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, identified with the names subjunctive, fake tense, fake past, modal past and referred to here as *X-marking* after von Fintel & Iatridou (2020), 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 featuring the attitude predicate *wish* in English. I motivate two desiderata for theories of *X*-marking in pursuit of an analysis that unifies the phenomenon across expression types and languages. I show how previous proposals for *X*-marking cannot satisfy these desiderata, making them insufficient for a unified account. I then develop a novel, formally explicit analysis of *X*-marking which I show to satisfy these desiderata. The proposed analysis makes use of presupposition projection together with pragmatic inference via Maximize Presupposition to provide a unified treatment of *X*-marking in English conditionals and *wish* expressions. 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–along with their ordinary uses, are vacuous.

*Acknowledgments to be added.

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 past. Here, I follow von Fintel & 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 Fintel & 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 in which 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 nearly all existing accounts of *X*-conditionals that make a proposal as to where *X*-marking is interpreted in the LF of the conditional, *X*-marking is assumed to be interpreted in a wide-scoping position. On such accounts, the *X*-morphology is assigned by a high operator to the embedded and main clause positions.[1] We will discuss the details of such accounts in the next section 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 *X*-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. For example, the counterfactual conditionals of Russian bear such a form—illustrated with the example in (3) from James (1982)—yet Russian is believed 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 (2005).

(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.'

[1] One exception to this is Iatridou (2000) where a multi-operator approach is considered along with a single operator approach, as will be discussed further in the next section. Additionally, Schulz (2019) develops a compositional analysis in which *X*-marking is interpreted in a lower position case, also discussed further in the next section.

(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.[2] With the assumption that the correct analysis of *X*-conditionals in English conditionals like (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, though, 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 & 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 & Iatridou (2020), where 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.[3] If the *X*-marking observed in the antecedent and consequent clauses of these two

[2]In discussing this point, Schulz (2014) claims that if there is not evidence of sequence-of-tense, then we may consider an alternative mechanisms for achieving long-distance *X*-marking agreement. However, the problem still pursists 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.

[3]Also discussed in von Fintel & 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 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 (71) from von Fintel & Iatridou (2020).

(1) 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

conditionals was assigned by a single operator we would expect 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. 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 Section 5 where a hypothesis is introduced that aims to unify past and imperfective form *X*-marking.

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

(6) Mary wishes it was snowing now.

One important difference between English *X*-conditionals and *wish* expressions is that in conditionals *X*-marking is represented in two positions–one in the antecedent and one in the consequent–whereas in English *wish* expressions *X*-marking is only observed in a single position, in the embedded clause. However, more important is that it is apparent that the *X*-marking of (6) cannot be assigned by sequence-of-tense or something akin to it 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, which is a goal of this paper, then it seems then 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 and for this reason will be excluded as an approach here.

In what follows, I take for granted the null hypothesis that *X*-marking is interpreted in the same way across all expressions and all languages.[4] 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 for *X*-marking to be interpretable from an embedded a position relative to the modal component that *X*-marking is associated with. This is stated in (7). 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. *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.

carries the past subjunctive form, though is interpreted with present tense. von Fintel & Iatridou (2020) show how this pattern is observed across a collection of languages and introduce a generalization to capture it.

[4] See von Fintel & Iatridou (2020) on this point.

(7) **Desideratum 1**
It should be possible to interpret *X*-marking in an embedded position relative to the modal that it is associated with.

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 exactly such patterns in which conditionals feature differing morphology in the antecedent and consequent clauses.

(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 this desideratum, such an analysis of *X*-marking in conditionals would allow for a more unified treatment 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 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 a sequence-of-tense like treatment of *X*-marking agreement is, as discussed above, not desirable. An account that at least allows for a multiple operator treatment of *X*-conditionals, perhaps in addition to a allowing for a single operator treatment, 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 of 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 while offering additional advantages over existing accounts of English conditionals. 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. Following Leahy (2011, 2018), I assume that *X*-marking on conditionals is vacuous and *X*-conditionals enter pragmatic competition with presuppositionally

stronger *O*-marked alternatives. The presuppositional implicature derived from the use of *X*-conditionals expresses a meaning representing the proposals of Stalnaker (1975) and von Fintel (1999) in which *X*-marking denotes the suspension of a presupposition in the context. The derived meaning additionally includes an update to these proposals offered in Mackay (2019) that *X*-marking is concerned with only the factive presuppositions of the context. In the technical implementation of the analysis developed, 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 analysis developed for English conditionals can be naturally extended to *wish* expressions. The analysis provides both 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 not felicitous in this position. 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 with both expressions results in contradictory assumptions, thereby forcing the use of vacuous *X*-marking which triggers no interpretation of modal remoteness in the absence of any competition with an *O*-marked alternative.

In Section 2, I discuss existing approaches to *X*-marking in conditionals along with the challenges that each of these accounts face. In Section 3, 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 that depends on this view of *O*-marked conditionals. This initial version of the analysis is shown to satisfy the Desideratum 1. In Section 3.6, I introduce an updated version of the proposed analysis which allows for an account of Desideratum 2, in which all conditionals feature multiple modal tense operators. In 4, I show how the analysis developed for *X*-conditionals can be extended to *wish* expressions. I end by introducing a hypothesis on the connection between the various forms of *X*-marking and the meanings associated with their typical uses.

2 Previous work

In this section, I will outline a collection of existing approaches to *X*-marking in conditionals and the challenges that they face. I also introduce the semantics for modal expressions that will be taken as the foundation for the following discussion.

There are two main categories of approaches to *X*-marking in the literature. On one kind of approach, the modal use of past tense morphology is attributed to an positioning of the usual temporal past operator in a wide scope position the LFs of these conditionals. On this approach, the past describes the temporal orientation of the modality of the conditional. Proposals of this kind include Thomason (1992), Tedeschi (1981), Dudman (1983), Dudman (1984), Edgington (1995), Ippolito (2003), Ippolito (2006), Ippolito (2013), Arregui (2007), Arregui (2009), Romero (2014), Khoo (2015), Khoo (2016). On the other kind of approach, the past morphology is taken to indicate the presence of some kind of modal operator in the conditionals that is dedicated to yielding interpretations of modal remoteness. Proposals that follow this intuition include Joos (1964), Steele (1975), Stalnaker (1975), James (1982), Palmer (1986), Fleis-

chman (1989), Dahl (1997), von Fintel (1998), Iatridou (2000), Starr (2014), Leahy (2011), Leahy (2018), Schulz (2014), Schulz (2018), Mackay (2019). While the temporal category of approach corresponds to a single core analysis, the details of which have been spelled out in various ways, the modal category corresponds to a wide variety of different proposals. Below, I will evaluate the temporal approach along with a collection of proposals in the modal family, with formal details of the approaches included if provided in the original proposals. Before discussing these approaches, it will be necessary to introduce Kratzer's analysis of modals and conditionals, on which the majority of previous accounts are based, along with the analysis that will be proposed in following sections.

2.1 Kratzer's semantics for modality

Kratzer's view of conditionals 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 elements, each contributing a set of relevant propositions given the context. The first of these elements is referred to as the *modal base*. A modal base can be characterized as a function f which maps a world-time pair to a set of propositions that are relevant to a particular modal theme, corresponding to, for instance, a body of knowledge or a set of rules that holds in the utterance context. For example the epistemic interpretation of a modal base corresponding to the body of knowledge of an individual or group of individuals x in a world w at a time t can be formulated as in (9).

(9) $f^{x}_{ep}(w,t) = \{p : p \text{ is known by } x \text{ at } t \text{ to be a fact of } w\}$

The second contextually-valued element in Kratzer's system is known as the *ordering source*, a function represented here as g. Like f, the ordering source is a function from world-time pairs to sets of propositions. Instead of yielding a set of facts relevant to a modal theme, g yields a set of propositions that represents an ideal of some kind (Kratzer 1981, 1991). This may represent an ideal with respect to, for example, rules or normalcy in the utterance world. Unlike in the case of modal bases, the propositions yielded by an ordering source need not be consistent with each other. The inclusion of an ordering source is motivated to avoid certain conflicts that can arise between the set of worlds determined from the modal base alone and the state of the utterance world. From the ordering source, we derive an order on worlds that reflects optimality according to the ordering. This is defined below for a given evaluation world w and time t. For notational simplicity, we can make what is known as the *limit assumption*, i.e. the assumption that there is always a non-empty set of closest worlds given an ordering.[5] Here, $w' \leq_{g(w,t)} w''$ represents that w' is at least as ideal as w'' with respect to $g(w,t)$.

(10) $\forall w', w'' \in W : w' \leq_{g(w,t)} w'' \Leftrightarrow \{p \in g(w,t) : w'' \in p\} \subseteq \{p \in g(w,t) : w' \in p\}$

When restricting the set of worlds ordered by $\leq_{g(w,t)}$ to those that are consistent with a modal base, a set of optimal worlds relative to the ordering can be determined. The set of worlds consistent with $f(w,t)$ can be determined by intersecting the relevant set of propositions $\bigcap f(w,t))$.

[5] Kratzer does not make this assumption in laying out her view of modality. See Kaufmann (2017) for a recent discussion of the limit assumption.

The set of optimal worlds given an f and g is represented here as $Opt_{g(w)}(\bigcap f(w))$ and is defined below.

(11) $Opt_{g(w,t)}(\bigcap f(w,t)) = \{w' \in \bigcap f(w,t)) : \neg\exists w''.\ w'' <_{g(w,t)} w'\}$

We can understand this set of maximally ideal worlds to be the domain of quantification for modals. A central aspect of Kratzer's view of modals is that the variety of modality is underspecified for epistemic or circumstantial modality, aka. root modality, (deontic, goal-oriented, etc.).[6] The intended interpretation of f and g is dependent on the context. For now, we can take contexts to be tuples containing a world, time and an individual. Kratzer's underspecification view of modal auxiliaries is especially motivated by the fact that the same variety of modal meanings is evident across many different languages. I provide an example semantics for a *must* expression in (12). Below I represent f and g as parameters on an interpretation function along with a context parameter.[7]

(12) $[\![must\ \phi]\!]^{c,f,g} = \lambda t.\,\lambda w.\,\forall w' \in Opt_{g(w,t)}(\bigcap f(w,t)) : [\![\phi]\!]^{c,f,g}(w') = 1$

The evaluation world and time are represented as separately integrated compositional elements, with propositions as sets of worlds. The output of the *must* ϕ below is assumed to be integrated with a tense operator valuing the evaluation time.

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 (13), 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—commonly referred to as *bare conditionals*—Kratzer assumes that there is a covert necessity modal quantifying over the restricted domain, as in (14). This operator, represented as *Nec* below, is understood as an epistemic modal in Kratzer's view.[8] Kratzer treats *if* as semantically vacuous.

(13) If Mary is here, then Sue must be here.
[[*must* [*if Mary is here*]] *Sue in here*]

(14) If Mary is here, then Sue is here.
[[*Nec* [*if Mary is here*]] *Sue is here*]

The restricted domain of quantification in these expressions is made up of the optimal worlds among the worlds consistent with the set of propositions resulting from the addition of the antecedent proposition to the set of propositions yielded by the modal base. The restricted modal

[6] There are some exceptions to the variability of modal bases of modal operators, e.g. *might* in English can only be interpreted epistemically.

[7] 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, a.

[8] See Khoo (2015) for arguments that the modal base of bare conditionals should be understood as metaphysical.

base worlds given a hypothetical proposition ϕ are represented as $\bigcap\{f(w,t)\cup\{[\![\phi]\!]^{c,f,g}\}\}$.[9] The analyses of (13) and (14) can both be represented with the semantic schema in (15).

(15) $[\![[[Nec\ [if\ \phi]]\ \psi]\,]\!]^{c,f,g} =$
$\lambda t.\lambda w.\forall w' \in Opt_{g(w,t)}(\bigcap\{f(w,t)\cup\{[\![\phi]\!]^{c,f,g}\}\}) : [\![\psi]\!]^{c,f,g}(w') = 1$

With this semantics for modals and conditionals, we can examine the existing formal proposals for *X*-marking, starting with the temporal approach.

2.2 Temporal back-shifting

On the temporal analysis of *X*-marked conditionals, fake past morphology is taken to indicate the presence of the real temporal past operator positioned outside of the clause that features the morphology. From this position, the past operator modifies the time at which the modality of the conditional is oriented. 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 of an expression, 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 LF for this view is shown in (16), featuring a restricted necessity modal. 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.

(16) $[Past\,[[Nec\ [if\ \phi]]\ \psi]]$

The means by which back-shifting in this LF allows for discussion of the counterfactual situation described by ϕ is illustrated in the model in (17). Here, $\bigcap f(w,t)$ represents the set of *metaphysically* accessible worlds given a context a world and a past time. This set consists of the set of worlds whose histories are identical to w's up to t and may differ after. The past operator of the LF relativizes the set of restricted accessible worlds to a time prior to an event γ that occurred in the utterance world, shown here as w_1, which ensured the falsity of the antecedent proposition ϕ. Applying the conditional function to the world w_1 and time t_1 in (17) yields a truth value 1 in this model. In (17), I show the ordering source as relativized to the same past time that the modal base is evaluated at, however it is not obvious that this should be so. For instance, a natural alterantive would be to understand the ordering source as representing ordering according to some ideal at the evaluation time of the conditional—see, for example, Lewis (1979) for a discussion.

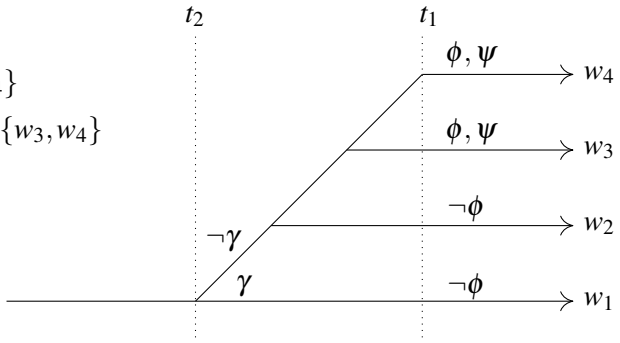
[9] This achieves the effects of similarity or closeness first proposed as a requirement in the semantics of conditionals by Stalnaker (1968) and Lewis (1973). On this view, the conditional must be evaluated with respect to a world or set of worlds maximally similar to the utterance world, which is represented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

(17) **Back-shifted conditionality**

$[\![(16)]\!]^{c,f,g} =$
$\lambda t.\lambda w.\ \exists t'.\ t' < t\ \&\ \forall w' \in Opt_{g(w,t')}(\bigcap\{f(w,t') \cup \{[\![\phi]\!]^{c,f,g}\}\}) : [\![\psi]\!]^{c,f,g}(w') = 1$

$\bigcap f(w_1,t_1) = \{w_1\}$
$\bigcap f(w_1,t_2) = \{w_1,w_2,w_3,w_4\}$
$\bigcap\{f(w_1,t_2) \cup \{[\![\phi]\!]^{c,f,g}\}\} = \{w_3,w_4\}$

$[\![(16)]\!]^{c,f,g}(w_1,t_1) = 1$



The back-shifted modality of these conditionals does not force counterfactuality of the restricting proposition; counterfactuality must be 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 discrepancy between the positions of *Past* and *X*-marking in (16) 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 an embedded clause is assigned by a tense operator in the matrix domain of a modal operator. This is exemplified in the example from Abusch (1988) in (18), where the interpretation of the embedded event of John and his mother having their last meal together is situated in the future relative to the utterance time yet the clause describing this event features the past-inflected auxiliary *were*.

(18) John decided a week ago that in ten days he would say to his mother that they were having their last meal together.

There are a collection of proposals for sequence-of-tense. For *X*-marking, Romero adopts a variable binding view in which the high tense operator binds a variable in the complement clause, assuming Heim's account of feature transmission by variable binding—see Heim (1994) and others. Regardless of how to analyze sequence-of-tense in (18), this effect looks parallel to the situation needed to derive past inflection in the embedded positions of (16) from the high Past operator, making this a viable means of the assignment of past morphology in the antecedent clause.[10]

[10]We will see in Section 3 empirical and theoretical concerns with a sequence-of-tense account of *X*-marking in

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 Sabine Iatridou and Kai von Fintel (2020), it is not clear how to understand the past morphology in the complement of counterfactual desire expressions, like (6) and (71), 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 (16), 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 (19). For now, we will ignore the tense features of the complement clause.

(19) 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 temporal overcrowding 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 (20). Here, we again run into semantic problems.

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

In (20) 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 (20) then can be ruled out on semantic grounds. In light of the problems of the LFs in (19) and (20), the temporal analysis of *X*-marking then faces a challenge in treating *X*-marking in attitude expressions as marking a real temporal past interpretation. I will next review the existing alternative family of accounts that treat *X*-marking as marking a special modal interpretation.

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conditional.

2.3 Domain expansion

Next, I will outline what I refer to here as the domain expansion analysis of *X* and *O*-marked conditionals, rooted in the work of Stalnaker (1975) and von Fintel (1998). The approach began with Stalnaker (1975) in which conditional semantics is grounded in 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*, 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 generally concerned with discerning among the worlds that we take to be candidates for the actual world. Though, this is not always the case and 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 in the interpretation of the conditional.

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 that Stalnaker discusses 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.

(21) 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.

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

Stalnaker's view accounts for this fact as well. Given the pragmatic default and a lack of *X*-marking to block it, 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.

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 (23a).

(23) 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 (23b) 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 Fintel (1998), 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 (24).

(24) **Stalnaker/von Fintel (SvF)**

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), (21) and (23), 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, with only very subtle differences in their meaning. von Fintel discusses the example in (25), attributed to a letter from Stanley Peters to Irene Heim.

(25) 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 motivations of which, as von Fintel says, can be interpreted differently by different hearers. We can similarly extend this analysis of (25) to account for other varieties of weak remoteness conditionals like future-less-vivids.

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

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

The SvF 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 (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 and (iii) how can such an analysis be extended to treat cases of *X*-marking in non-conditional expressions. I return to these questions in following sections. Moving on to other approaches to *X*-marking that similarly attribute the meaning to a modal operator of some kind, I discuss next the influential approach of Iatridou (2000), which proposes a stronger meaning associated with *X*-marking than the SvF approach.

2.4 Modal exclusion

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 (27). Here the variable *x* represents the type of elements within the set T of topic elements and the set C of context elements.

(27) 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. On Kratzer's view of conditionals, this can be understood as the domain of quantification for the restricted operator (though Iatridou does not explicitly make use of Kratzer's view). C_x is understood to represent the set of worlds that, for all the speaker knows, are the actual world, i.e. the information state of the speaker. On this reading, the exclusion relation then expresses that no elements of the speaker's information state are in the conditional domain of quantification. Iatridou assumes that this interpretation of (27) 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, however it 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 (28). After speaker A 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 as B does by pointing to a state of the actual world.

(28) 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, we would not expect facts of the actual world to 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.

2.5 Factive containment

In Mackay (2019), an alternative to the exclusion analysis is proposed to avoid the empirical issues raised for the modal exclusion approach to *X*-marking in Mackay (2015). 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). 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 (30), 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 local set grounded in the context that is 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.[11] This contrasts with proposals like Stalnaker (1975), von Fintel (1998) and many others which take *X*-marking to represent a relation with the context set. Mackay discusses 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 uses an example from Edgington (1995) shown in (29). Consider a context in which

[11] See also Nolan (2003) and Stalnaker (2005).

it is presupposed that dancing results in rain the next day and someone in the context utters the conditional in (29) and it does not end up actually raining the next day.

(29) 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 (1998).[12] On such an approach, the indicative conditional in (29) 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 it must be 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 in order to allow for the utterance in (29) to evaluate to false in contexts where it is false. Using this set, C^T, Mackay proposes the meaning of *X*-conditionals shown in (30).[13]

(30) $[\![[Past\ [[\text{Nec}\ [if\ \phi]]\ \psi]]]\!]^{c,f,g} =$
$\lambda w : f(w) \subset C^T.\ \forall w' \in Opt_{g(w)}(\bigcap\{f(w) \cup \{\phi\}\}) : \psi(w') = 1$

The (proper) subset relation presupposed in (30) 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 exclusion accounts. For conditionals with *O*-marking, Mackay assumes that the modal base is the factive set of propositions in the context.[14]

A challenge that Mackay's analysis faces is that, like the temporal account, it cannot satisfy either of the desiderata of 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 the modal quantifier that *X*-marking is associating with.[15] 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

[12]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.

[13]I represent the conditional semantics as stated above resulting from the limit assumption, assumed throughout the paper for notational simplicity, though it should be noted that Mackay formulates the proposed meaning without the limit assumption, casting the conditional truth conditions in the more complex notation that result from this.

[14]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 the principle *Maximize Presupposition* of Heim (1991), which will be discussed later here.

[15]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 alternative implementation of Mackay's view to try to resolve this issue and others brought up by Schulz, with an approach based on co-indexation of modal base pro-forms.

an LF poses 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 including properties observed in the counterfactual conditionals of languages like Spanish, Russian and Japanese. For this reason, this account is not sufficient for a unifying account of cross-linguistic *X*-marking in conditionals and English *wish* expressions.

2.6 Vacuous *X*-marking

The last approach to *X* and *O*-marking that I discuss here is differentiated from all other approaches, both modal and temporal, by assuming that *X* morphology makes no presuppositional or truth-conditional contribution. On this approach, there is some aspect 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 factors. This idea was first introduced in Karttunen & Peters (1979), who do not offer a formal means of deriving the proposed pragmatics for *X*-marked conditionals. Leahy (2011, 2018) offers an analysis of *X*-marking in this spirit that aims to make the pragmatics of such a proposal more explicit.

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 proposition is epistemically possible. This is then combined with the pragmatic principle of Maximize Presupposition (Heim 1991), which favors presuppositional strength. I define the principle below as in Singh (2011).

(31) **Maximize Presupposition (MP)**
If ϕ and ψ are contextually equivalent alternatives, and the presuppositions of ψ are stronger than those of ϕ, and are met in the context of utterance c, then one must use ψ in c, not ϕ.

Given MP, if a speaker utters an expression which 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 (32). Here the inference that Mary has more than two siblings can be derived from competition with the presuppositionally stronger alternative in (33) featuring *both*. This alternative presupposes that the domain of the quantifier contains exactly two members.[16]

(32) All of Mary's siblings are here.
Inference: Mary has more than two siblings.

(33) Both of Mary's siblings are here.

[16]Throughout this paper I will make the underlying assumption that the relevant quantifiers presuppose that their domains are not empty.

As long as we can determine a formal definition of alternatives under which (33) is an alternative of (32) we can derive the presuppositional implicature in (32), for example in the spirit of Horn (1972) we may posit the scale $\langle$*both*, *all*$\rangle$ ordered by presuppositional strength. (33) can then be derived as an alternative of (32) given by replacing *all* with *both*.

Turning to conditionals, Leahy proposes that the interpretation of X-conditionals results in a presuppositional implicature like in (32), attributed to the presupposition of an alternative O-conditional. Along with MP, an additional ingredient necessary in Leahy's proposal is that speakers are opinionated about the presuppositions of expressions that are alternatives to those expressions that they utter. Additionally, Leahy makes the two final assumptions that 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 sated below. With these assumptions, Leahy derives counterfactual interpretations of X-conditionals as in (34). That the speaker does not take the antecedent ϕ 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.

(34) **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 ϕ not to be epistemically possible, which, as Leahy explains, entails the counterfactuality of ϕ. 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 (34).

I introduce here 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 has to do with the proposed treatment of Anderson and *modus tollens* conditionals, which requires that the opinionatedness assumption needed to derive counterfactual interpretations is not made in such non-counterfactual contexts. Such uses, shown in (21) and (23), 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 with this approach is that we can create felicitous variants of these cases that make explicit the opinionatedness of the speaker, as in (35). It's important to reiterate here that the opinionatedness of the speaker is only in regards to the possibility of the antecedent, not the truth of the antecedent. 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.

(35) I believe that Jones probably took arsenic because...
if Jones had taken arsenic, he would show exactly these symptoms.

In this case, 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, with the felicitous *O*-marked version of the conditional required given MP, thus posing a serious challenge for this approach. Moreover, Leahy's assumption to handle such non-counterfactual uses as (35) 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 ϕ is the case are not opinionated about the epistemic possibility of ϕ. It is quite a natural situation that participants of such conversations are presupposed in the context to be opinionated about the epistemic possibility of ϕ. Indeed any debate on the truth of ϕ embodies such a scenario.

Another issue that Leahy's proposal faces, related to the one discussed above, arises with the variety of non-counterfactual conditionals discussed in von Fintel (1998) shown in (25), which illustrate the ability to use *X* and *O*-conditionals in the same context. von Fintel'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 Fintel 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 (25), 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 (26) or the present tense conditional in (36).[17]

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

As in the discussion of cases like (25), 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.

[17] See Iatridou (2000) on these varieties of *X*-conditionals.

It appears then that Leahy's proposal does not sufficiently account for the various non-counterfactual uses of *X*-conditionals. While this poses a difficult challenge for this particular account, in what follows I will make use of the same intuition and pragmatic machinery that Leahy's approach makes use of. I combine this pragmatic approach to *X*-marking with the proposed meanings of the account of Stalnaker, von Fintel and Mackay to provide a formally explicit analysis of *X* and *O*-marking that accounts for counterfactual and non-counterfactual uses of *X*-marking in English conditionals in addition to accounting for English *wish* expressions, satisfying the two desiderata on theories of *X*-marking layed out in the introduction.

3 Presupposition projection and pragmatic competition

In this section, I propose an analysis of *X*-marking in conditionals that satisfies Desideratum 1 in (7) for an account of *X*-marking, that *X*-marking be interpreted within the scope of the associated modal quantifier. In the following section I introduce a revision to this analysis that allows for satisfaction of Desideratum 2. In addition to the satisfaction of Desideratum 1, I aim to show that the analysis introduced in this section is able to capture all the various counterfactual and non-counterfactual uses of *X*-conditionals discussed in the previous section. With regard to the meaning attributed to *X* and *O*-conditionals, I take inspiration from the Stalnaker/von Fintel view discussed in the previous section, though the means by which these interpretations are derived differs from this approach. Following Leahy (2011, 2018), I take *O*-marked conditionals to carry a presupposition that their *X*-marked counterparts lack and understand the interpretations associated with *X*-marking to be derived as an anti-presupposition given Maximize Presupposition. The key difference between the account that I propose here and Leahy's is the following: where Leahy's account was shown to yield a meaning for *X*-marked expressions that is too strong to allow for the range of meanings observed with *X*-marked expressions, the approach developed below strengthens the contribution of *O*-marking in conditionals, thereby weakening the inferred meaning of *X*-marking in a way that allows for the non-counterfactual interpretations that Leahy's analysis does not. Assuming Kratzer's semantics for conditionals, I introduce the novel assumption that the scope of the restricted modal quantifier of *O*-conditionals contains a world-level presupposition 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 embodies Desideratum 1.

3.1 Presuppositions in quantificational environments

The topic of presupposition projection has to do with the contribution of embedded presuppositions to the presuppositions of the expressions containing them. 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 presuppositions, as competing formal theories of presuppositions diverge in their predictions for such expressions. The situation is illustrated in (37), featuring an LF in which ϕ is the restrictor of a quantifier Q, ψ is the nuclear scope and γ 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 γ through the generalized quantifier? and ii. how does that give rise to the presuppositional meaning associated with the expression?

(37) LF: $[[Qx\ \phi(x)]\ \psi_\gamma(x)]$
Assertion: $Qx \in \phi(x) : \psi(x) = 1$
Presupposition: ?

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 (37), I will take for granted that when Q is universal, γ projects in a way that supports a universal inference. This is illustrated in (38).[18]

(38) 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).

3.2 Presupposition projection in *O*-conditionals

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 (39).

(39) **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 α.

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 (37), where the projected meaning is

[18]The literature does not universally agree that this is the correct understanding of the presuppositional content of (38). 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 (37), regardless of the force of Q.

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. Though the literature has focused on presupposition projection in the context of quantification over entities, these proposals appear to make a prediction of parallel projection behavior across quantifiers regardless of the type of the element being quantified over.

Assuming Kratzer's quantificational analysis of conditionals, I take the LF of *O*-conditionals to be of the form in (37). The question now is what is the content of that presupposition represented as γ in the scope of the quantifier in (37). I attribute this presupposition to an operator *O* defined in (40), which contributes the world-level presupposition that the input world of the proposition is in a local set of worlds in the context. In identifying this set of local worlds, I take motivation from Mackay's view discussed in Section 2.5. Mackay takes the context-oriented modal domain involved in the relation expressed by *X*-marking to be the set of true presuppositions in the context. This was to account for cases in which *O*-conditionals are uttered in a context in which the speaker believes that proposition to be true but it is false, like (29), which creates problems for an account that makes reference only to the set of presuppositions of the context. In the following formalizations, I will use the notation c^T to represent the set of all true presuppositions of the context, i.e. the *factive common ground*.

(40) $[\![O]\!]^{c,f} = \lambda p.\, \lambda w : w \in \bigcap c^T.\ p(x) = 1$

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 (41).

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

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 the intersection of c^T. This is a stronger meaning than that proposed in Leahy's analysis of *O*-conditionals. To recount Leah's view, *O*-conditionals presuppose that the antecedent is possible. Casting this view in terms of the framework assumed here, we can understand this as an existential presupposition that there is some world in the domain of the quantifier that is also in the factive context set. This is a weaker meaning than the universal meaning in (41), which presupposes that all worlds in the domain are in the context set. In the next subsection, I discuss the consequence of this: that a pragmatically derived meaning of the corresponding *X*-marked conditionals using Maximize Presupposition will be weaker.

3.3 Deriving the inference of *X*-conditionals

In the proposed analysis of *X*-conditionals, I follow in the spirit of Leahy (2011) by maintaining that *X*-marking makes no direct presuppositional or truth-conditional contribution. As in Leahy's proposal, *X*-marking's contribution will arise from competition with an *O*-marked alternative. This competition supports an inference derived as a presuppositional variety of

scalar implicature, based on the pragmatic principle Maximize Presupposition (Heim, 1991). While the spirit of the proposal follows that of Leahy's, there will be important differences, most notably in the meaning that is derived from *X*-marking. This difference is derived from a difference in the proposed meaning of *O*-conditionals. It was discussed in Section 2.6 that Leahy's analysis is too restrictive and cannot naturally extend to non-counterfactual interpretations of *X*-marked conditionals. I show that the meaning resulting from competition with *O*-conditionals as proposed above allows for coverage of all varieties of *X*-marking discussed here, This proposal, formally derives a pragmatic inference assumed to be triggered with the use *X*-marked conditionals that the hypothetical modal base of the conditional is a proper subset of the factive context set. In this way, the proposal offers a means of pragmatically deriving the meaning embodying the views of Mackay (2019), Stalnaker (1975) and von Fintel (1998) in a way that satisfies the two Desiderata laid out at the beginning of the paper, as I will show over the next two sections. After laying out the analysis, I discuss further advantages of deriving this meaning pragmatically over Mackay's presuppositional approach.

The meaning associated with vacuous *X*-morphology will be pragmatically derived given the principle of Maximize Presupposition (Heim 1991), restated in (42).

(42) **Maximize Presupposition (MP)**
If ϕ and ψ are contextually equivalent alternatives, and the presuppositions of ψ are stronger than those of ϕ and are met in the context of utterance c, then one must use ψ in c, not ϕ.

I define contextually equivalent alternatives using a definition of contextual equivalence following Sauerland (2003) and Schlenker (2006), defined in (43). This definition makes use of scales as used in Horn (1972) and much following literature in analysis of scalar implicatures.

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

Two expressions ϕ and ψ are *contextually equivalent* given a context c *iff*...
$\{w \in \bigcap c : [\![\phi]\!]^c(w)\} = \{w \in \bigcap c : [\![\psi]\!]^c(w)\}$

We may then posit a scale comprised of *O* defined in (40) 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 (44) 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.

(44) $[\![X]\!]^c = \lambda p.\, \lambda w.\; p(w) = 1$

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 O-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.

(45) **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. The proposed inference derived from the utterance of an X-conditional is detailed below.

(46) **Derivation of the inference of X-conditionals**
S utters an X-marked conditional χ in w, c.

$[\![\chi]\!]^{c,f}(w) = 1$ *iff* $\forall w' \in \bigcap f(w) \cap \phi : \psi(w') = 1$

H reasons as follows:

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

   $[\![\omega]\!]^{c,f}(w) \in \{0,1\}$ *iff* $\forall w' \in \bigcap f(w) \cap \phi : w' \in \bigcap c^T$

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

The resulting meaning of the pragmatic inference corresponds to the presupposition of Mackay's analysis attached to X-marked conditionals shown in (30). It is important to note here that the O-marked alternative ω will always have a presupposition that is inconsistent with its modal base. The projected presupposition of ω, 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 in detail in the next subsection. Given this inconsistency, though ω qualifies as a contextually equivalent alternative to χ and is presuppositionally stronger than χ, it is logically infelicitous. Thus, the projected presupposition of ω

is false in any context in which the X-marked conditional can be felicitously uttered. From the negation of the presupposition of ω 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 in (46). In this way, a hearer can derive from the utterance of an X-conditional the meaning attributed to X-conditionals in Stalnaker (1975) and von Fintel (1998), that presuppositions are being suspended in the interpretation of the conditional.

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 Section 4 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 Fintel (1998), there can be a variety of motivations for a speaker to suspending 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 Fintel. 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 (46). On this view, X-marking only indirectly indicates the suspension of presuppositions and in this way contrasts with the proposal of Mackay (2019), which proposes the same meaning for X-marking as a presupposition, *viz.* that the hypothetical modal base of the conditional is a proper subset of the factive context. It was discussed in Section 2.5 that Mackay's presuppositional analysis faces challenges when considering the two desiderata on a generalizable account of X-marking from the introduction. In Section 3.6, I show how the proposed analysis of X and O conditionals allows for satisfaction of Desideratum 2 in (8), with a modification. Satisfaction of both desiderata gives the proposed analysis of presupposition projection + pragmatic inference an advantage over the straight presuppositional analysis of Mackay (2019) which was shown not to be able to satisfy either Desiderata.

3.4 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 p.262/3) 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 complementary distribution between X and O-conditionals, which appears not to be true given cases like (25), restated below.

(47) 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.

It is indeed true that if the *O*-conditional in (47) was a contextually equivalent alternative to the *X*-conditional, then we should only expect the presuppositionally stronger *O*-conditional in (47z′) to be felicitous in light of Maximize Presupposition. However, the *O*-conditional in (47z′) is not an contextually equivalent alternative to (47z), by the definition of contextually equivalent alternatives in (43). 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 (47), 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.

(48) Given the context c of (47):
$f_z = c^T - \gamma$
$f_{z'} = c^T$

For this reason, we do not rule out (47z) on the availability of (47′). However, it must be that the true *O*-marked alternative is disqualified for independent reasons in order for (47z) to be felicitous in this context. The *O*-marked conditional that is contextually equivalent to (47z)–and is identical in surface form to the *O*-conditional in (47z′)–is not felicitous in any contexts. As was noted in the previous subsection, we can derive a contradiction from the *O*-marked alternative to 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 (43). A proof of this contradiction is provided in (49). The felicitous *X* conditional is represented as χ, and the *O*-marked alternative is ω. The notation $\chi^{[X/O]}$ represents the LF of χ with the modal tense operator *X* replaced with its scalemate *O*. γ represents some set of presuppositions suspended from the factive common ground.

(49) **Derivation of contradiction in *O*-marked alternatives**
Given a context c in which an *X*-marked conditional χ can be felicitously uttered:

1.	$f_\chi(c) = c^T - \gamma$	*speaker's choice*
2.	$\omega = \chi^{[X/O]}$	*scalar substitution*
3.	$[\![\omega]\!]^c = [\![\chi]\!]^c$	*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.	$\bigcap c^T \subset \bigcap f_\omega(c)$	*from 6*

8. $\exists w \in \bigcap f_{\omega}(c) : w \notin \bigcap c^T$ *from 7*
9. $\neg\forall w \in \bigcap c^T : w \in \bigcap c^T$ *from 8 + duality of* $\exists\forall$
10. $\bot$ *from 5 + 9*

Where the *O*-conditional ω in (49) yields a contradiction with the *X*-conditional, an *O*-conditional of the kind featured in (47) is not a contextually equivalent alternative to the *X* conditional. This is because the modal base of a felicitous *O*-marked conditional like (47) is identical to the factive common ground. So, while the surface form of (47z′) is identical to the *O*-marked alternative of (47z), 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 of a speaker using either *X* or *O* in such contexts as (47) 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) and von Fintel (1998) in which a speaker can optionally suspend a presupposition of the context with the use of *X*-marking.

3.5 Presupposition projection in possibility conditionals

A question arises for the proposed presupposition projection account of *O*-conditionals when considering the parallel projection assumption in (39). 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 (38), 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 (51), 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.

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

(51) A boy rode his bike to school.
Presupposition: At least one boy has a bike.

Given PP in (39), 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 (41). 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 (52), under Kratzer's view of conditionals, the modal restricted by the *if*-clause is *may* for such conditionals.

(52) 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* in (51), the resulting interpretation would amount to: there at least one world in the hypothetical domain of *may* which is in 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 proposition '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 which appears at first to illustrate that presupposition projection through modal quantifiers does not pattern with the PP assumption in (39) made here. I will show that this does not suffice as a test for the question of how presuppositions project through possibility modals which I leave open, leaving the PP assumption still maintainable.

As discussed in Section 2.3, 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 (53).

(53) #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 (53) is attributed to a resulting tautology, in the spirit of the Stalnaker/von Fintel approach discussed in Section 2.3. This explanation for (53) 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 (53) 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 (53). 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 (54), which minimally differs from (53) in that it features a restricted possibility modal *may* in place of *must*. This expression appears to be equally infelicitous as (53).

(54) #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 (54) is due to a universal projection of the *O*-presupposition, yielding the same tautological meaning of (53) 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 (54) 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 regards to a defense of PP in light of (54).

First, it should be a logical consequence of any analysis that the infelicity of an expression due to uninformativity 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 (54) is asymmetrically entailed by the necessity example in (53). If the stronger example in (53) is infelicitous due uninformativity, then it should be a result of our analysis of presupposition projection that the weaker (54) is uninformative as well. Regardless of whether it is correct to assume that *O* projects existentially through *may* in (54), we should expect (54) 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 (54) 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.

(55) 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), Fauconnier (1978), Ladusaw (1979), von Fintel (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.

(56) Every student passed the exam. $\Rightarrow$ Every linguistics student passed the exam.
Some student passed the exam. $\not\Rightarrow$ Some linguistics student passed the exam.

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

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

What Hsieh observes is that *O*-marked possibility conditionals also license NPIs in their restrictors, unlike existential generalized quantifiers, as in (58).

(58) 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 an 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 (58) is accounted for by the fact that the necessity modal creates a downward entailing context as in (57). On another possible account of (58) 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 (58) again involves restriction of a universal quantifier by the *if*-clause, creating a downward entailing context licensing the NPI *ever*.[19] If either of these views of possibility conditionals is correct, then the *O* presupposition in (54) will be situated in the immediate scope of a universal quantifier, thus projecting universally as in (53). 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 observed with (54).

3.6 A multi-operator treatment of *X*-conditionals

Up to this point, we have not discussed Desideratum 2 with respect to the proposed analysis. This desideratum 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 Fintel & 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 in-

[19] 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 Crnič (2011). Hsieh points out that this view coupled with a non-monotonic analysis of conditionals can be used to explain (58). On such a view, all conditionals will license NPIs given that, being non-monotonic, they will never create upward entailing contexts.

volve 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 a 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 (59), with the strong trigger *too* in the restrictor of the quantifier. We can compare this to the minimally different expression in (60), which features the same strong trigger in the nuclear scope of the quantifier yielding in an identical projected presupposition.

(59) 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.

(60) 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, that we get if we just have the *O* conditional in the main clause, as originally proposed in Section 3.2. 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, our LF for present tense *X*-conditionals looks as in (61i) with the new locality assumption of the modal tense operators. Here, one instance of *X* is situated in the antecedent and a separate instance in the main clause under the scope of the past-inflected *would*, which I represent below as underlying *woll* + past morphology, following Abusch (1985) among others. I assume that the complex constituent featuring *would* and the restricting *if*-clause modifying it are initially merged in a position below the *X* operator in the main clause, in the typical position of auxiliary modals. This constituent is subsequently raised to a position in which it scopes above the *X* operator of the main clause where it is interpreted. Though the modal complex that makes up the restricted *would* quantifier is interpreted above the matrix positioned *X*, we achieve assignment of *X*-morphology to this modal by realizing this morphology on the lower copy of this constituent, where *would* is pronounced. I represent the PF and LF structures with copies of the restricted modal quantifier constituent, assuming Chomsky's copy theory of movement (Chomsky 1995). We can assume that due to linearization rules of English, at the PF level *if*-clause of the higher copy is realized while the *would* of the lower copy is realized. Along with the LF, the PF interpretation of the syntactic structure of *X*-conditionals is shown in (61ii), in which the modal quantifier restricted by the *if*-clause is phonologically realized in the lower copy of the modal quantifier constituent and the *if*-clause of the higher copy is realized. 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 the consequent, i.e. main, clause.

(61) i. LF: $[[woll\text{-}ed_{X_A}\ [if\ [X_A\ \phi\text{-}ed_{X_A}]]]_i\ [X_C\ [\sout{woll\text{-}ed_{X_C}}\ \ [\sout{if}\ [\sout{X_A}\ \sout{\phi\text{-}ed_{X_A}}]]]_i\ \psi]$
ii. PF: $[\sout{woll\text{-}ed_{X_A}}\ \ [if\ [X_A\ \phi\text{-}ed_{X_A}]]]_i\ [X_C\ [woll\text{-}ed_{X_C}\ [\sout{if}\ [\sout{X_A}\ \sout{\phi\text{-}ed_{X_A}}]]]_i\ \psi]$

On this view, we can assume that the LF and PF representations of *O*-conditionals is parallel to that in (61), the only difference being that *O* is occupying all positions occupied by *X* in (61).

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.

4 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: *X*-marking must be interpreted within the scope of *wish* and *X*-marking is obligatory in the complement of *wish*, illustrated with (62) and the clearly unacceptable (63).

(62) John wishes it was raining now.

(63) *John wishes it is raining now.

What is particularly puzzling here is that the obligatory X-marking in (62) 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 (62) 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 and in doing so draws close parallels between *wish* expressions and anderson and Anderson and *modus tollens* conditionals on the proposed view. 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*.

4.1 *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*, involved 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.[20] Heim spells out an analysis of desire predicates which captures the discussed 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 in the context.

[20] For instance, Heim initially motivates this for the semantics of desire predicates generally with cases like in (1). 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.

(1) 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 desireable among a set of worlds maximally similar to the utterance world. Thus, for (1), the set of worlds corresponds to a set of most desireable 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.

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. The assumed lexical definition of the *wish* is provided below.

(64) $[\![wish]\!]^c = \lambda p_{\langle s,t\rangle}.\lambda x.\lambda w : \neg\exists w' \in p : w' \in \bigcap c.\ \forall w'' \in des(x,w,c) : p(w'') = 1$

An important question here is around the interpretation of c. 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 (65), which can be compared to the infelicitous alternative lacking X-marking in (66).

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

(66) #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 cases like (65). 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 (67).

(67) 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 believes 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.[21] Taking cases like (67) into consideration, we must understand the c parameter on the interpretation function in the definition of *wish* (64) to correspond to a local context representing the presuppositions of the attitude holder.

[21] See Schlenker (2009) for a non-dynamic conception of local contexts.

4.2 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: that *X* can be interpreted within the scope of *wish* and 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 *O*. With the presuppositionally stronger alternative infelicitous, *X* is required given that its vacuity makes it compatible with the contribution of *wish* in interpreting the expression. This is the same treatment of both Anderson and *modus tollens* expressions, inspired by Stalnaker (1975), where *X*-marking is understood to be required in both varieties of conditionals despite given that *O*-marking yields a tautological and contradictory meanings, respectively.

The key step in 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 (63), the LF and corresponding interpretation of such expressions is shown in (68). This meaning includes the interpretation resulting from the projection of the world-level *O* presupposition in (40) through the universal quantifier of *wish*, as defined in (64), parallel to the interpretation of *O*-conditionals. Here, c is understood to be the local context reflecting the beliefs of the attitude holder, A. As in the previous section, I abstract away from additional semantic properties like tense, which don't play a role in the proposed analysis.

(68) $[\![[A\ [wish\ [O\ \phi]]]]\!]^c =$
$\lambda w : \neg\exists w' \in [\![\phi]\!]^c : w' \in \bigcap c\ \ \&\ \ \forall w'' \in des(A,w,c) : w'' \in \bigcap c^T .$
$\forall w''' \in des(A,w,c) : [\![\phi]\!]^c(w''') = 1$

This meaning features the co-occurrence of the presupposition of *wish*, that there are no ϕ worlds in the context set of c and the projected interpretation that all worlds in the desire domain, $des(A,w,c)$, are in the factive context set of c. These two elements of the meaning in (68) are inconsistent, as is derived in (69).

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

Given an *O*-marked conditional with an LF of the form in (68) and w, c:

1.	$\forall w' \in des(A,w,c) : [\![\phi]\!]^c(w') = 1$	*truth conditions*
2.	$\forall w' \in des(A,w,c) : w' \in \bigcap c^T$	*from projection of O through 'wish'*
3.	$\exists w' \in [\![\phi]\!]^c : w' \in \bigcap c^T$	*from 1, 2*
4.	$\neg\exists w' \in [\![\phi]\!]^c : w' \in \bigcap c$	*presupposition of 'wish'*
5.	$c^T \subseteq c$	*from def of c^T*
6.	$\neg\exists w' \in [\![\phi]\!]^c : w' \in \bigcap c^T$	*from 4, 5, downward entailment*
7.	$\bot$	*from 3, 6*

The use of *O* in the modal tense layer in the complement of *wish* yields a contradiction that there are some ϕ worlds in the factive context set and there are no ϕ worlds in factive context set, making such expression 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 (70), with a meaning comprised of only the truth-conditional meaning of the expression and the counterfactual presupposition triggered by *wish*.

(70) $[\![[A\ [wish\ [X\ \phi]]]]\!]^c =$
$\lambda w : \neg\exists w' \in [\![\phi]\!]^c : w' \in \bigcap c\ .\ \forall w'' \in des(A,w,c) : [\![\phi]\!]^c(w'') = 1$

Given the vacuity of *X* and the absence of any competition leading to a pragmatic inference, the LF in (70) yields a consistent meaning reflecting the understood interpretation of *wish* expressions. With the embedded positioning of *X* in the syntactic structure 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 & Mari (2021), Portner & 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 question for future work.

4.3 Counterfactual desire in non-English languages

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 & 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 (71) from von Fintel & 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.

(71) 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 & Iatridou (2020) propose the following generalization.

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

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

b. unattainable desire: I $want_{cons}$ that p_{ant}

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

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 of why *X*-marking in so many languages bears an identical form to past tense morphology in English. The discussion up until this point has not considered this question with respect to the proposed analysis. 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. 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 (73), we see plural past *X*-marking in the complement.

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

This fake past + fake plural form morphology has been traditionally identified as the subjunctive in English grammatical literature.[22] However, given that this 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 (74), we see imperfective morphology in Greek, taken from Iatridou (2000). As discussed by Iatridou, this

[22] See, for example, Greenbaum (1996), Section 5.

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.

(74) 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 (75), we can see an example of what has been identified as *X*-marked habitual morphology used in Hindi counterfactual construction, shown not to be fake habitual as discussed in Bhatt (1997), Iatridou (2000), Bhatt & 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.

(75) 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.'

While there has been proposals for explaining the role of some of these additional non-past morphologies [23] I do not intend to evaluate the details of these ideas. 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. 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 (76) as problem A, calls for an explanation of how each of these types of *X*-marking is connected to its homophonous non-*X* counterpart, in order to explain the morphological commonality. 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 (76B) 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, both cross-linguistically and in some cases within the same language, as in the case of past/plural in English and past/imperfective in Greek.

(76) **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 interpretations of modal remoteness?

[23] 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).

Each of these individual problems associated with each variety of X morphology are difficult as they require a means of drawing underlying connections between different types of morphologies across languages. The modal and non-modal meanings associated with these morphemes are notably different. 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 at once. 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 vacuous functions. This is stated in (77).

(77) **Generalized Vacuity Hypothesis**

For all morphological forms that can serve as X-marking, all interpretations of these forms, whether modal or not, are associated with a semantically vacuous function in the LF of the expression containing the morphology.

Under this hypothesis, both the modal and non-modal interpretations of past, plural, imperfective and habitual arise from presuppositional implicatures due to competitions with some alternative that bears a presupposition trigger matching the type of the associated semantically vacuous function. This is as detailed in Section 3.3 for X-conditionals. When considering the ordinary interpretations of the four morphemes 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 it is undoubtedly a considerable task to explore how realistic such a hypothesis is. 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 (77) could be a promising line of approach for future research.[24]

von Fintel (1998) 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, 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.[25] This point is based

[24]It should be noted that in Sauerland (2002), the opposite of what is entailed from (77) for the interpretation of tense is argued for. Sauerland considers examples like (1), 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*.

(1) Every Tuesday this month I fast.

Thomas (2015) argues against Sauerland's vacuous Past treatment of cases like (1) and in favor of a treatment of (1) as a futurate expression rather than an ordinary present tense expression.

[25]See also Leahy (2018) on this point by von Fintel.

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 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 (77).

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