



# Modal tense: *if* and *wish*

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## Abstract

This paper is concerned with uses of certain morphemes, most notably the past, to represent meanings of distance from reality in modal expressions. This class of morphology has been identified with the names subjunctive, fake tense, fake past, modal past and is referred to here as X-marking, after von Stechow and Iatridou (Linguist Philos, 2020). X-marking has been most studied in the context of English conditionals however, it is well-known that the morphology is observed in many non-English languages and can appear in various other types of constructions, including counterfactual desire expressions. I motivate two desiderata for theories of X-marking in pursuit of an analysis that unifies the phenomenon across expression types and languages. I then develop a novel, formally explicit analysis of X-marking which I show to satisfy these desiderata while providing greater empirical coverage of well-known cases compared to existing accounts. The proposed analysis makes use of modal presupposition projection together with pragmatic inference via Maximize Presupposition to provide a unified treatment of X-marking in English conditionals and counterfactual desires expressions of English featuring wish. I show how previous proposals for X-marking cannot satisfy these desiderata, making them insufficient for a unified account. Lastly, I introduce a hypothesis that all varieties of morphology that can be used as X-marking cross-linguistically—including past, imperfective, plural and habitual—are vacuous in both their X-marked and ordinary uses.

**Keywords** Counterfactuals · Fake tense · Conditionals · Desires

## 1 Introduction

This paper is concerned with uses of certain morphemes, most notably the past, to represent meanings of *distance from reality* in modal expressions. This phenomenon has been given many names in the literature—subjunctive, fake tense, fake past, modal

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past. Here, I follow von Stechow and Iatridou (2020) in referring to all such morphology as *X-marking*. *X-marking* is observed across a variety of languages and in various types of expressions but it is perhaps most familiar from the study of English conditionals, as in (1). In this expression, past morphology appears in both the antecedent and the main clauses, neither of which describe situations prior to the utterance time. Compare the *X*-marked conditional in (1) to the minimally contrasting conditional in (2) featuring ordinary tense morphology both in the antecedent and the main clause. This ordinary tense marking is referred to here as *O-marking*, again following von Stechow and Iatridou (2020). On the most natural interpretation of (1), the hypothetical proposition expressed by the antecedent clause is taken to be false, or *counterfactual*—though, as is well-known, this is not always the case for such expressions. On the other hand, (2) appears to only be felicitous in contexts where the hypothetical proposition is taken to be a live possibility.

(1) If it was snowing now, it would be cloudy.

(2) If it's snowing now, it's cloudy.

In the remainder of this introduction, I will motivate two desiderata for a general account of *X-marking*, considering both cross-linguistic and non-conditional examples. These desiderata will serve the basis of the view developed in this paper.

Nearly all accounts of *X*-conditionals that specify where *X-marking* is interpreted at LF assume it to be interpreted in a wide-scoping position. On such accounts, the *X*-morphology is assigned by an operator scoping above the embedded and main clauses.<sup>1</sup> We will discuss the details of such accounts but for now what matters is that the mechanisms by which *X-marking* is assigned within the antecedent clause is—either implicitly or explicitly—attributed to some kind of cross-clausal morphological agreement. Arregui (2009) and Romero (2014) develop analyses in which the same mechanisms involved with sequence-of-tense phenomena are used to account for the assignment of *X*-morphology in conditionals. However, certain empirical facts raise concerns for such an approach. There are languages that do not have any evidence of cross-clausal assignment of tense morphology yet require counterfactual conditionals to bear *X-marking* in both the antecedent and main clause. The counterfactual conditionals of Russian bear such a form, illustrated with the example in (3) from James (1982). However, Russian has been argued not to have sequence-of-tense (see, for example, Grønn & Von Stechow 2010). Similarly, in Ogihara (1989) it is argued that Japanese also lacks sequence-of-tense, yet counterfactual conditionals bear the same pattern of *X-marking* as in English, illustrated with the example in (4) from Ogihara (2004).

<sup>1</sup> One exception to this is Iatridou (2000) where a multi-operator approach is considered along with a single operator approach, discussed later in the paper. Additionally, Schulz (2019) develops a compositional analysis in which *X-marking* is interpreted in a lower position case, also discussed later in the paper.

- (3) yesli but                    dul                    poputnwy veter, mw pliuli    znacitel'no bwstreye  
 if    hypothetical blow-PAST favorable wind, we sail-PAST much faster  
 'If a favorable wind were blowing, we would be sailing along much faster.'
- (4) Mosi Taroo-ga sono-toki soko-ni i-ta ra, nagut-te i-ta daroo.  
 if Taro-NOM then            there-at be-PAST, hit-PROG PAST probably  
 'If Taro had been there then, I would have hit [him].'

With the absence of independent evidence of sequence-of-tense-like agreement in these languages, we should avoid (if possible) resorting to a view that is dependent on this kind of agreement to capture the morphology form of *X*-conditionals. On such a view, we would be required to accept—barring any additional empirical discoveries—that the only expressions where this kind of agreement occurs in these languages is *X*-conditionals, where it is not clear that it is happening.<sup>2</sup> With the assumption that the correct analysis of (1) is the same for (3) and (4), the facts of Japanese and Russian suggest that cross-clausal tense agreement is not at play in *X*-marked conditionals generally. However, as will be discussed below, this should not be taken as a knock-down argument against such a view.

James (1982) notes that all languages that have *X*-marking appear to feature it in conditionals, however not all languages exhibit the same *X*-marking patterns in conditionals. As has been discussed in Iatridou (2000) and von Fintel and Iatridou (2020), there is a cross-linguistic pattern not observed in English in which *X*-marking in the antecedent is of a different morphological form than in the main clause. Spanish is a language of this kind, as is Greek and French. This is illustrated with the Spanish example in (5) from von Fintel and Iatridou (2020). Here the antecedent verb form bears past subjunctive morphology while the main clause bears a conditional form.

- (5) Si fuera                    más alto            sería                    un jugador de baloncesto.  
 If be.3.sg.past.subj more tall    be.3.sg.cond a player of basketball  
 'If s/he was taller, s/he would be a basketball player.'

Examples like (5) bearing different forms of *X*-marking in different positions appear to suggest that the separate instances of *X*-marking can be associated with separate instances of *X* operators.<sup>3</sup> If the *X*-marking observed in the antecedent and consequent clauses of these two conditionals was assigned by a single operator we would expect

<sup>2</sup> In discussing this point, Schulz (2014) claims that if there is no evidence of sequence-of-tense, then we may consider an alternative mechanisms for achieving long-distance *X*-marking agreement. However, the problem still persists with this assumption. The fact is that there appears to be no independent evidence of any kind of cross-clausal tense agreement phenomena in Russian and Japanese. Whether we want to try to associate the mechanics of such a process with exactly those of sequence-of-tense or some other mechanisms, we would still be forced to assume that in the case of Russian and Japanese cross-clausal tense agreement only occurs in counterfactual conditionals.

<sup>3</sup> Also discussed in von Fintel and Iatridou (2020) is the fact that in Spanish, along with many other languages, counterfactual desires are represented with *X*-marking and bear a certain resemblance to *X*-marked conditionals that is not found in English *wish* expressions. Counterfactual desires in Spanish feature *X*-marking in both the main and embedded clause, where the *X*-marking in the main clause

the morphology to be the same in both clauses. This data does not entirely exclude an analysis wherein a single instance of an *X*-marking operator can have different morphological reflexes in different finite clauses. However, such a morphosyntactic property would be exceptional and without further evidence of such an exceptional behavior of an operator we should avoid relying on such an assumption. There is another important cross-linguistic phenomenon observable in *X*-marking expressions, which is the obligatory use of imperfective morphology in *X*-marking constructions of certain languages. This fact is discussed in detail in Iatridou (2000) for Greek counterfactual constructions. This paper will be primarily concerned with past form *X*-marking, though I return briefly to the point of imperfective *X*-marking in Sect. 5 where a hypothesis is introduced that aims to unify past and imperfective *X*-marking.

In addition to conditionals, attitude constructions are another type of expression in which *X*-marking is seen across various languages. In English, this can be illustrated with counterfactual desire expressions featuring *wish* like (6), which require *X*-marking in the embedded clause.

(6) Mary wishes it was snowing now.

One important difference between English *X*-conditionals and English *wish* expressions is that in conditionals *X*-marking is represented in two positions, whereas in *wish* expressions *X*-marking is only observed in a single position, in the embedded clause. Moreover, it is apparent that the *X*-marking of (6) cannot be assigned by a tense operator in the matrix domain, like sequence-of-tense, given that the matrix verb *wish* bears present tense morphology which reflects the semantic tense of the desire. If we want to have a unified treatment of *X*-marking in conditionals and *wish* expressions, then it seems that the *X*-marking in (6) must be assigned from within the embedded clause. The alternative to this is that *X*-marking is assigned by *wish*, as is assumed in more traditional views of mood selection. However, as will be discussed further in this paper, this view does not allow for a unified treatment of *X*-marking in conditionals and *wish* expressions.

In what follows, I take for granted the null hypothesis that *X*-marking is interpreted in the same way across all expression types and all languages.<sup>4</sup> In reflecting on the data discussed so far with respect to this null hypothesis, I take this data to lead to two desiderata for any theory of *X*-marking. The first is that the theory should allow

Footnote 3 continued

resembles that of the main clause of counterfactual conditionals and *X*-marking in the complement clause resembles that of the antecedent of counterfactual conditionals. This is illustrated with the example in (i) from von Fintel and Iatridou (2020).

(i) Querría que fuera más alto de lo que es.

Want.3.sg.cond that be.3.sg.past.subj more tall than it that be.3.sg

'I wish s/he was taller than s/he is.'

The desire predicate is marked with the conditional morphology and the main copular verb of the embedded clause carries the past subjunctive form, though is interpreted with present tense. von Fintel and Iatridou (2020) show how this pattern is observed across a collection of languages and introduce a generalization to capture it.

<sup>4</sup> See von Fintel and Iatridou (2020) on this point.

for *X*-marking to be interpretable from an embedded position relative to the modal component that *X*-marking is associated with. This is stated in (7).<sup>5</sup> In the case of *wish* expressions in English, we must assume that *X*-marking is interpreted in an embedded position relative to the modal component, *wish*, targeted by *X*-marking.

(7) **Desideratum 1**

It should be possible to interpret *X*-marking in an embedded position relative to the modal that it is associated with.

*X*-conditionals in languages like Japanese and Russian favor a view in which *X*-marking in the antecedent clause does not get assigned from outside the embedded clause boundary. This entails an analysis for such conditionals in which there is an *X*-assigning operator interpreted within the antecedent clause. If we must assume that *X*-marking in the antecedent of conditionals is assigned by an embedded operator, assuming that sequence-of-tense is not active, then we can derive from Desideratum 1 an additional desideratum around the interpretation of *X*-marking in conditionals. This leads to an analysis in which conditionals feature two distinct, possibly identical, operators in the antecedent and consequent. Such an assumption is supported by the data of Spanish considered above and was originally considered in Iatridou (2000), in light of such patterns observed in Spanish and other languages.

(8) **Desideratum 2**

*X*-marking in the antecedent and main clause of conditionals can be attributed to separate instances of *X*-marking operators.

As an additional motivation for Desideratum 2, such an analysis of *X*-marking in conditionals would allow for a unified treatment of the syntax of *X* and *O*-conditionals. In *O*-conditionals, we observe ordinary tense morphology in the antecedent and consequent which reflects the local and distinct tense properties of the two clause. Given that we must assume that this *O*-marked agreement is attributed to local and distinct tense

<sup>5</sup> A reviewer raises the question of whether Desideratum 1 conflicts with the known ability for modals to be interpreted below temporal tense operators in *O*-marked expressions (Condoravdi, 2002). The reviewer offers the example below, which can be uttered in a context in which the speaker has forgotten the names of dinosaurs they once knew.

- (ii) When I was younger, I could name many types of dinosaurs.

With the ability to name many types of dinosaurs being past-oriented, the past form *O*-marked modal *could*—where the past morphology is clearly temporal—must be in the scope of a past tense operator in (ii). While the LF involves a (temporal) tense operator above a modal, I do not see these examples as problematic with respect to Desideratum 1. The desideratum only calls for the ability for a modal operator to be interpreted above an operator associated with *X*-marking. Moreover, it only calls for this to be a possibility for certain *X*-marked expressions—as motivated by English *wish* expressions—and does not even go so far as to say that *X*-marking should always be interpreted in the scope of the associated modal (though this will be the case in the proposed analysis). So, Desideratum 1 calls for the possibility of the *X*-associated operator being interpreted above the modal and applies only to *X*-marking, while (ii) indicates the possibility for temporal tense operators to be interpreted below *O*-marked modals. As far as I can see, these are compatible. If we have reason to believe that the scope possibilities of temporal and fake tense operators relative to modals are different, then, on a view in which the two types of operators are of a different syntactic/semantic category (as in the view proposed in this paper), then we may attribute these to differences in syntactic and semantic properties. I leave for future research the questions of exactly what the differences in scope properties are and how they may be derived from syntactic/semantic differences.

operators, with Desideratum 2 we can assume that the morphology that distinguishes between *X* and *O*-marked conditionals arises through identical syntactic processes, allowing for a simpler and more unified view of conditionals.

I would like to make clear a difference in the status that the two desiderata have in the development of the proposed analysis of *X*-marking below. I intend Desideratum 2 to take on a sort of secondary status in relation Desideratum 1, corresponding to a difference in their respective empirical motivation. Desideratum 1 appears to be a requirement for a unified treatment of *X*-marking in conditionals and *wish* expressions. Desideratum 2, on the other hand, does not. While the empirical points discussed above in relation to Desideratum 2 raise concerns for a single operator approach to *X*-conditionals, they do not rule out such an analysis. It may well be that in languages like Japanese and Russian, sequence-of-tense—or something like it—is only active in *X* conditionals. Additionally, while the unificational aspect of the multi-operator view is beneficial, it should not in itself be viewed as motivator of one view over another. However, being forced into maintaining an exceptional sequence-of-tense-like treatment of *X*-marking agreement in such languages is, as discussed above, not desirable. An account that at least allows for a multiple operator treatment of *X*-conditionals has an advantage over those that are incompatible with such a view, which all existing technical proposals are, as will be discussed.

There are two aims to this paper. The first is to develop a new technically explicit analysis of English *X* and *O*-conditionals which satisfies the two desiderata above, capturing the full range of core data, which no existing accounts are able to do. This includes both counterfactual and well-known non-counterfactual uses of *X*-marking from Anderson (1951) and *modus tollens* conditionals, as discussed in Stalnaker (1975) and many others. While the account is developed with a focus on English expressions, I additionally consider various cross-linguistic facts relevant to the established desiderata. Following the view of Leahy (2011, 2018), I assume that *X*-marking on conditionals is vacuous and *X*-conditionals enter pragmatic competition with presuppositionally stronger *O*-marked alternatives. A presuppositional implicature derived from the use of *X*-conditionals expresses a meaning represented in the proposals of Stalnaker (1975), von Stechow (1999) and Mackay (2019), in which *X*-marking denotes the suspension of a presupposition in the context. The derived meaning additionally includes a modification to these proposals offered in Mackay (2019) that *X*-marking is concerned with only the factive presuppositions of the context. In developing the proposed view, I introduce the novel assumption that the presuppositional meaning of *O*-conditionals is the result of presupposition projection from an embedded position within the scope of the restricted modal. The second aim of this paper is to show how the proposed presupposition projection analysis developed for conditionals can be naturally extended to English *wish* expressions. The analysis provides an account of the ability for *X*-marking to be interpreted in the complement of *wish* while also explaining why *O*-marked tense morphology is infelicitous in the complement of *wish* expressions. The proposed view allows for a common explanation of the obligatory use of *X*-marking in *wish* expressions and *modus tollens* conditionals. In both cases, it is shown that the use of *O*-marking results in a contradiction, thereby forcing the use of vacuous *X*-marking with no competing alternatives.

The last component of the proposed view addresses the question of morphological commonality between the *X* and *O* uses of the same morphological form, a question that must be addressed by all modal accounts of *X*-marking.<sup>6</sup> For this, I introduce the unificational hypothesis that all uses of all morphology that can be interpreted as *X*-marking are vacuous. This hypothesis extends to *X* and *O* interpretations of past tense, in addition to *X* and *O* interpretations of other types of morphology that can be treated as *X*-marking cross-linguistically, including imperfective, habitual and plural. I show how this hypothesis provides a simple explanation to an otherwise particularly challenging problem. I leave the task of exploring such a hypothesis for future research.

In Sect. 2, I outline the proposed analysis of conditionals, starting with an initial version of the proposed presupposition projection treatment of *O*-marked conditionals along with the proposed pragmatic treatment of *X*-marked conditionals. I show this initial version of the analysis to satisfy Desideratum 1. In Sect. 2.6, I introduce an updated version of the proposed analysis which allows the view to additionally satisfy Desideratum 2, in which all conditionals are assumed to feature multiple modal tense operators. In 3, I show how the analysis developed for *X*-conditionals can be extended without modification to *wish* expressions. In Sect. 4, I discuss existing approaches to *X*-marking along with the challenges that each of these accounts face, comparing these accounts to the proposed account. In the last section, I introduce the unificational hypothesis for all varieties of *X* and *O* morphologies.

## 2 English *X* and *O*-conditionals

In this section, I propose an analysis of *X* and *O*-marking in English conditionals that satisfies Desideratum 1 in (7) and Desideratum 2 in (8). I aim to show that the analysis introduced in this section is able to capture the various counterfactual and non-counterfactual uses of English *X*-conditionals discussed below. With regard to the meaning attributed to *X* and *O*-conditionals, I take inspiration from what I refer to as the domain expansion view represented in Stalnaker (1975); von Stechow (1999) and Mackay (2019). With regard to how that meaning is derived, I follow in the spirit of Leahy (2011, 2018), in assuming that *X*-marking makes no direct presuppositional or truth-conditional contribution and attribute the meanings associated with *X*-marking to an inference derived from pragmatic competition. In the proposed analysis, I assume Kratzer's quantificational semantics for conditionals and I introduce the novel assumption that the scope of the restricted modal quantifier of *O*-conditionals contains a world-level presupposition tied to a set of worlds local to the context that projects through the quantifier. I start by laying out the proposed presupposition projection analysis of *O*-conditionals. I then illustrate the corresponding analysis of *X*-conditionals that depends on this, showing how the proposed view satisfies Desideratum 1. I then show how this view of conditionals can be modified to embody a multi-operator treatment of conditionals, satisfying Desideratum 2.

<sup>6</sup> The temporal account of *X*-marking which treats it simply as past tense has no such question to answer when considering past-form *X*-marking. On this view *X*-marking and *O*-marked counterparts of the same form are all interpreted in the same way, *viz.* temporal anteriority. However, such an account faces problems when considering the fact that *X*-marking can take on other morphology forms.



## 2.1 Quantificational semantics for conditionals

The proposed account is developed on top of Kratzer's view of conditionals which is based on Kratzer's view of modals (Kratzer, 1977, 1981, 1986, 1991, 2012). Kratzer assumes that modal elements like *must* and *possibly* are quantificational operators ranging over possible worlds. A central aspect of Kratzer's view is that the domain of quantification for modals is determined by two contextually-valued components referred to as the *modal base* and the *ordering source*. Below, I focus only on the modal base as the ordering source won't play a role in the proposed analysis.

A modal base can be characterized as a function  $f$  which maps a world to a set of propositions relevant to a particular modal theme.<sup>7</sup> This theme may correspond to, for instance, a body of knowledge (epistemic) or a set of rules (deontic) that holds in the utterance context.<sup>8</sup> The epistemic interpretation of a modal base corresponding to the body of knowledge of an individual or group of individuals in a world  $w$  can be formulated as in (9). Importantly, the set of propositions associated with a modal base must be internally consistent.<sup>9</sup>

$$(9) f_{ep}^x(w) = \{p : p \text{ is known by } x \text{ to be a fact of } w\}$$

I provide an example semantics for a *must* expression in (10), with the simplifications noted above. I represent  $f$  as a parameter on an interpretation function.<sup>10</sup> The domain of the quantifier is understood as the intersection of the propositions in the modal base.

$$(10) \llbracket \text{must } \phi \rrbracket^f = \lambda w. \forall w' \in \bigcap f(w) : \llbracket \phi \rrbracket^f(w') = 1$$

The modal base and the truth conditions of the prejacent have implicit temporal variables and the output of (10) is assumed to integrate with a tense operator binding those variables.

Kratzer's view of conditionals is inspired by the proposal in Lewis (1975) that *if*-clauses restrict the domain of adverbs of quantification that scope immediately above conditionals. Kratzer generalizes this restrictor analysis to all *if*-clauses, proposing that *if*-clauses restrict either an overt or covert modal quantifier (Kratzer 1978, 1979, 1986, 2012). In cases where there is an overt modal in the consequent clause of a conditional, as in (11), Kratzer assumes that this can serve as the modal quantifying over the domain restricted by the *if*-clause. In conditionals lacking an overt restricted modal, Kratzer assumes that there is a covert necessity modal quantifying over the

<sup>7</sup> More explicitly, a modal base maps a world-time pair to a set of propositions, however in the proposal here I abstract away from the time component for simplicity. This will be come more relevant when discussion previous proposals for *X*-marking, in particular with the temporal account discussed in Sect. 4.4.

<sup>8</sup> Like the modal base, the ordering source is a function from world to sets of propositions. However, the ordering source, is used to represent optimality with respect to some ideal, for example, a set of rules or normalcy in the utterance world Kratzer (1981, 1991).

<sup>9</sup> Modal bases differ in this respect to order sources which need not be internally consistent.

<sup>10</sup> The proposed analysis does not hinge on this assumption and is consistent with the treatment of these elements as compositionally integrated, represented with pro-forms in the LF of modal expressions which are valued by a context-dependent assignment function.



restricted domain, as in (12). This operator, represented as *Nec* below, is understood as an epistemic modal in Kratzer's view.<sup>11</sup> Kratzer treats *if* as semantically vacuous.

(11) If Mary is here, then Sue must be here.

$[[\textit{must} [\textit{if} \textit{Mary is here}]] \textit{Sue is here}]$

(12) If Mary is here, then Sue is here.

$[[\textit{Nec} [\textit{if} \textit{Mary is here}]] \textit{Sue is here}]$

The restricted domain of quantification in these expressions is made up of the worlds consistent with the set of propositions resulting from the addition of the antecedent proposition to modal base, again omitting representation of the ordering source for simplicity.<sup>12</sup> I represent the restricted modal base worlds given a hypothetical expression  $\phi$  as  $\bigcap f(w) \cap \llbracket \phi \rrbracket^f$ . The analyses of (11) and (12) can both be represented with the semantic schema in (13).

(13)  $\lambda w. \forall w' \in \bigcap f(w) \cap \llbracket \phi \rrbracket^f : \llbracket \psi \rrbracket^f(w') = 1$

I assume this semantics for all conditionals moving forward, again abstracting away from both the ordering source and time-related components of meaning, which should be understood as implicit.

## 2.2 The domain expansion view of conditionals

The analysis proposed in this section falls into a family of approaches to *X* and *O*-conditionals, which I refer to here as the domain expansion view. Domain expansion is rooted in Stalnaker (1975), in which conditional semantics is attributed to a selection function that selects the closest world to the actual world at which the hypothetical proposition is true. Stalnaker additionally posits a pragmatic default according to which the selection function is assumed to stay within the *context set*, i.e., the set of worlds consistent with all mutually presupposed propositions in the context. This represents the intuitive idea that, even when speaking hypothetically, we are by default—but not always—concerned with discerning among the worlds that we take to be candidates for the actual world. The role of *X*-marking under Stalnaker's view is to block this default, in order to allow the selection function to select worlds outside of the context set. *X*-marking thus signals the suspension of some presupposition(s) in the interpretation of the conditional.

<sup>11</sup> See Khoo (2015) for arguments that the modal base of bare conditionals should be understood as metaphysical.

<sup>12</sup> In conditionals, the ordering source achieves the effects of similarity or closeness first proposed as a requirement in the semantics of conditionals by Stalnaker (1968) and Lewis (1973). On this view, the conditional must be evaluated with respect to a world or set of worlds maximally similar to the utterance world, which is represented with an ordering on the set of possible worlds.

There may be a variety of motivations to suspend presuppositions, the most natural being that the hypothetical proposition is taken to be false in the context, as in the case of counterfactual conditionals. However, as Stalnaker discusses, there may be other motivations for the selection function to reach outside of the context. One such situation is when the interpretation of a conditional within the context set results in a logically infelicitous meaning. Stalnaker notes the non-counterfactual use of *X*-marking conditionals first discussed in Anderson (1951) as one such case.

- (14) Jones must have taken arsenic because...  
       if Jones had taken arsenic, he would be showing these exact symptoms.

In such a use of *X*-marking the speaker typically is interpreted as arguing in favor of the truth of the hypothetical proposition. This meaning is permitted by Stalnaker's view given that the semantics of this view still allows for the hypothetical proposition to be possible. However, what is particularly interesting about conditionals in such contexts is that it is not just possible for the conditional to bear *X*-marking, it is a requirement. The *O*-marked counterpart is infelicitous in such contexts.

- (15) #If Jones took arsenic, he is showing these exact symptoms.

Stalnaker's view accounts for this fact as well. If all worlds in the domain of the restricted quantifier are assumed to be in the context set, then it is trivially true that all of those worlds are worlds at which a proposition is true that is presupposed to be true in the context. We can then attribute the infelicity of (15) to its lack of informativity.

The analysis can be extended to explain similar facts involving *X* and *O*-conditionals in *modus tollens* arguments, which also require the use of *X*-marked conditionals, despite the antecedent proposition not being counterfactual. Stalnaker discusses cases like (16a).

- (16) The murderer used an axe but...  
       a. if the butler had done it, he wouldn't have used an axe.  
       b. #if the butler did it, he didn't use an axe.

If the domain of the conditional was a subset of the context set, given the pragmatic default, the speaker's assertion in (16b) would express that all worlds in a subset of the context set are worlds at which a presupposition of the context is false. This meaning is contradictory, allowing Stalnaker's account to correctly predict the expression to be infelicitous. Thus, Stalnaker's view allows for an explanation of not only the ability to use *X*-marking conditionals when the antecedent proposition is not counterfactual but the requirement to do so in certain cases.

In von Stechow (1999), Stalnaker's analysis of conditionals is restated to fit Kratzer's quantificational semantics for conditionals. With this modification, the view of *X* and *O*-conditionals can be stated as in (17).

- (17) a. *O*-marking in conditionals are interpreted with a pragmatic default assumption that the domain of the quantifier is contained within the context set.  
       b. *X*-marking in conditionals presupposes that the domain of the quantifier is partly outside the context set.

von Fintel offers a collection of additional empirical arguments motivating this view. von Fintel shows that in addition to the cases in (1), (14) and (16), this view can explain the relative weakness of the contribution of *X*-marking in certain contexts in which minimally different *X* and *O*-conditionals are both acceptable. von Fintel discusses the example in (18), attributed to a letter from Stanley Peters to Irene Heim.

(18) X: Kennedy was shot by a lone gunman.

Y: Kennedy was shot by two gunmen.

Z: Look guys. You gotta admit this. If two gunmen had shot Kennedy, then two guns would have been found. So let's find out how many were in fact found. Perhaps, that's going to get us somewhere.

Z': Look guys. You gotta admit this. If two gunmen shot Kennedy, then two guns must have been found. So let's find out how many were in fact found. Perhaps, that's going to get us somewhere.

von Fintel notes that the use of the *X*-marked form in Z allows the speaker to take on a more diplomatic position on the truth of the hypothetical. We can understand the presupposition that is being suspended in the *X*-marking conditional of Z's response as the presupposition that the antecedent is epistemically possible. In speaking without presupposing the possibility of the antecedent, Z is expressing a more neutral stance on the possibility that two gunmen shot Kennedy than Z'. The motivation for this, as von Fintel says, can be interpreted differently by different hearers. We can similarly extend this analysis of (18) to account for other varieties of weak remoteness conditionals like, for example, future oriented *X*-conditionals referred to as future-less-vivids.

(19) If it snowed tomorrow, the flight would be canceled.

Here we can understand the speaker to be motivated to use *X*-marking to suspend the belief that the antecedent is possible in order to implicate that the speaker takes the hypothetical future event to be less likely to occur than not.

The domain expansion view thus offers a wide empirical coverage of core examples of *X* and *O*-conditionals in English. The primary challenges for such an approach are the following three: (i) How can we formally derive this analysis? (ii) How can we connect the meaning associated with *X*-marking with the typical temporal interpretation of past morphology? (iii) How can such an analysis be extended to treat cases of *X*-marking in non-conditional expressions? In the remainder of this section, I will introduce a means by which the domain expansion view can be implemented, with some modifications to the view, using a few additional assumptions that I take from the existing literature.

Mackay (2019) proposes a means of technically implementing the domain expansion view. On Mackay's account *X*-marking denotes a presupposition that the modal base of the conditional is a proper subset of the true presuppositions of the context. The meaning of the proposed account will align with that of Mackay's account and the domain expansion view generally however, there are important differences in how the meaning is derived, which will be discussed in various sections below.

### 2.3 The factive common ground

Mackay (2019) argues that in a domain expansion style approach, the set of worlds grounded in the context should not be based on the beliefs of the members of the context but a more restrictive set of propositions. This set of propositions represents the true beliefs of the context.<sup>13</sup> This contrasts with original formulation in Stalnaker (1975); von Fintel (1999) and many others which take  $X$ -marking to represent a relation with simply a set of beliefs in the context. As Mackay argues, there are empirical motivations for this more restrictive meaning involving situations in which  $O$ -conditionals are uttered yet must reach outside of the context set given false presuppositions of the speaker. Mackay considers an example from Edgington (1995) shown in (20). Consider a context in which it is presupposed that dancing results in rain the next day. Imagine that someone in this context utters the conditional in (20) and it does not end up actually raining the next day.

(20) If we dance, it will rain tomorrow.

As Mackay discusses, such situations pose a problem for an account in which the domain of  $O$ -conditionals is interpreted as a subset of the context set, noting the proposal of von Fintel (1999).<sup>14</sup> On such an approach, the indicative conditional in (20) is predicted to be true given the false presupposition of the context because it is the case that at all worlds in the context set in which the participants in the conversation dance it rained the following day. This is the case despite the fact that in this context the actual world is not in the context set. Mackay then concludes that if a conditional selects from or quantifies over a set of worlds in the context, it must be the subset of factive worlds in the context set, not the context set in its entirety. This allow for the utterance in (20) to evaluate to false in contexts where it is indeed false. I follow Mackay in this assumption and develop an implementation of the domain expansion view where the relevant domain is derived from the set of shared presuppositions that are true in the context, i.e., the *factive common ground*.

### 2.4 Presupposition projection in $O$ -conditionals

The proposed analysis of  $O$ -conditionals involves the projection of presuppositions through quantificational operators. What we will be concerned with first is the projection behavior of presuppositions in the nuclear scope of a generalized quantifier. This topic has become an area of particular importance within the study of presupposition as competing formal theories of presupposition diverge in their predictions for such expressions. The relevant LF configuration is illustrated in (21) in which  $\phi$  is the restrictor of a quantifier  $Q$ ,  $\psi$  is the nuclear scope and  $\gamma$  is a presupposition applying to the variable  $x$  bound by  $Q$ . The empirical questions surrounding this situation are i. what is the presupposition that arises from the projection of  $\gamma$  through the generalized

<sup>13</sup> See also Nolan (2003) and Stalnaker (2005).

<sup>14</sup> Mackay shows that such cases are not problematic for the closely-related proposal of Stalnaker given that Stalnaker's pragmatic default is taken to only apply when a conditional is evaluated in the context set.

quantifier? and ii. how does that give rise to the presuppositional meaning associated with the expression?

$$(21) \quad [[Qx \phi(x)] \psi_\gamma(x)]$$

Different analyses of presuppositions make different predictions about the force of the projected presupposition, where some take it to always be universal (Heim, 1983; Charlow, 2009), or always existential (Beaver, 2001), while others predict that it will depend on the force of  $Q$  (Chemla, 2009; George, 2008; Sudo et al., 2012; Fox, 2013). The empirical facts surrounding presupposition projection from the scope of quantifiers have proven difficult to clearly pin down. I will start by making an empirical assumption that has to do with projection from the scope of a universal quantifier. Looking at (21), I will take for granted that when  $Q$  is universal,  $\gamma$  projects in a way that supports a universal inference. This is illustrated in (22).<sup>15</sup>

- (22) Every boy rode his bike to school.  
 Presupposition: Every boy has a bike.

In more recent literature, empirical evidence shows a contrast between the force of the presuppositional inference associated with universals and existentials, which appears to depend on the type of presupposition (Chemla, 2009).

Following Kratzer, I take modals to express quantification over possible worlds. I make the assumption here that the projection behavior of presuppositions in the scope of modals is parallel to that of generalized quantifiers. This assumption is formalized in (23).

(23) **Parallel Projection Assumption (PP)**

Given an expression  $E_1$  containing a quantificational phrase  $Q_1$  and an expression  $E_2$  containing a quantificational phrase  $Q_2$ , if the quantificational force of  $Q_1$  and  $Q_2$  are the same and  $Q_1$  and  $Q_2$  both take inputs with interpretations of the form  $\lambda\alpha : p(\alpha). q(\alpha)$ , then the quantificational force of the projected presuppositions of  $E_1$  and  $E_2$  will be the same regardless of the type of  $\alpha$ .

In the discussion following, parallelism of projection behavior is only considered in the contexts of quantification over worlds and entities, though I assume that this should extend to any other types including, for example, time points, degrees, or complex types. With PP, given a universal modal quantifier and a world-level presupposition trigger in its scope, we would expect to observe a projection behavior parallel to that in (21), where the projected meaning is understood to hold true of every world in the domain of the quantifier. I do not commit here to a particular analysis of presupposition projection. The literature has focused on presupposition projection in the context of quantification over entities. However, the existing proposals appear to make a prediction of parallel projection behavior across quantifiers regardless of the type of the element being quantified over. I leave it to the reader to explore this.

<sup>15</sup> The literature does not universally agree that this is the correct understanding of the presuppositional content of (22). Beaver (2001) offers arguments aiming to show that universal presuppositions for such expressions are too strong, in light of cases in which universal generalized quantifiers are negated. Beaver concludes with such cases, and others, that presuppositions should be assumed to project existentially in all contexts like (21), regardless of the force of  $Q$ .

Assuming Kratzer's quantificational analysis of conditionals, I take the LF of  $O$ -conditionals to be of the form in (21). The question now is what is the content of that presupposition represented as  $\gamma$  in the scope of the quantifier in (21). I attribute this presupposition to an operator  $O$  defined in (24), which contributes the world-level presupposition that the input world of the proposition is the set of worlds consistent with the factive common ground. In the following formalizations, I take  $c$  to represent the set of propositions believed to be true in the utterance world by the members of the conversation, i.e., the common ground. This is treated as a parameter on the interpretation function. I will use the notation  $c^T$  to represent the set of all true presuppositions of a context  $c$ , i.e., the factive common ground.

$$(24) \quad \llbracket O \rrbracket^{c,f} = \lambda p. \lambda w : w \in \bigcap c^T. p(w) = 1$$

I assume that  $O$  sits in the immediate scope of the restricted modal quantifier in the LF of  $O$ -conditionals, from where it projects its world-level presupposition through the modal quantifier. The proposed LF and derived presuppositional meaning for a conditional bearing a restricted universal quantifier is shown in (25).

$$(25) \quad \llbracket \llbracket Nec [if \phi] \rrbracket \llbracket O \psi \rrbracket \rrbracket^{c,f} = \\ \lambda w : \forall w' \in \bigcap f(w) \cap \llbracket \phi \rrbracket^{c,f} : w' \in \bigcap c^T. \forall w'' \in \bigcap f(w) \cap \llbracket \phi \rrbracket^{c,f} : \\ \llbracket \psi \rrbracket^{c,f}(w'') = 1$$

The projection of the presupposition of  $O$  through the universal modal results in a universal presupposition that all worlds in the domain of the conditional are in set of worlds consistent with the factive common ground.<sup>16</sup> In this way, we derive the same assumption in regards to the context containment of the relevant worlds in  $O$ -marked conditionals as in Stalnaker and von Stechow's views. However, a key difference here is

<sup>16</sup> A reviewer raises the question of whether the  $O$  operator would be present in regular declarative  $O$ -marked expressions like (iii).

(iii) It's cloudy.

As the reviewer points out, if (iii) features an obligatory  $O$ , then all declarative expressions are only defined within the factive context set. This may not be problematic since these expressions serve to shrink the context set and would only call for a slight modification of the theory of assertion to understand assertions as operating on the factive context set. Alternatively, as the reviewer points out, if (iii) does not contain  $O$ , then what is to block the embedding of (iii) within a conditional without  $O$ ? The proposed view of both  $X$  and  $O$ -conditionals requires  $O$ -marked conditionals to always have the  $O$  operator. If indeed there is reason to believe that  $O$  is not present in the LF of (iii), there is a possible picture in which we can still ensure the presence of  $O$  in  $O$ -conditionals. On this view, the presence of modal tense operators is dictated by the presence of modal auxiliaries. We may postulate a syntactic selection feature on modal auxiliaries that that is only satisfied with the presence of either  $X$  or  $O$ . On this view (iii) does not contain  $O$ , however (iv) does.

(iv) It must be cloudy.

Such a view would require evidence in which the modals of  $O$ -marked modal expressions like (iv) are ranging over a domain contained within the factive context set. I leave the question of whether we can/should assume that all  $O$ -marked declarative expressions contain  $O$ , as well as the exploration of the alternative view considered here for future research.

that this is represented as a projected presupposition as opposed to a pragmatic default, as in Stalnaker and von Stechow's views.<sup>17</sup>

## 2.5 Deriving the inference of *X*-conditionals

In the proposed analysis, an inference that will be triggered by the use of *X*-marked conditionals is that the hypothetical modal base of the conditional is a proper subset of the factive context set, as in the domain expansion implementation of Mackay (2019). This aspect of the proposal is inspired by the pragmatic view of conditionals offered in Leahy (2011, 2018), though with important differences as discussed in detail in Sect. 4.

The inference associated with *X*-marked conditionals on the proposed view is a presuppositional variety of scalar implicature, based on the pragmatic principle Maximize Presupposition (Heim, 1991). I define the principle below as in Singh (2011).

### (26) Maximize Presupposition (MP)

If  $\phi$  and  $\psi$  are contextually equivalent alternatives, and the presuppositions of  $\psi$  are stronger than those of  $\phi$ , and are met in the context of utterance  $c$ , then one must use  $\psi$  in  $c$ , not  $\phi$ .

I define contextually equivalent alternatives using a definition of contextual equivalence following Sauerland (2003) and Schlenker (2006), defined in (27). This definition makes use of scales as used in Horn (1972) and much following literature in analysis of scalar implicatures.

### (27) Contextually equivalent alternatives (CEA)

The set of contextually equivalent alternatives of an expression  $\phi$ ,  $Alt_c(\phi)$ , is the set of expressions that are contextually equivalent to  $\phi$  that are created by replacing all scalar elements in  $\phi$  with their scalemates.

Two expressions  $\phi$  and  $\psi$  are *contextually equivalent* given a context  $c$  iff...  
 $\{w \in \bigcap c : \llbracket \phi \rrbracket^{c,f}(w)\} = \{w \in \bigcap c : \llbracket \psi \rrbracket^{c,f}(w)\}$

Given MP, if a speaker utters an expression that has a presuppositionally stronger alternative, a hearer can then infer that the presuppositionally stronger alternative was not uttered because the speaker takes its presupposition to be false. Such a presuppositional implicature, also referred to as an *anti-presupposition*, can be observed in (28). Here, the inference that Mary has more than two siblings can be derived from competition with the presuppositionally stronger alternative in (29) featuring *both*. This alternative presupposes that the domain of the quantifier contains exactly two members.<sup>18</sup>

(28) All of Mary's siblings are here.

Inference: Mary has more than two siblings.

<sup>17</sup> The other difference is the factive nature of the relevant context set in the proposed view, following Mackay, which is not an aspect of Stalnaker's view.

<sup>18</sup> Throughout this paper I will make the underlying assumption that the relevant quantifiers presuppose that their domains are not empty.



(29) Both of Mary’s siblings are here.

As long as we can determine a formal definition of alternatives under which (29) is an alternative of (28), we can derive the presuppositional implicature in (28), for example in the spirit of Horn (1972) we may posit the scale  $\langle both, all \rangle$  ordered by presuppositional strength. (29) can then be derived as an alternative of (28) given by replacing *all* with *both*.

Turning to conditionals, we may then posit a scale comprised of  $O$  defined in (24) and an additional element that is presuppositionally weaker than  $O$  which appears in  $X$ -conditionals. I refer to this presuppositionally weaker operator as  $X$  and define it in (30) as a semantically vacuous function of type  $\langle \langle s, t \rangle, \langle s, t \rangle \rangle$ . Given that  $X$  is not a presupposition trigger, it is presuppositionally weaker than  $O$  and, like  $O$ , makes no truth-conditional contribution. I take  $X$  to be responsible for licensing  $X$ -morphology in its various forms.

$$(30) \llbracket X \rrbracket^{c,f} = \lambda p. \lambda w. p(w) = 1$$

Granting CEA, for a given conditional featuring  $X$ , we can find an  $O$ -marked alternative of the form in (2) which is truth-conditionally equivalent and presuppositionally stronger than the  $X$ -conditional. Given the availability of this  $O$ -marked alternative, a hearer of an uttered  $X$ -conditional may infer, given MP, that the speaker takes the presupposition of the conditional derived from  $O$  to be false. There is one other component to the analysis needed to derive the final inference that the hypothetical modal base is a proper subset of the factive context. I make the assumption that those modal quantifiers that can be restricted by an *if*-clause carry a presupposition that their modal base is a subset of the factive common ground.

(31) **Subset Property of Modal Bases (SP)**

Given a world  $w$ , a context  $c$  and a modal  $M_f$  such that  $X$  and  $O$  can appear in the immediate scope of  $M_f$ ,  $f(w) \subseteq c^T$ .

The subset property represents the two varieties of conditionals under discussion: one in which the modal base is identical to the factive common ground, corresponding to  $O$ -marked conditionals and the other in which the modal base is a proper subset of the factive common ground, corresponding to  $X$ -marked conditionals, in which case presuppositions of the context are being suspended.

With MP, CEA, and SP along with the scale  $\langle O, X \rangle$ , we can derive the proposed meaning via the pragmatic inference derived from the usage of  $X$ -marked conditionals as below.

(32) **Derivation of the inference of  $X$ -conditionals**

S utters an  $X$ -marked conditional  $\chi$  in  $w, c$ .

$$\llbracket \chi \rrbracket^{c,f}(w) = 1 \text{ iff } \forall w' \in \bigcap f(w) \cap \llbracket \phi \rrbracket^{c,f} : \llbracket \psi \rrbracket^{c,f}(w') = 1$$

H reasons as follows:

1. There exists an expression  $\omega \in Alt_c(\chi)$ , such that  $\omega$  is presuppositionally stronger than  $\chi$ .

- $$[[\omega]]^{c,f}(w) \in \{0, 1\} \text{ iff } \forall w' \in \bigcap f(w) \cap [[\phi]]^{c,f} : w' \in \bigcap c^T$$
- if defined,  $[[\omega]]^{c,f}(w) = [[\chi]]^{c,f}(w)$  by CEA + projection of  $O$
2.  $\neg \forall w' \in \bigcap f(w) \cap [[\phi]]^{c,f} : w' \in \bigcap c^T$  from 1 + MP
  3.  $\exists w' \in \bigcap f(w) : w' \notin \bigcap c^T$  from 2 + duality of  $\exists \forall$
  4.  $f(w) \not\subset c^T$  from 3
  5.  $f(w) \subset c^T$  from 4 + SP

The resulting meaning is that there is some presupposition(s) in the factive common ground that is not in, i.e., is suspended from, the modal base of the conditional, thereby embodying a version of the domain expansion view. It is important to note that the *O*-marked alternative  $\omega$  will always have a presupposition that is inconsistent with its modal base. The projected presupposition of  $\omega$ —that all worlds in the hypothetical domain of the conditional are consistent with  $c^T$ —cannot be consistent with  $f(w)$  which is missing at least one presupposition included in  $c^T$ . I discuss this point further in Sect. 2.7. Given this inconsistency, though  $\omega$  qualifies as a contextually equivalent alternative to  $\chi$  and is presuppositionally stronger than  $\chi$ , it is logically infelicitous. Thus, the projected presupposition of  $\omega$  is false in any context in which the *X*-marked conditional can be felicitously uttered. From the negation of the presupposition of  $\omega$  and the assumption that the modal base of the conditional will always be a subset of the factive common ground, the hearer can derive the resulting inference that the modal base of the conditional is properly contained in the factive common ground, as shown in (32).<sup>19</sup>

Considering Desideratum 1 stated in (7), *X*-marking is interpreted in the main clause from an embedded position relative to the restricted modal quantifier. In Sect. 3, I show how this allows for a unified analysis of *X*-marking in conditionals and *wish* expressions. That the modal base of an *X*-marked conditional is a proper subset of the factive common ground is a result of the speaker’s choice. As discussed in von Stechow (1999), there can be a variety of motivations for a speaker to suspend presuppositions from the hypothetical domain of a conditional. One such motivation may be that the hypothetical proposition is counterfactual. Another may be that the speaker wishes to implicate that they take the hypothetical proposition to be unlikely. Indeed, the motivation for an utterance of an *X*-marked conditional can even be interpreted differently by different hearers, as discussed by von Stechow. On the proposed analysis, the hearer is not immediately aware of this choice and must derive this aspect of the interpretation of the conditional via inference of the form in (32). On this view, *X*-marking only indirectly indicates the suspension of presuppositions, contrasting with the proposal of Mackay (2019), in which this meaning for *X*-marking is represented as a presupposition. Next, I show how the proposed analysis of *X* and *O*-conditionals allows for satisfaction of Desideratum 2 in (8), with a modification.

<sup>19</sup> A reviewer notes that this analysis may have a natural extension to treating weak necessity modals like *should*. Indeed, as is discussed in von Stechow and Iatridou (2020), in many languages the meaning of weak necessity is created by adding *X*-marking to strong necessity modals. A natural next step then is to explore the viability of the proposed analysis of *X*-marking in conditionals to weak necessity modals.

## 2.6 A multi-operator treatment of *X*-conditionals

Desideratum 2 states that an account of *X*-marking should allow for the two instances of *X*-marking observed in the antecedent and consequent clauses of conditionals to be associated with distinct, though possibly identical, operators. This had two empirical motivations in the introduction. The first corresponds to the existence of languages that have *X*-marking in the antecedent and consequent yet do not have independent evidence of cross-clausal tense agreement. Japanese and Russian have been argued to be of this kind. With the absence of cross-clausal agreement, like sequence-of-tense, then we should aim to only rely on mechanisms that there is independent evidence for in the given language. This leads to an analysis in which *X*-marking in conditionals is assigned by separate instances of *X* assigning operators in each clause, allowing for local morphological agreement. The second motivation for this desideratum comes from observation from Iatridou (2000) and von Stechow and Iatridou (2020) that in some *X*-marking languages *X*-marking can take on different forms in the antecedent and consequent clauses, illustrated with the Spanish example in (5). An additional theoretical advantage of this view is that it allows for a unificational treatment *X* and *O*-conditionals that is not allowed on other views, wherein all conditionals can be said to have the same LF and involve the same syntactic agreement processes. As discussed in the introduction, the motivations for a multi-operator analysis of *X*-conditionals are not strong enough to rule out a single operator analysis. While the question of whether *X*-conditionals should include a single or multiple *X*-assigning operators is still open, I take it as an advantage of the view developed above that it is, as I show in this section, compatible with both a single or multiple operator view, unlike existing proposals which are forced into a single operator view.

The idea of *X*-marking in conditionals being interpreted separately in the antecedent and consequent clauses of *X*-conditionals was originally considered in Iatridou (2000), however this idea has not been implemented in any analyses since then. The vacuous *X*-marking analysis proposed above allows for a straightforward means of supporting such a local distributed analysis of *X* and *O* in conditionals. Given that *X* makes no presuppositional or semantic contribution, we may situate it in the embedded antecedent clause in addition to the main clause (as above), without it disrupting the conditional's presuppositional or truth-conditional meaning. However, the question now is whether this antecedent *X* would have pragmatic consequences that yield a meaning other than the target meaning for these expressions. We may expect that a vacuous *X* in the antecedent of conditionals does in fact trigger a competition with an *O*-marked alternative that features parallel instances of *O* in its antecedent. For a moment, let's consider just the meaning of an *O*-conditional with two instances of *O*—one in the antecedent and one in the main clause. As was assumed with the projection of the main clause *O* above, we would expect the projection of *O* from the antecedent to pattern with the projection behavior of strong presuppositions in the restrictor of generalized quantifiers. Charlow (2009) discusses such cases for generalized quantifier constructions and shows that strong presuppositions appear to project universally from such positions. This is illustrated in the variant on Charlow's examples shown in (33), with the strong trigger *too* in the restrictor of the quantifier. We can compare this to

the minimally different expression in (34), which features the same strong trigger in the nuclear scope of the quantifier yielding in an identical projected presupposition.

- (33) Some of these 100 students who also smoke MARLBOROS are trying to quit.

*Presupposition:* each of the 100 students smokes a cigarette other than Marlboros.

- (34) Some of these 100 students also smoke MARLBOROS.

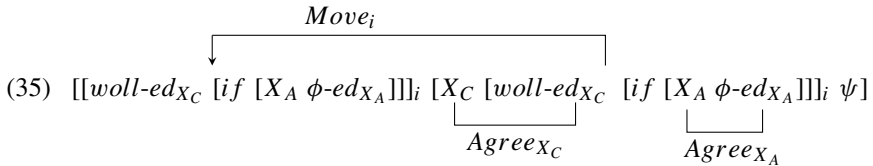
*Presupposition:* each of the 100 students smokes a cigarette other than Marlboros.

If we assumed that *O*-conditionals feature *O* in both the antecedent and the consequent, we would then expect identical projected presuppositions from the two positions. This would amount to the same meaning of universal containment, i.e., that all of the hypothetical worlds are in the factive context set, which we get if we just have the *O* conditional in the main clause, as originally proposed in Sect. 2.4. The result of this for *X*-conditionals is that we can then situate *X* in the antecedent clause in a way that doesn't negatively affect the meaning we are deriving pragmatically; the presuppositional implicature will still be the negation of the presupposition of the *O*-conditional. On the proposed view, the meanings for both *X* and *O* conditionals are entirely unchanged if we assume that whatever modal tense operator is featured in the main clause, that is also featured in the antecedent clause. This is allowed not just by the vacuity of *X* in the proposed analysis but of the combination of vacuous *X* and the presupposition projection treatment of *O*. It is the presupposition projection aspect of the proposal that results in an unchanged meaning for the *O*-conditionals as a whole despite the occurrence of presuppositional element in two distinct clausal domains.

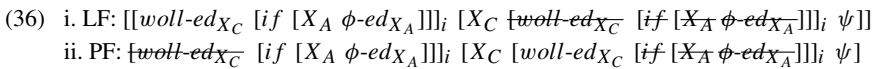
Turning now to the syntactic details of the multiple embedded *X* view, the derivation of the syntactic structure for *X*-conditionals is shown in (35). I represent the syntactic analysis here in a single cycle grammar where all movement (covert and overt) as well as agreement apply to the same narrow syntactic representation and differences in the interpretation and surface form of the expression correspond to differences in interpretation rules at LF and PF respectively—see, for example, Bobaljik (2002).<sup>20</sup> In the proposal, one instance of *X* is situated in the antecedent and a separate instance is in the main clause under the scope of *would + if*-clause at LF. However, I assume that the *would + if*-clause constituent is initially merged in a position below the *X* operator in the main clause, in the typical position of auxiliary modals. It is at this earlier point in the derivation that the *X* operator of the main clause agrees with the lower modal, which I represent below as underlyingly *woll* following Abusch (1985) and others. I assume that an agreement operation *Agree* requires that *X* scopes above (c-commands) the lower inflectional element. The *X* operator in the main clause, notated as  $X_C$ , and the *X* operator located in the antecedent clause, notated as  $X_A$ , separately agree with their local verbs— $X_C$  agreeing with the low copy of the *would* constituent (labeled  $Agree_{X_C}$  in (35)) and  $X_A$  agreeing with the verb of the antecedent (labeled  $Agree_{X_A}$  in (35)). Notationally,  $-ed_{X_A}$  represents *X*-marking assigned by the  $X_A$  operator of the antecedent clause and  $-ed_{X_C}$  represents *X*-marking assigned by the  $X_C$  operator of

<sup>20</sup> This is simply for expository purposes. The proposed analysis of conditionals does not depend on this view of the grammatical architecture.

the consequent clause, i.e., the main clause. After both instances of Agree, the *would* + *if*-clause constituent, marked with an index *i*, is subsequently raised to a position in which it scopes immediately above  $X_C$  in the main clause where it is interpreted at LF, labeled as  $Move_i$  in (35). I represent movement in accordance with the Copy Theory of Movement (Chomsky 1995).



The two copies of the *would* + *if*-clause chain indexed *i* resulting from movement are treated differently at the PF and LF interfaces. At LF, the higher copy gets interpreted, with the lower copy ignored. At PF, the *if*-clause of the higher copy is realized with the lower *if*-clause ignored but the *would* of the higher copy is ignored and the *would* of the lower copy is realized.<sup>21</sup>



On this view, we can assume that the LF and PF representations of *O*-conditionals is parallel to that in (36), the only difference being that *O* is occupying all positions occupied by *X* in (36).

Considering the Spanish example in (5), bearing different forms of *X*-marking in the antecedent and consequent, we can assume that languages like Spanish have two vacuous *X* operators of the same syntactic category that license different *X* forms. In such languages, the main clause *X* operator can be understood to be syntactically selected for by the modal quantifier to appear in the main clause, and the other *X* operator is reserved for the embedded antecedent position. I leave a more explicit discussion of such an analysis for future work.

### 2.7 On the distribution of *X* and *O* in conditionals

On the proposed analysis, *O*-conditionals carry a projected presupposition that the domain of the conditional is properly contained within the factive context set. Leahy (2011) claims that such a meaning cannot be represented as a presupposition because this conflicts with known empirical facts relating to the distribution of *X* and *O*-conditionals. Specifically, Leahy claims that such a locality presupposition would predict a complementary distribution between *X* and *O*-conditionals, which appears not to be the case in light of cases like (18), restated below.

- (37) x: Kennedy was shot by a lone gunman.
- y: Kennedy was shot by two gunmen.

<sup>21</sup> To note, the representation of the EPP subject in the main clause is left out of (36) for simplicity. I assume that at PF the higher subject position would be realized linearly in front of the lower *would* that is realized.

z: Look guys. You gotta admit this. If two gunmen had shot Kennedy, then two guns would have been found. So let's find out how many were in fact found. Perhaps, that's going to get us somewhere.

z': Look guys. You gotta admit this. If two gunmen shot Kennedy, then two guns must have been found. So let's find out how many were in fact found. Perhaps, that's going to get us somewhere.

It is indeed true that if the *O*-conditional in (37) was a contextually equivalent alternative to the *X*-conditional, then we should only expect the presuppositionally stronger *O*-conditional in (37z') to be felicitous in light of Maximize Presupposition. However, the *O*-conditional in (37z') is not an contextually equivalent alternative to (37z), by the definition of contextually equivalent alternatives in (27). This definition determines the set of alternatives of an expression to be those expressions that are equivalent in a given context modulo any parallel scalemates. In a context like (37), the two conditionals contrast in the modal tense operators they feature however they also contrast in their modal bases. The modal base of the *O*-conditional is the set of factive presuppositions of the context, while the modal base of the *X*-conditional is lacking at least one of the presuppositions contained in the factive presuppositions of the context. With contrasting modal bases, the two expressions are not contextually equivalent.

(38) Given the context *c* of (37):

$$\begin{aligned} f_z &= c^T - \gamma \\ f_{z'} &= c^T \end{aligned}$$

For this reason, we do not rule out (37z) on the availability of (37'). However, it must be that the true *O*-marked alternative is disqualified for independent reasons in order for (37z) to be felicitous in this context. The *O*-marked conditional that is contextually equivalent to (37z)—and is identical in surface form to the *O*-conditional in (37z')—is not felicitous in any context. We can derive a contradiction from the *O*-marked alternative of any felicitous *X*-marked conditional. This contradiction arises between the projected presupposition from *O* and the assumption regarding the modified modal base of the *X* expression which must be preserved in all alternatives to satisfy contextual equivalence given the definition of alternatives in (27). A proof of this contradiction is provided in (39). The felicitous *X* conditional is represented as  $\chi$ , and the *O*-marked alternative is  $\omega$ . The notation  $\chi^{[X/O]}$  represents the LF of  $\chi$  with the modal tense operator *X* replaced with its scalemate *O*.  $\gamma$  represents some set of presuppositions suspended from the factive common ground.

(39) **Derivation of contradiction in *O*-marked alternatives**

Given a context *c* in which an *X*-marked conditional  $\chi$  can be felicitously uttered:

1.  $f_\chi(c) = c^T - \gamma$  *speaker's choice*
2.  $\omega = \chi^{[X/O]}$  *scalar substitution*
3.  $\llbracket \omega \rrbracket^{c,f} = \llbracket \chi \rrbracket^{c,f}$  *by CEA*
4.  $f_\omega(c) = c^T - \gamma$  *from 1 + 3*
5.  $\forall w \in f_\omega(c) : w \in \bigcap c^T$  *from 2 + projection of O presupposition*
6.  $f_\omega(c) \subset c^T$  *from 4*

- |     |  |   |
|-----|--|---|
| 7.  | $\bigcap c^T \subset \bigcap f_\omega(c)$                  | <i>from 6</i>   |
| 8.  | $\exists w \in \bigcap f_\omega(c) : w \notin \bigcap c^T$ | <i>from 7</i>   |
| 9.  | $\neg \forall w \in \bigcap c^T : w \in \bigcap c^T$       | <i>from 8 + duality of <math>\exists \forall</math></i> |
| 10. | $\perp$  | <i>from 5 + 9</i>                                       |

Where the *O*-conditional  $\omega$  in (39) yields a contradiction with the *X*-conditional, an *O*-conditional of the kind featured in (37) is not a contextually equivalent alternative to the *X*-conditional. This is because the modal base of a felicitous *O*-marked conditional like (37) is identical to the factive common ground. So, while the surface form of (37z') is identical to the *O*-marked alternative of (37z), this *O*-marked expression is not equivalent to that alternative. In this way, we can understand why *X*-conditionals can co-exist with what appears on the surface to be their presuppositionally stronger *O*-marked alternatives. The optionality for a speaker to use either *X* or *O* in such contexts as (37) to express the same conditional meaning can be attributed to the option of either using a modal base that is missing a presupposition of the context or using a modal base identical to the factive common ground. We are then following in the spirit of Stalnaker (1975) in which a speaker can optionally suspend a presupposition of the context with the use of *X*-marking.

## 2.8 Presupposition projection in possibility conditionals

A question arises for the proposed presupposition projection account of *O*-conditionals when considering the parallel projection assumption PP in (23). This has to do with a known empirical fact of presuppositions with generalized quantifiers that the strength of the projected presupposition depends on the strength of the generalized quantifier (Chemla, 2009). Consider the universal quantificational expression in (22), restated below. The presupposition triggered by *his* in the nuclear scope is associated with a universal interpretation of the possessive presupposition, as was discussed previously. Now, consider the expression in (41), which features an existential subject quantifier. The reported intuition is that the speaker of this expression is presupposing that at least one boy has a bike, not every boy in the context. Chemla (2009) presents experimental work that establishes this quantifier dependence.

- (40) Every boy rode his bike to school.  
*Presupposition:* Every boy has a bike.
- (41) A boy rode his bike to school.  
*Presupposition:* At least one boy has a bike.

Given PP in (23), we should expect a similar contrast in the context of presupposition projection from within the scope of modal quantifiers. We may assume that the interpretation resulting from the projection of the *O* presupposition of an *O*-conditional through the restricted modal quantifier is affected by the strength of the modal quantifier. The presupposition of *O* projected through a universal modal should result in a universal application of the embedded presupposition to all members of the restricted modal domain as in (25). However, if a possibility modal were to be featured in an *O*-marked conditional, the *O* presupposition would be expected to project in a way



that yields a weaker meaning. Taking, for example, the possibility conditional in (42), under Kratzer's view of conditionals the modal restricted by the *if*-clause is *may* for such conditionals.

(42) If the temperature drops below 32 degrees, it may snow.

If we assume that the *O* presupposition will project through *may* as *his* projects through *a boy* in (41), the resulting interpretation would amount to: there is at least one world in the hypothetical domain of *may* which is in the factive context set. Such a presupposition appears to capture the interpretation associated with *O*-marked conditionals that the antecedent is a live possibility in the context. We can derive the possibility of the hypothetical situation that the temperature drops below 32 degrees from the existence of a world in the hypothetical domain which is necessarily a temperature-drops-below-zero world that is also in the factive context set. Given that both the existential and universal application of the world-level *O* presupposition to the hypothetical domain of the quantifier yields the desired meaning for *O*-marked possibility conditionals, how do we determine which of the two meanings is correct? I will consider here one test that can be devised from empirical facts already discussed. These cases appear at first to illustrate that presupposition projection through modal quantifiers does not pattern with the PP assumption in (23) made here. I will show that this does not suffice as a test for the question of how presuppositions project through possibility modals, a question I leave open. As such, this allows the PP assumption to be maintained here.

As discussed in Sect. 2.2, it is an important empirical fact that *O*-marked necessity conditionals are infelicitous when the consequent proposition is true in the context (Stalnaker, 1975). This is illustrated again with (43).

(43) #If Jones took arsenic, he must be showing these exact symptoms.

On the proposed analysis, the domain of this conditional is presupposed to be a subset of the factive context set and the infelicity of (43) is attributed to a resulting tautology, in the spirit of the domain expansion approach of Stalnaker and von Stechow discussed in Sect. 2.2. This explanation for (43) relies on the presupposition applying universally to the members of the hypothetical domain. We might then take this as a test for the projection properties of *O* in the scope of possibility modals. If the expression resulting from replacing *must* with an possibility modal in (43) is felicitous, that can be taken as evidence that the presupposition of *O* projects existentially, thus not resulting in a tautology. If it is infelicitous, we might conclude that the force of the projection is universal, yielding a tautological meaning as in (43). The prediction of the view in which *O* projects universally through possibility modals appears to be borne out. This can be illustrated with the variant in (44), which minimally differs from (43) in that it features a restricted possibility modal *may* in place of *must*. This expression appears to be equally infelicitous as (43).

(44) #If Jones took arsenic, he may be showing these exact symptoms.

We may then conclude from this, assuming the view developed here, that the infelicity of (44) is due to a universal projection of the *O*-presupposition. This yields the same tautological meaning of (43) amounting to 'all worlds in a subset of the factive context set are worlds in which a proposition holds true that is in the factive common ground'.

If this were the correct diagnosis of (44) then this would entail that the PP assumption is not correct and the projection behavior of presuppositions in the scope of modal quantifiers is not parallel to those in the scope of generalized quantifiers. I will make two points here in defense of PP in light of (44).

First, it should be a logical consequence of any analysis that the infelicity of an expression due to un informativity should extend to any expression whose meaning is entailed by it. The weaker of two expressions in an asymmetric entailment relation is necessarily less informative than the other. The example in (44) is asymmetrically entailed by the necessity example in (43). If the stronger example in (43) is infelicitous due to un informativity, then it should be a result of our analysis of presupposition projection that the weaker (44) is uninformative as well. Regardless of whether it is correct to assume that *O* projects existentially through *may* in (44), we should expect (44) to be infelicitous, allowing us to maintain the parallelism between presuppositions in the context of generalized quantifiers and modal quantifiers. However, there may be reason to question the assumption that *O* presupposition projects existentially through *may* in (44) in the first place, discussed next.

Hsieh (2014) considers patterns regarding NPI licensing in the context of *O*-marked necessity and possibility conditionals that illustrates an apparent contrast between the contexts of generalized quantifiers and modal quantifiers. There is a known contrast in the ability of universal and existential generalized quantifiers to create contexts that license NPIs, shown with the two examples below from Hsieh.

- (45) Every student who had ever been to Paris became a good chef.  
 \*Some student who had ever been to Paris became a good chef.

This contrast is accounted for by the downward entailment analysis of NPI licensing—Fauconnier (1975, 1978), Ladusaw (1979), von Stechow (1999)—in which NPIs are taken to be licensed in environments that support downward entailing inference. The restrictor of universal quantifiers is such a context and that of existential quantifiers is not.

- (46) Every student passed the exam.  $\Rightarrow$  Every linguistics student passed the exam.  
 Some student passed the exam.  $\nRightarrow$  Some linguistics student passed the exam.

It is known that necessity conditionals can license NPIs in their restrictor, like universal generalized quantifiers.

- (47) If John has ever been to Paris, he must have seen the Arc de Triomphe.

Hsieh discusses cases where *O*-marked possibility conditionals license NPIs in their restrictors, unlike existential generalized quantifiers, as in (48).

- (48) If John has ever been to Paris, he may have seen the Arc de Triomphe.

This is unexpected on the assumption that the possibility modal of possibility conditionals is an existential quantifier restricted by the *if*-clause given that this would not create a downward entailing context in the *if*-clause. Hsieh considers two possible approaches to this puzzle that allow one to maintain that NPIs are licensed in downward entailing contexts, both of which assume that the *if*-clause of possibility

conditionals restrict a universal quantifier. On one approach, the *if*-clause of possibility conditionals is not taken to restrict the overt possibility conditional but instead a covert necessity modal. As is discussed in Geurts (2004), von Fintel (2012) and others, conditionals can have two readings, one which requires a covert epistemic *must*. Hsieh shows that these two readings can be derived for possibility conditionals with LFs that both feature a covert epistemic *must* restricted by the *if*-clause. On this analysis, the acceptability of (48) is accounted for by the fact that the necessity modal creates a downward entailing context as in (47). On another possible account of (48) that Hsieh considers, we may assume that the overt possibility modal is restricted by the *if*-clause of possibility conditionals but does not denote an existential quantifier. Hsieh cites work in Klinedinst (2007) which argues that possibility modals should contain a universal quantificational component, with a treatment comparable to plural indefinites. Similarly, Rullmann et al. (2008) argue that possibility modals in St'a't'imcets can be treated a universal quantifiers over worlds selected by a modal choice function and suggest that this analysis could be maintained for English possibility modals. On this view, the possibility conditional in (48) again involves restriction of a universal quantifier by the *if*-clause, creating a downward entailing context licensing the NPI *ever*.<sup>22</sup> If either of these views of possibility conditionals is correct, then the *O* presupposition in (44) will be situated in the immediate scope of a universal quantifier, thus projecting universally as in (43). This will yield the universal inference that all worlds in the domain of the quantifier are in the factive context set which, given the content of the consequent, results in an uninformative meaning and thus an infelicitous expression, as is observed with (44).

## 2.9 On the markedness of X-marking

von Fintel (1999) makes a point on the status of *X*-marking as a marked form in comparison to *O*-marking. As von Fintel puts it, we may expect that, with *X* marking being the more marked form in comparison to *O*-marking, it should carry the presupposition distinguishing it from the typical interpretation that we get without that presupposition.<sup>23</sup> This point is based on the assumption that markedness should correspond to presuppositional strength. However, we may take an alternative perspective in which the status of *X* as a marked element can be attributed to its vacuity. Interpreting *X*-marked expressions requires additional effort on the part of the hearer to access the intended interpretation of the speaker. That is, the target meaning of *X*-marked expressions is more restricted than what we get just from its truth-conditional and presuppositional content. After computing the truth-conditional and presuppositional meaning of *X*-marked expressions, the hearer is required to compute the relevant alternative expressions along with their presuppositions, compare the strength of the alternative presuppositions to that of the uttered expression and finally infer additional

<sup>22</sup> Hsieh considers a third option in which NPIs are not taken to be licensed by downward entailing contexts. On an alternative account of NPIs, they have a less restrictive condition of appearing in non-upward entailing contexts, as in Progovac (1993), Rothschild (2006) and Crnić (2011). Hsieh points out that this view coupled with a non-monotonic analysis of conditionals can be used to explain (48). On such a view, all conditionals will license NPIs given that, being non-monotonic, they will never create upward entailing contexts.

<sup>23</sup> See also Leahy (2018) on this point by von Fintel.

meaning taking into account Maximize Presupposition. The final result of this effort is the understanding that there is some presupposition(s) that the speaker is suspending from the presuppositional background against which these expressions are typically interpreted. This additional pragmatic effort is not required in the case of the *O*-marked alternative which can be interpreted at face value once the truth-conditional and presuppositional content is computed. In this way, we may associate the markedness of *X* morphology with greater computational burden. Whether or not there is actually a measurable difference in computational cost between the interpretation of *X* and *O*-expressions could be an interesting research problem in consideration of the vacuity hypothesis in (71).

### 3 English *wish* expressions

The other type of English expression that features *X*-marking discussed in the introduction is *wish* expressions. There are two important facts of *X*-marking in *wish* expressions: (i) *X*-marking must be interpreted within the scope of *wish* and (ii) *X*-marking is obligatory in the complement of *wish*, illustrated with (49) and the clearly unacceptable (50).

(49) John wishes it was raining now.

(50) \*John wishes it is raining now.

What is particularly puzzling here is that the obligatory *X*-marking in (49) appears to have no effect on the meaning of the expression. We must assume that the attitude *wish* itself carries a meaning of prejacent counterfactuality, given that *wish* expressions are always interpreted with such a meaning. However, with that assumption, *X*-marking in such expressions is rendered ineffective. What then could be the role of *X*-marking in (49) and why must it play that role in all *wish* expressions? I will show in this section how the analysis developed for conditionals above provides a straightforward analysis of both questions raised by *wish* expressions. In doing so, we will see close parallels between *wish* expressions and puzzling conditionals discussed above, in particular Anderson and *modus tollens* conditionals. I compare this proposed analysis of *X*-marking in *wish* expressions to existing assumptions in the literature that *X*-marking in the complement of *wish* corresponds to selection of subjunctive mood by *wish*.

#### 3.1 *Wish* as a counterfactual quantifier

I assume that *wish* is a universal quantifier over some set of worlds that denote the desires of the attitude holder or some subset of them. There is a significant literature that is concerned with the precise definition of this set of worlds. In the classical analysis of attitude verbs from Hintikka (1969), these lexical elements denote universal quantifiers over domains representing attitude states. Hintikka's proposal for the semantics of desire predicates, including *wish* and its non-counterfactual counterpart *want*, involves universal quantification over a set of worlds consistent with the attitude holder's desires. It has since been shown that this view is too simplistic and

that desire predicates must be concerned with a more restricted set of possibilities than merely the attitude holder's desires. Most notably, Stalnaker (1984) and Heim (1992) showed that the set of worlds of desire predicates must be constrained by the beliefs of the attitude holder in the context.<sup>24</sup> Heim spelled out an analysis of desire predicates which captures the relevant cases in a dynamic semantic system, however von Fintel (1999) showed how Heim's proposal can be translated into a quantificational semantics for *want* and *wish* under Kratzer's treatment of modals. As far as I can see, the precise definition of the domain of desire quantifiers will not bear on the proposed analysis of *wish* expressions. The important point here is that desire predicates can be treated as universal quantifiers and in this respect the treatment of *wish* expressions outlined in von Fintel (1999) should suffice. To remain agnostic about the definition of the domain of *wish* I denote this domain simply as  $des(x, w, c)$  where  $x$  denotes the attitude holder,  $w$  denotes the evaluation world and  $c$  the set of presuppositions of a context. I will take a moment to make an important point in regards to the nature of contexts in this analysis.

Up to this point,  $c$  and correspondingly  $c^T$  have been understood to contain shared presuppositions of the participants in the conversation. However, in the case of attitude expressions, data shows that *wish* and *want* are in fact interpreted against the beliefs of the attitude holder. Iatridou (2000) shows that for *wish* expressions, the prejacent of *wish* can be interpreted as counterfactual relative to the attitude holder and not relative to the members of participants of the conversation. Iatridou points to examples like (51), which can be compared to the infelicitous alternative lacking  $X$ -marking in (52).

- (51) John wishes he were married to exactly the type of woman he is married to but he doesn't know it.
- (52) #John wishes he is married to exactly the type of woman he is married to but he doesn't know it.

What these cases show is that the counterfactuality of *wish* +  $X$ -marking must be understood as counterfactuality relative to the beliefs of the attitude holder, given that the complement of *wish* is in fact believed to be the case by the speaker. This corresponds with well-known facts regarding presuppositions of attitude expressions that gave rise to the notion of *local contexts*, i.e., contexts which accommodate for beliefs of the attitude holder which may not be consistent with beliefs of the participants in the conversation. Local contexts were first discussed in Karttunen (1974) and later formally implemented by Heim (1992) and others to deal with situations very close to

<sup>24</sup> For instance, Heim initially motivates this for the semantics of desire predicates generally with cases like in (v). The problem this poses for a simple Hintikka semantics for *want* is that it is possible for the person who utters the sentence to actually prefer not to teach at all.

(v) I want to teach on Tuesdays and Thursdays.

This case appears to indicate that the desire is taking into account certain relevant facts of the utterance context, for example, that the speaker is required to teach. Heim proposes for such cases that the domain of *want* corresponds to a set of worlds that are the most desirable among a set of worlds maximally similar to the utterance world. Thus, for (v), the set of worlds corresponds to a set of most desirable worlds that are also consistent with the fact that the subject is required to teach at some point in the week. Heim suggests a collection of further refinements on the semantics of both *want* and *wish* to capture additional cases.

cases like (51). On the early conception of local contexts, they correspond to contexts of evaluation for an attitude expression or expressions closely following them in the discourse that represent the beliefs of the attitude holder, rather than the members of the context. Consider the example from Heim (1992) in (53).

- (53) Patrick is under the misconception that he owns a cello and he wants to sell his cello.

The possessive presupposition of *his* in the attitude expression cannot be interpreted against the presuppositions of the actual context given that the speaker does not take this presupposition to be satisfied. Karttunen takes cases like this to indicate that the presuppositions of the desire expression are not evaluated against the beliefs of the actual context but against the beliefs of the attitude holder. Heim (1992) offers a means of formalizing Karttunen's empirical description in a dynamic semantic framework.<sup>25</sup> Taking cases like (53) into consideration, we must understand the *c* parameter on the interpretation function in the definition of *wish* (54) to correspond to a local context representing the presuppositions of the attitude holder.

With the notion of local contexts, we can move now to a semantic definition of *wish* expressions. The counterfactual aspect of *wish* I represent with a presupposition that no worlds in the set of all worlds at which the prejacent of the expression are true are also true in the set of worlds consistent with the presuppositions of the context according to the attitude holder. In formulating the semantics we must differentiate between the utterance context and the embedded local context. I refer to the utterance context as *c* and the embedded context representing the beliefs of an input attitude holder *x* as *c<sub>x</sub>*. I assume the following definition of *wish*.

$$(54) \llbracket wish \rrbracket^{c,f} = \lambda p_{(s,t)}. \lambda x. \lambda w : \neg \exists w' \in p : w' \in \bigcap c_x. \forall w'' \in des(x, w, c) : p(w'') = 1$$

Importantly, the counterfactual nature of the prejacent *p* here is attributed to the presuppositional component which relativizes the counterfactuality of *p* to the local context *c<sub>x</sub>*. All other context-sensitive elements of *p* are additionally assumed to be interpreted in *c<sub>x</sub>*. Assuming this definition of *wish* we will next discuss the effects that inserting both *X* and *O* in the scope of *wish* have on the presuppositional content of *wish* expressions to explain the mysterious properties of *wish* expressions.

### 3.2 Forcing *wish* + *X*

In this section, I show how the analysis of *X* and *O* conditionals in the previous section can be extended to an account of *wish* expressions. This crucially relies on the two key aspects of the proposed view: the presupposition projection of *O* and the competitive interactions between *X* and *O* expressions. This will account for the important criteria for any account of *wish* expressions discussed in the introduction: (i) that *X* can be interpreted within the scope of *wish* and (ii) that *X* is obligatory. The account of *wish* will I propose here maintains that the obligatory nature of *X* in *wish* expressions is due to an independent problem that arises with the alternative featuring

<sup>25</sup> See Schlenker (2009) for a non-dynamic conception of local contexts.

*O*. With the presuppositionally stronger alternative being infelicitous, *X* is required given that its vacuity makes it compatible with the contribution of *wish* in interpreting the expression. In fact, this is the same treatment of both Anderson and *modus tollens* conditional proposed above, inspired by Stalnaker (1975). In those conditionals, *X*-marking is understood to be required in both varieties of conditionals given that *O*-marking yields a tautological meaning in the case of Anderson conditionals and a contradictory meaning in the case of *modus tollens* conditionals.

The key step in arguing for the proposed analysis of *wish* is to show how the use of *O* with *wish* yields a problematic interpretation that forces the use of the vacuous *X*. I assume that there is a modal tense layer in the clausal complement of *wish*. Considering an *O*-marked *wish* expression like (50), the LF and corresponding interpretation of such expressions is shown in (55). This meaning includes the interpretation resulting from the universal projection of the world-level *O* presupposition in (24) through the universal quantifier of *wish*, as defined in (54). The presupposition of *O* is assumed to project such that its remoteness component is interpreted relative to the factive local context  $c_A^T$ , i.e., the set of true propositions in the set of propositions consistent with the beliefs of the attitude holder *A*.

$$(55) \quad \llbracket [A [\textit{wish} [O \phi]]] \rrbracket^c = \\ \lambda w : \neg \exists w' \in \llbracket \phi \rrbracket^{c_A} : w' \in \bigcap c_A \ \& \ \forall w'' \in \textit{des}(A, w, c) : w'' \in \bigcap c_A^T. \\ \forall w''' \in \textit{des}(A, w, c) : \llbracket \phi \rrbracket^{c_A}(w''') = 1$$

This meaning features the co-occurrence of the presupposition that there are no  $\phi$  worlds in the local context set  $\bigcap c_A$ —triggered by *wish*—and the presupposition that all worlds in the desire domain are in the local factive context set  $\bigcap c_A^T$ —resulting from the projection of the presupposition of *O*. These two elements of the meaning in (55) are inconsistent, as is demonstrated below.

(56) **Derivation of contradiction with *wish* + *O***

Given an *O*-marked conditional with an LF of the form in (55) and *w, c*:

1.  $\forall w' \in \textit{des}(A, w, c) : \llbracket \phi \rrbracket^{c_A}(w') = 1$  *truth conditions*
2.  $\forall w' \in \textit{des}(A, w, c) : w' \in \bigcap c_A^T$  *from projection of O through 'wish'*
3.  $\exists w' \in \llbracket \phi \rrbracket^{c_A} : w' \in \bigcap c_A^T$  *from 1, 2*
4.  $\neg \exists w' \in \llbracket \phi \rrbracket^{c_A} : w' \in \bigcap c_A$  *presupposition of 'wish'*
5.  $c_A^T \subseteq c_A$  *from def of c\_A^T*
6.  $\neg \exists w' \in \llbracket \phi \rrbracket^{c_A} : w' \in \bigcap c_A^T$  *from 4, 5, downward entailment*
7.  $\perp$  *from 3, 6*

The use of *O* in the modal tense layer in the complement of *wish* yields a contradiction that there are some  $\phi$  worlds in the factive context set and there are no  $\phi$  worlds in factive context set, making such expressions infelicitous in all contexts. Assuming that the modal tense layer in the complement of *wish* must be occupied, we can then understand why the *X* operator must always be featured in the complement of *wish*. The proposed analysis of *wish* expressions is shown in (57), with a meaning comprised of only the truth-conditional meaning of the expression and the counterfactual presupposition triggered by *wish*.



$$(57) \llbracket [A [\textit{wish} [X \phi]]] \rrbracket^c = \lambda w : \neg \exists w' \in \llbracket \phi \rrbracket^{cA} : w' \in \bigcap c_A . \forall w'' \in \textit{des}(A, w, c) : \llbracket \phi \rrbracket^{cA}(w'') = 1$$

Given the vacuity of  $X$  and the absence of any competition leading to a pragmatic inference, the LF in (57) yields a consistent meaning reflecting the understood interpretation of *wish* expressions. With the embedded positioning of  $X$  in the LF of the expression, we can understand how  $X$ -morphology is realized within the embedded complement of the expression.

An alternative approach to the treatment of past morphology in *wish* is to say that *wish* itself assigns this morphology. This assumption is maintained in existing literature on the topic of mood selection by attitude predicates, in which the embedded past morphology is understood as a property of mood. This literature has studied the distribution of mood in the complement of attitudes across many languages in which subjunctive mood is associated with dedicated subjunctive morphology—see Palmer (1986), Giannakidou and Mari (2021), Portner and Rubinstein (2020) among many others. Extending such a view to English *wish* expressions, past tense morphology in the complement of *wish* would be taken to represent subjunctive mood licensed by *wish*. Iatridou (2000) showed that there are languages that have both past form  $X$ -marking and subjunctive morphology and that these forms are not in complementary distribution. For this reason, as Iatridou concludes, we should not treat  $X$ -marking as the subjunctive. Considering *wish*, we should aim to treat  $X$ -marking in the complement clause in the same way that we treat  $X$ -marking in conditionals in order to achieve a unified analysis of  $X$ -marking across expression types and the current proposal does this. The requirement to use  $X$  in light of a contradiction that arises with  $O$  rests on the assumption that the complement of *wish* must feature either  $X$  or  $O$ ; ordinary tense morphology in the complement of *wish* cannot correspond to no modal tense in the LF. A question then arises here as to how generalized this requirement is. Is it that all attitude predicates require either  $X$  or  $O$  in their complement or does this only apply to some subset of predicates? And, consequently, do all attitude complement clauses that appear with ordinary tense morphology feature  $O$ ? I leave these questions for future work.<sup>26</sup>

<sup>26</sup> Another important set of relevant facts that I do not discuss here involves certain means of expressing counterfactual desire with  $X$ -marking in non-English languages. In Iatridou (2000) and von Fintel and Iatridou (2020), patterns are discussed in non-English languages wherein counterfactual desires share properties with counterfactual conditionals. For instance, counterfactual desires in Spanish feature  $X$ -marking in both the main and embedded clause, where the  $X$ -marking in the main clause resembles that of the main clause of counterfactual conditionals and  $X$ -marking in the complement clause resembles that of the antecedent of counterfactual conditionals. This is illustrated with the example in (vi) from von Fintel and Iatridou (2020). Here the desire predicate is marked with the conditional morphology and the main copular verb of the embedded clause carries the past subjunctive form, though interpreted with present tense.

- (vi) Querría            que fuera            más alto de    lo que es.  
 Want.3.sg.cond that be.3.sg.past.subj more tall than it that be.3.sg  
 ‘I wish s/he was taller than s/he is.’

The pattern seen with Spanish counterfactual conditionals and desire constructions appears in various other  $X$ -marking languages, motivating von Fintel and Iatridou (2020) propose the following generalization.

(vii) **Conditional/Desire Generalization (CDG):**

- a.  $X$ -marked conditional: if  $p_{ant}$ ,  $q_{cons}$

## 4 Alternative accounts

In this section, I will discuss a collection of existing approaches to *X*-marking in conditionals along with the challenges that they face. I start by discussing Leahy's approach to conditionals. I show how Leahy's account derives a different meaning from the proposed account and I show how Leahy's account cannot explain non-conditional uses of *X*-conditionals. Following this, I consider the well-known proposal of Iatridou (2000), known as the modal exclusion account, along with a challenge for this account noted in Mackay (2015). I then consider Mackay's response to Iatridou (2000), developed in Mackay (2019). I show that, despite deriving the same meaning for *X*-conditionals as the proposed account, the implementation of Mackay's view is inconsistent with the two desiderata set out in the introduction. Lastly, I consider the temporal approach to *X*-conditionals, which differs from all other accounts discussed here by maintaining a temporal past semantics for *X*-marking. This approach faces challenges too, which I discuss below.

### 4.1 Leahy (2011, 2018)

The first approach to *X* and *O*-marking I discuss here comes from Leahy (2011, 2018), which introduces the novel idea that *X* morphology makes no presuppositional or truth-conditional contribution.<sup>27</sup> On this view, there is some element of the meaning of *O*-marked conditionals that indicates that the speaker takes the antecedent proposition to be possible. *X*-marked conditionals are assumed to lack this feature and their interpretations are assumed to arise from pragmatic inference. Leahy's view provides inspiration for the proposed view which similarly attributes the meaning of *X*-marked expressions to a pragmatic inference. However, Leahy's meaning differs from the proposed meaning in a way that faces various empirical challenges, which the proposed meaning does not.

Leahy makes use of the notion of pragmatic alternatives to derive the meaning of *X*-conditionals as the negation of the meaning of *O*-conditionals. It is first assumed that *O*-conditionals presuppose that the speaker believes that the antecedent is epistemically possible. This is then combined with the pragmatic principle of Maximize Presupposition (Heim, 1991), which favors presuppositional strength, as discussed in Sect. 2.5. Leahy proposes that the interpretation of *X*-conditionals results in a presuppositional implicature like in (28), attributed to the presupposition of an alternative *O*-conditional. Along with Maximize Presupposition, an additional ingredient necessary in Leahy's proposal is that speakers are opinionated about the presuppositions of the alternatives of the expressions they utter. Additionally, Leahy makes two final

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b. unattainable desire: I want<sub>cons</sub> that *pant*

I leave the question of how to capture this pattern within the view of *X* and *O*-marking developed here for future work.

<sup>27</sup> Leahy was innovating on an intuition first introduced in Karttunen and Peters (1979). Karttunen and Peters propose that *O*-conditionals are interpreted as indicating that the speaker takes the antecedent proposition to be epistemically possible, while *X*-marked conditionals express that the speaker takes the antecedent proposition not to be epistemically possible.

assumptions that (a) *O*-marked conditionals presuppose that the speaker believes that the antecedent is possible according to their own knowledge and (b) speakers are reliable. These assumptions are formally stated below. With these assumptions, Leahy derives counterfactual interpretations of *X*-conditionals as in (58). The meaning *the speaker does not take the antecedent  $\phi$  to be epistemically possible* is an inference made by the hearer derived from (i) that the speaker did not use the presuppositionally stronger *O*-marked alternative and (ii) that the speaker is opinionated about the possibility of the antecedent.  $\neg\phi$  can then be derived by from this given the assumption that the speaker is reliable.

(58) **Assumptions**

Opinionatedness of the speaker:  $B_s(\Diamond_{ep_s}(\phi)) \vee B_s(\neg\Diamond_{ep_s}(\phi))$

Reliability of the speaker:  $B_s(\Diamond_{ep_s}(\phi)) \rightarrow \Diamond_{ep_s}(\phi)$

**Deriving counterfactuality**

1.  $\neg B_s(\Diamond_{ep_s}(\phi))$

*Maximize Presupposition*

2.  $B_s(\neg\Diamond_{ep_s}(\phi))$

*Opinionatedness of the speaker*

3.  $\neg\Diamond_{ep_s}(\phi)$

*Reliability of the speaker*

The meaning that is derived here is that the speaker takes  $\phi$  not to be epistemically possible, which, as Leahy explains, entails the counterfactuality of  $\phi$ . On Anderson and *modus tollens* style non-counterfactual *X*-conditionals, Leahy claims that in contexts in which these expressions are uttered, the speaker is assumed not to be opinionated about the antecedent, as they are discussing whether or not the antecedent is true. In this way, a counterfactuality interpretation cannot be derived via presuppositional implicature as in (58). I introduce next two problems that Leahy's approach faces and discuss an additional issue that Leahy acknowledged, all of which involve non-counterfactual *X*-marked conditionals.

The first challenge for Leahy's approach has to do with the proposed treatment of Anderson and *modus tollens* conditionals. For these cases, Leahy proposes that the opinionatedness assumption—needed to derive counterfactual interpretations—is suspended in such non-counterfactual contexts. Such uses, shown in (14) and (16), involve the speaker making an argument in favor of the antecedent, in the case of Anderson arguments, and against it in the case of *modus tollens* conditionals. The problem is that we can create felicitous variants of these cases that make explicit the opinionatedness of the speaker, as in (59). In this version of the Anderson example, the speaker is making clear that they believe the hypothetical proposition to be true and felicitously utters the *X*-conditional in an attempt to convince the hearer of this opinion.

(59) I believe that Jones probably took arsenic because...

if Jones had taken arsenic, he would show exactly these symptoms.

It's important to reiterate here that the opinionatedness of the speaker in Leahy's view is only in regards to the possibility of the antecedent, not the truth of the antecedent. In (59), the speaker clearly believes in the possibility of the antecedent, in fact they believe something stronger: that the antecedent is likely true. It then seems difficult to maintain

that the speaker is not opinionated about the epistemic possibility of the antecedent in such a context. With the opinionatedness of the speaker being made explicit here, such cases are predicted by Leahy's account to be infelicitous. The felicitous *O*-marked version of the conditional should be required given MP, thus posing a challenge for this approach. Moreover, Leahy's assumption to handle such non-counterfactual uses as (59) is not restricted to Anderson style cases but must be a general assumption about any participants in any conversation about whether or not a proposition is the case. Clearly it does not hold that the participants of any discussion of whether or not a proposition  $\phi$  is the case are not opinionated about the epistemic possibility of  $\phi$ . It is quite a natural situation that participants of such conversations are presupposed in the context to be opinionated about the epistemic possibility of  $\phi$ . Indeed, any debate on the truth of  $\phi$  embodies such a scenario.

Another challenge that Leahy's proposal faces, related to the one discussed above, arises with the variety of non-counterfactual conditionals discussed in von Stechow (1999) shown in (18). These cases illustrate the ability to use *X* and *O*-conditionals in the same context. von Stechow's empirical claim is that an individual can optionally utter an *X* or *O*-conditional in precisely the same context with the same attitude towards the hypothetical proposition. Moreover, the speaker of the conditional can utter the *X*-version even when they take the hypothetical proposition to be possible. This may be because they take the hypothetical to be more likely false than not or alternatively, as von Stechow discusses, it may be motivated due to a desire to speak in a more diplomatic way. Under Leahy's proposal, if the speaker believes that the hypothetical proposition is possible, it is necessary to use an *O*-marked conditional, given MP. Though, on all interpretations of the use *X*-marking in (18), the speaker of the conditional takes the hypothetical to be possible, posing a challenge to Leahy's proposal. This issue is closely related to another issue that Leahy's proposal faces, which Leahy acknowledges. This is that Leahy's account cannot explain the felicity of weak remoteness *X*-conditionals, like *future-less-vivid* expressions in (19) or the present tense conditional in (60).<sup>28</sup>

- (60) I don't know if it's snowing now...  
but if it was, it would be cloudy.

As in the discussion of cases like (18), these expressions can be uttered when the speaker believes that the antecedent hypothetical is possible. *X*-marking in such expressions is understood to express that the speaker takes the hypothetical to be unexpected. Moreover, this may be only a very weak degree of unexpectedness and the speaker's attitude towards the likelihood of the hypothetical propositions could be accurately represented with either the *X* and *O*-conditional.

It appears then that Leahy's proposal does not sufficiently account for the various non-counterfactual uses of *X*-conditionals. Though the proposed analysis follows in the spirit of Leahy's pragmatic approach to *X* and *O*-conditionals, the meaning derived is crucially different in a way that can extend to non-counterfactual uses of *X*-conditionals.

<sup>28</sup> See Iatridou (2000) on these varieties of *X*-conditionals.

## 4.2 Iatridou (2000)

Iatridou (2000) aims to capture the contribution that  $X$ -marking makes to the meaning of conditionals and counterfactual desire expressions in a way that explains the connection between  $X$ -marking and temporal interpretations of past morphology. Iatridou proposes that past morphology always marks an abstract relation of exclusion. This relation holds between a set of elements that the expression bearing  $X$ -marking is concerned with, the topic elements, and corresponding elements in the context. This relation is characterized by Iatridou as an *Exclusion Feature*, and is represented in (61). Here the variable  $x$  represents the type of elements within the set  $T$  of topic elements and the set  $C$  of context elements.

(61) Exclusion Feature:  $T_x$  excludes  $C_x$

The differences in the modal and temporal uses of past morphology correspond to the two possible values for  $x$ . On the temporal interpretation, the Exclusion Feature expresses that the topic time of the expression—a set of time points—excludes the utterance time. While it is true that both past times and a future times are excluded from a given utterance time, Iatridou assumes that the evaluation time of an expression can only be a present or past time—with the future expressed modally (Palmer, 1986; Vlach, 1993; Kamp & Reyle, 1993). With this assumption, the exclusion of the topic time from the context entails that the time is in the past, as future times are never candidates for the topic time of an expression. On the modal interpretation, the set  $T_x$  corresponds to the set of worlds that the expression is about. Iatridou assumes that this interpretation of (61) supports an implicature that the modal exclusion relation holds because the speaker knows that the proposition restricting the domain of quantification is false. Iatridou assumes that this implicature is cancellable, along with much of the existing literature on counterfactuals, in light of the non-counterfactual uses of  $X$ -marked conditionals examples from Anderson (1951) and Stalnaker (1975). A compositional derivation of the exclusion analysis is not provided in Iatridou (2000), though see Schulz (2014) for a proposed compositional implementation of Iatridou's proposal. The modal exclusion approach has the merit of accounting for the basic uses of  $X$ -marking while offering an explanation of the connection between temporal and modal interpretations of past morphology.

The modal exclusion view has been shown to make problematic empirical predictions. By excluding the actual world from the worlds of consideration in a conditional, we make invalid *modus ponens* forms of reasoning, which appear to be valid in natural language—see Mackay (2015) and Leahy (2018) for alternative versions of this point. Consider the dialogue in (62). After speaker utters an  $X$ -marked conditional expressing a correlation between John's being here and Mary's being here, it is possible for someone to contest this by pointing to a state of the actual world.

(62) A: If John were here, Mary would be here.  
 B: You're wrong because John is actually here and Mary isn't.

The possibility of arguing for the falsity of an  $X$ -marked conditional given the facts of the actual world indicates that it must be that the actual world is not excluded from the domain of the conditional; if the worlds being described by the conditional were all

presupposed not to be candidates for the actual world, then facts of the actual world should not be able to falsify the conditional in this way. For this reason, it seems that we should take for granted that the actual world can be in the domain of hypothetical worlds under consideration in both *X* and *O*-conditionals.

### 4.3 Mackay (2019)

Mackay (2019) proposes an account of *X*-marking as an alternative the modal exclusion analysis of Iatridou (2000), to avoid the empirical issues raised in Mackay (2015) for the modal exclusion approach. Mackay proposes that *X*-marking expresses a proper subset relation between sets of propositions. The account is based on the fact that when considering counterfactual situations, we must give up certain beliefs, following the intuition of Stalnaker (1975). This meaning is identical to the meaning of the proposed account but the means by which it is derived in Mackay’s analysis is different. Assuming Kratzer’s restrictor analysis of conditionals, Mackay proposes that *X*-marked conditionals feature a modal *Past* operator that presupposes that the modal base of the covert *Nec* operator is properly contained within the set of factive propositions in the context. Mackay’s proposal is represented in (63), with the meaning formatted as in Mackay (2019), in which the modal past operator takes wide scope over the conditional in the LF. An important assumption here is that the modal base is compositionally represented with a pro-form that receives its value from an assignment function *a* represented as a parameter on the interpretation function. Mackay takes the relevant local context set involved in the relation expressed by *X*-marking to be the set of propositions that are presupposed in the context and are true in the utterance world, represented as  $C^T$ . The empirical motivation for this understanding of the common ground, rather than the more traditional usage of the non-factive common ground, was discussed in Sect. 2.3. Mackay proposes the meaning of *X*-conditionals shown in (63).

$$(63) \quad \llbracket [Past \llbracket [Nec [if \phi]] \psi \rrbracket] \rrbracket^{c,f} = \lambda w : f(w) \subset C^T. \forall w' \in \bigcap f(w) \cap \llbracket \phi \rrbracket^{c,f} : \psi(w') = 1$$

The (proper) subset relation presupposed in (63) forces the set of worlds quantified over by *Nec* to contain the utterance world, thus avoiding the empirical issues brought up in Mackay (2015) for modal exclusion accounts. For conditionals with *O*-marking, Mackay assumes that the modal base is the factive set of propositions in the context, an assumption used in the proposed account.<sup>29</sup>

A challenge that Mackay’s analysis faces is that, like the temporal account, it cannot satisfy either of the desiderata in the introduction. In Mackay’s analysis, the *Past* operator takes wide scope over the conditional, modifying the hypothetical modal base of the expression. In this sense, the analysis does not align with Desideratum 1 in which *X*-marking can be interpreted from a position embedded within the scope of

<sup>29</sup> Mackay considers two possibilities for how this could be determined: either there is a present counterpart to the modal past operator that presupposes identity between the indicative modal base and the factive set or this is the result of pragmatic reasoning motivated by Maximize Presupposition.

the modal quantifier that *X*-marking is associating with.<sup>30</sup> Considering Desideratum 2—that *X*-marking in conditionals be interpreted by distinct operators in the antecedent and main clauses—Mackay’s analysis cannot have this property given that there is only a single hypothetical modal base of the conditional. For the *Past* operator to be interpreted in both the embedded and matrix domains, it must be that there are positions in both of these domains in which the conditional modal base can be interpreted. Such an LF would pose challenges of compositionality and does not align with standard views on conditional semantics, including Kratzer’s view which Mackay adopts. Thus, Mackay’s approach does not allow for the cross-linguistic coverage of *X*-marked conditional expressions which motivated Desideratum 2, including properties observed in the counterfactual conditionals of languages like Spanish, Russian and Japanese. For this reason, this account cannot be a candidate for a unified account of cross-linguistic *X*-marking in conditionals and English *wish* expressions.

#### 4.4 Temporal back-shifting

On the temporal analysis of *X*-marked conditionals, *X*-marking is to understood to mark the presence of the temporal past operator positioned outside of the clause that features the morphology. Proposals of this kind include Thomason (1992), Tedeschi (1981), Dudman (1983), Dudman (1984), Edgington (1995), Ippolito (2003, 2006, 2013), Arregui (2007, 2009), Romero (2014), Khoo (2015, 2016). From a wide-scope position, the past operator modifies the time at which the modality of the conditional is oriented. The LF for this view is shown in (64), featuring a restricted necessity modal.

(64) [*Past* [[*Nec* [*if*  $\phi$ ]]  $\psi$ ]]

Worlds are taken to be complete histories and the set of future possibilities within a world increases the further back you move in the history of that world. On this view, to talk about a situation that is not true in the utterance world at the utterance time, it is necessary to back-shift to a time prior to the occurrence of an actual event in the utterance world that ensured the counterfactuality of the antecedent situation. The conditional modality is assumed to require an temporal evaluation time above the conditional, which provides the time that the modality of the modal base of *Nec* is anchored to. The back-shifted modality of these conditionals does not force counterfactuality of the restricting proposition; counterfactuality is derived as an implicature. On this view, the back-shifting of the temporal orientation of the accessibility relation is taken to implicate that the speaker doesn’t believe that the antecedent proposition is a live possibility in the set of worlds accessible from the utterance time. The alternative of the past-oriented conditionals is the present counterpart with *O*-marking, which does involve quantification over a restricted set of worlds accessible from the utterance time.

There is an additional requirement for this view of *X*-marking, which is to explain how the temporal past morphology is assigned by the high *Past* operator. The discrep-

<sup>30</sup> Mackay’s analysis additionally raises a question of compositionality in regards to how the *Past* operator could play the proposed role from a position scoping above the modal and its modal base. See Schulz (2018) for discussion on this and a technical adaptation of Mackay’s view to try to resolve this issue and others brought up by Schulz.



ancy between the positions of *Past* and *X*-marking in (64) calls for a long-distance licensing process not found in typical finite clauses. This is discussed in Arregui (2009) and Romero (2014), who both attribute tense assignment to sequence-of-tense. Sequence-of-tense is the phenomenon by which tense morphology that appears in the embedded clause of an attitude predicate is assigned by a tense operator in the matrix domain of a modal operator, a parallel situation to the LF in (64).

One challenge that faces the temporal approach to *X*-conditionals, has to do with *X*-marking in non-conditional environments, particularly in the cases of attitude predicates like *wish*. As noted in von Stechow & Iatridou (2020), it is not clear how to understand the past morphology in the complement of counterfactual desire expressions like (6) as temporal. I will go through each possible positioning of *Past* in the LF for (6) to show what exactly goes wrong. As a first approach, we might assume that *Past* is situated in a matrix position above the attitude predicate. This would give (6) an LF that parallels that in (64), in which a modal quantifier and clause boundary intervenes between *Past* and the past-inflected element. There are two possible LFs of this kind. Either *Past* is above the high *Pres* operator, whose presence we must assume given the interpretation of the expression and the form of the matrix predicate, or *Past* is below it. These two structures are both shown (65). For now, we will ignore the tense features of the complement clause.

- (65) a. [*Past* [*Pres* [*John* [*wishes* [*Sue was here now*]]]]]  
 b. [*Pres* [*Past* [*John* [*wishes* [*Sue was here now*]]]]]

Both LFs here face semantic and syntactic issues. First, it is not clear how to interpret the two matrix tenses together if we make the standard assumption that they are both non-relative tense operators, always expressing a relation between the evaluation time and the utterance time. This additionally creates a critical compositional problem, in which the higher tense operator cannot semantically compose with the object it is sister to which will already be saturated for tense. On a more intuitive level, it is not clear how the wishing described in (6) could in any way be understood as occurring in the past. Considering the syntax, if there was a matrix past tense operator which had the ability to license past morphology to the embedded auxiliary, this should also necessarily license past morphology on the matrix predicate if it is below *Pres*. Alternatively if *Past* is above *Pres*, *Pres* should intervene on the tense assignment from the high *Past* to the embedded inflectional element. These issues appear to show that a past tense operator cannot be in the matrix domain of (6). Let's consider now the possibility that *Past* is in the embedded clause, giving us an LF for (6) as in (66). Here, we again run into semantic problems.

- (66) [*Pres* [*John* [*wishes* [[*Past* [*Sue was here now*]]]]]]]

In (66) we avoid problematic morphology licensing by placing *Past* in a local position relative to the past-inflected auxiliary, however there is a conflict in the tense interpretation of the complement clause. This proposition must be interpreted as present tense, enforced by the adverb *now*. Thus, if *Past* was in the same clause, there would be contradictory descriptions of the embedded evaluation time. An LF like (66) then can be ruled out on semantic grounds. In light of the problems of the

LFs in (65) and (66), the temporal analysis of *X*-marking then faces a challenge in treating *X*-marking in attitude expressions as marking a real temporal past meaning.

## 5 A unificational hypothesis for *X*-marking

For any account of *X*-marking that proposes a modal interpretation of the morphology, it is necessary to provide an explanation for why in English *X*-marking bears an identical form to past tense morphology. However, this problem is only one part of a larger problem that requires an explanation of this kind for all additional types of morphology that can be identified as *X*-marking, in both English and non-English languages. I will discuss three more types of morphemes that appear to be non-past forms of *X*-marking.

We have already seen that past form *X*-marking appears in English and we also see some version of past morphology in the large majority of other *X*-marking languages. However, in English we see another form of morphology that can optionally co-occur with *X*-marking in all the same kinds of expressions, *viz.* fake plural morphology. In (67), we see plural past *X*-marking in the complement.

(67) I wish it were raining. *past-X + plural-X*

This fake past + fake plural form has been traditionally identified as the subjunctive in English grammatical literature.<sup>31</sup> However, given that this fake plural form has the same distribution of past *X*-marking in English, with no detectable difference in meaning with or without the added plural morphology, we should understand this past plural form as a alternative form of *X*-marking available in English. Considering non-English languages, in (68) taken from Iatridou (2000), we see fake imperfective morphology in Greek. As discussed by Iatridou, this morphology is required to occur with past-form *X*-marking in all *X*-marked constructions. Iatridou discusses a variety of other *X*-marking languages that similarly have such a requirement for past + imperfective *X*-marking.

(68) An eperne                      afto to siropi    tha    ginotan kala.    *past-X + imperfective-X*  
if take-PAST-IMPV this    syrup    FUT become-PAST-IMPV well  
'If we took this syrup, he would get better.'

Lastly, in (69), we can see an example of what has been identified as *X*-marked habitual morphology used in Hindi counterfactual constructions, shown not to be habitual in meaning in Bhatt (1997), Iatridou (2000), Bhatt and Pancheva (2005). Iatridou (2000) makes the point that habitual is not the same as progressive in Hindi and thus habitual-form *X*-marking should be distinguished from imperfective-form *X*-marking.

(69) agar Mona yahan aa-tii,    to    men us-ke-saath foto    khichvaa-taa    *habitual-X*  
if    Mona here    come-HAB then I    her-with    photo draw.cause-HAB  
'If Mona had come here, I would have had a picture taken with her.'

<sup>31</sup> See, for example, Greenbaum (1996), Section 5.

There have been proposals to explain the role of some of these additional non-past morphologies however, each proposal aims to explain the role of a type of *X* morphology individually and does not aim to make progress on the broader unificational problem.<sup>32</sup> The difficulty of making progress on the unificational problem under such approaches will become evident once we state the problem more clearly as I will do next.

We can state the unificational problem of *X*-marking taking into account the four varieties of *X*-morphology discussed here. The difficulty of this problem is that there are really two problems encapsulated in one broader problem. The first, stated in (70) as problem A, calls for an explanation of how each of these types of *X*-marking is connected to its homophonous non-*X* counterpart. For example, what is the connection between the operator that assigns past form *X*-morphology and the operator responsible for interpretations of temporal anteriority? The other sub-problem of the unificational problem, stated in (70B) calls for a unificational picture of all types of *X*-marking. We must explain why each of these types of morphological forms can appear in the same environments with the same meanings. This applies both cross-linguistically and, in some cases, within the same language, as in the cases of past/plural in English and past/imperfective in Greek.

**(70) The Unificational Problems of *X*-marking**

- A. What is the connection between each variety of *X*-marking and their homophonous ordinary-use counterparts, if they have one?
- B. What is the connection between all varieties of *X*-marking observed across languages that makes these forms suitable for representing the interpretations associated with *X*-marking?

Both of these problems are difficult as they require a means of drawing underlying connections between seemingly unrelated morphologies that span a wide variety of semantic categories expressing tense, number and aspect. It is still an open question as to whether there is truly a unificational explanation for both problems, however a vacuous approach to *X*-marking, as in the analysis proposed above, can offer a simple explanation to both problems. The hypothesis I wish to push forward is that all morphologies that can be characterized as a form of *X*-marking in addition to their homophonous non-*X* counterparts are associated with semantic vacuity. This hypothesis is stated in (71).

**(71) Generalized Vacuity Hypothesis**

All morphological forms that can serve as *X*-marking are semantically vacuous in all uses, both modal and non-modal, and any meaning attributed to these forms is the result of a pragmatic inference due to competition with an alternative.

Under this hypothesis, both the modal and non-modal interpretations of past, plural, imperfective and habitual arise from presuppositional implicatures due to competitions

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<sup>32</sup> On the role of imperfective *X*-marking, see, for example, Iatridou (2000) and Ferreira (2016). On the role of Hindi habitual, see Iatridou (2000) and Bhatt and Pancheva (2005).

with some alternative. The alternative bears a presupposition trigger matching the type of the associated semantically vacuous function. This is as detailed in Sect. 2.5 for *X*-conditionals. When considering the ordinary interpretations of the four morphemes considered here, we can naturally identify what the alternative meanings are that determine the alternatives for the presuppositional implicature: for past it is present, for plural it is singular, for imperfective it is perfective and for habitual it is non-habitual.

This hypothesis calls for novel views on heavily studied phenomena and for that reason exploring such a hypothesis is undoubtedly a considerable task. However, there already has been work done that can be viewed as progress towards validating the hypothesis. In Sauerland (2003) and Sauerland et al. (2005), strong empirical evidence is discussed in favor of a vacuous interpretation of the plural, showing various non-plural interpretations of plural morphology across languages. With convincing evidence that one of the collection of *X*-marking morphology forms is vacuous in its ordinary interpretation has been independently shown to be vacuous, the exploration of the hypothesis in (71) could be a promising line of approach for future research.<sup>33</sup>

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<sup>33</sup> In Sauerland (2002), the opposite of what is entailed from (71) for the interpretation of tense is argued for. Sauerland considers examples like (viii), which don't have a present tense meaning. In light of this example, Sauerland proposes the present tense should be treated as vacuous with its meaning derived from a presuppositional implicature due to a presuppositionally stronger alternative with *Past*.

(viii) Every Tuesday this month I fast.

Thomas (2015) argues against Sauerland's vacuous Past treatment of cases like (viii) and in favor of a treatment of (viii) as a futurate expression rather than an ordinary present tense expression.

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