmann, & L. Casillas (Eds.), *Stanford papers on semantics*. CSLI Publishers.
 DeRose, K. (1991). Can it be that it would have been even though it might not have been? *Philosophical Perspectives*, 13, 385–413.
 Dowty, D. (1979). *Word meaning and montague grammar*. Dordrecht: Reidel.
 Dowty, D. (1982). Tenses, adverbs and compositional semantic theory. *Linguistics and Philosophy*, 5, 23–55.
 Dudman, V. H. (1983). Tense and time in english verb clusters of the Primary Pattern. *Australian Journal of Linguistics*, 3, 25–44.
 Dudman, V. H. (1984). Conditional interpretation of *if*-sentences. *Australian Journal of Linguistics*, 4, 143–204.
 Enç, M. (1986). Towards a referential analysis of temporal expressions. *Linguistics and Philosophy*, 9(4), 405–426.
 von Fintel, K. (1994). *Restrictions on quantifier domains*. Amherst, MA: GLSA.
 von Fintel, K., & Heim, I. (2000). Lecture Notes, MIT.
 von Fintel, K., & Iatridou S. (2002): Since MIT, ms.
 Hawkins, J. (1991). On (in)definite articles: Implicatures and (un)grammatical prediction. *Journal of Linguistics*, 27, 405–442.
 Heim, I. (1983). On the projection problem for presuppositions. In *Proceedings of WCCFL* (Vol. 2, pp. 114–125).
 Heim, I. (1990). Presupposition projection. In R. van der Sandt. (Ed.), *Presupposition, lexical meaning and discourse processes: Workshop reader*.
 Heim, I. (1991). Articles and definiteness. In A. von Stechow & D. Wunderlich. (Eds.), *Semantics. An international handbook of contemporary research*. Berlin: De Gruyter.

⁴⁹ Here p stands for whatever form this and similar presuppositions turn out to have.

- Heim, I. (1992). Presupposition projection and the semantics of attitude verbs. *Journal of Semantics*, 9, 183–221.
- Heim, I. (1994). Comments on Abusch's theory of tense. In H. Kamp. (Ed.), *Ellipsis, tense and questions*. University of Amsterdam.
- Iatridou, S. (2000). The grammatical ingredients of counterfactuality. *Linguistic Inquiry*, 31(2), 231–270.
- Iatridou, S., Anagnostopoulou, E., & Izvorski R. (2001). Observations about the form and meaning of the perfect. In M. Kenstowicz (Ed.) *Ken Hale: A life in language*. Cambridge, MA: MIT Press.
- Ippolito, M. (2003). Presuppositions and implicatures in counterfactuals. *Natural Language Semantics*, 11, 145–186.
- Ippolito, M. (2004). Imperfect modality. In J. Gueron, & J. Lecarme (Eds.), *The Syntax of time*. Cambridge, MA: The MIT Press.
- Kamp, H. (2001). The importance of presupposition. Selected papers from the SFB 340. In C. Rohrer, & A. Rosseutscher (Eds.), *Linguistic form and its computation*, CSLI.
- Karttunen, L. (1973). Presuppositions of compound sentences. *Linguistic Inquiry*, 4.2, 169–193.
- Karttunen, L., & S. Peters (1979). Conventional implicature. In C.-K. Oh, & D. A. Dinneen (Eds.), *Syntax and semantics 11: Presupposition* (pp. 1–56). New York: Academic Press.
- Kratzer, A. (1981). The notional category of modality. In H.-J. Eikmeyer, & H. Rieser. *words, worlds, and contexts* Berlin: de Gruyter.
- Kratzer, A. (1986). Conditionals. In *CLS 22: Papers from the parasession on pragmatics and grammatical theory* (pp. 1–15). Chicago IL: University of Chicago.
- Kratzer, A. (1991). Modality. In *Semantics. An international handbook of contemporary research*, A.von Stechow, & D. Wunderlich (Eds.), Berlin: De Gruyter.
- Kratzer, A. (1998). More structural analogies between pronouns and tenses. In *Proceedings of SALT VIII*.
- Kripke, S. (1990). Presupposition and anaphora: Remarks on the formulation of the projection problem. Princeton University, Ms.
- Lewis, D. (1973). Counterfactuals. Oxford: Blackwell.
- Lewis, D. (1975). Adverbs of quantification. In E. Keenan (Ed.), *Formal semantics of natural language*. (pp. 3–15). Cambridge, MA: Cambridge University Press.
- Lewis, D. (1979). Counterfactual dependence and time's arrow. *it* *Noûs*, 13, 455–476
- McCoard, J. (1978). *The English present perfect: Tense-Choice and the pragmatic interfaces*. Amsterdam: North-Holland Press.
- Mondadori, F. (1978). Remarks on tense and mood: the perfect future. In F. Guenther, & C. Rohrer (Eds.), *Studies in formal semantics: intensionality, temporality, negation*, (pp. 223–248). Amsterdam: North-Holland.
- Musan, R. (1997). Tense, predicates and lifetime effects. *Natural Language Semantics*, 5, 271–301.
- Ogihara, T. (1996). *Tense, attitudes, and scope*. Kluwer Academic Publishers.
- Ogihara, T. (2002). Counterfactuals, temporal adverbs, and association with focus. In *Proceedings of SALT X*. Cornell University: CLS Publications.
- Partee, B. (1973). Some structural analogies between tense and pronouns. *The Journal of Philosophy*, 70(18), 601–609.
- Rooth, M. (1992). A theory of focus interpretation. *Natural Language Semantics*, 1, 75–116.
- Soames, S. (1989). Presupposition. In *Handbook of philosophical logic* (vol. IV, pp. 553–617), Dordrecht: Reidel.
- Stalnaker, R. (1973). Presuppositions. *Journal of Philosophical Logic*, 2, 447–457.
- Stalnaker, R. (1974). Pragmatic Presuppositions. In M. Munitz, & P. Unger (Eds.), *Semantics and philosophy*, (pp. 197–213) New York: New York University Press.
- Stalnaker, R. (1975). Indicative conditionals. *Philosophia*, 5, 269–286.
- Stalnaker, R. (1978). Assertion. In P. Cole (Ed.), *Syntax and Semantics: 9*, New York: Academic Press.
- Stalnaker, R. (1981). A Defense of conditional excluded middle. In W. L. Harper, C. R. Stalnaker & G. Pearce (Eds.), *Ifs*. (pp. 87–104). Dordrecht: D. Reidel.
- Stalnaker, R. (1999). *Context and Content*. Oxford, UK: Oxford University Press.
- Stalnaker, R. (2002). Common ground *Linguistics and Philosophy*, 25, 701–721.
- Thomason, R. (1984). Combinations of tense and modality. In *Handbook of philosophical logic: Extensions of classical logic*, D. Gabbay, & F. Guenther (Eds.), (pp. 135–165). Dordrecht: Reidel.
- van der Sandt, R. (1992). Presupposition projection as anaphora resolution. *Journal of Semantics*, 9, 333–377.