
WORLDS
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FUTURE

by · Gregor Williamson

Worlds of the Future

*Modality & Future Licensing at the
Syntax-Semantics Interface*

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Declaration

I, Gregor Williamson, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Abstract

The objective of this dissertation is to accurately describe and derive the distribution of future reference in English. In particular, the dissertation covers the following constructions in depth: (i) prejacents to modal auxiliaries (Chapter 2), (ii) (non)-finite complements to attribute predicates (Chapter 3), (iii) adverbial clauses including conditionals, causal/concessive clauses, and temporal clauses (Chapter 5). We propose that future reference in English is introduced by a covert temporal operator *FUT* (Matthewson, 2012; Giannakidou and Mari, 2018). This operator is an existential quantifier over times following the local evaluation time. We propose that the distribution of this operator is constrained by a contingency presupposition which is modeled as a condition, not on a world, but on a set of worlds, *the modal context* (Portner, 1997; Yalcin, 2007; Anand and Hacquard, 2013). We attempt to derive this distribution by appealing to the grammatical principle of Analyticity (Gajewski, 2002, 2009; Abrusán, 2014; Del Pinal, 2019). Throughout the dissertation, we supply arguments for this particular approach. We provide evidence from of scope interactions that future reference is introduced by an independent operator as opposed to modal elements. In addition, we provide evidence that *FUT* is locally licensed, as opposed to globally (e.g., Kaufmann, 2005; Kaufmann et al., 2006; Bohnemeyer, 2009). In Chapter 6, we discuss a number of additional constructions which are able to license future reference in a way which is compatible with the theory developed. These are: (i) sentential adverbials, (ii) disjunctions, and (iii) restrictor arguments of universal quantifier phrases.

Chapter 4 is dedicated to past-in-future readings of the perfect marker *have* under deontic modals and commitment predicates. There, a novel observation is made regarding an asymmetry between the acceptability of past-in-future readings of obligation modals on the one hand, and the unacceptability of past-in-future readings of permission modals on the other. We attribute this to an interaction between the presuppositions of performative modals and a grammatical principle of Redundancy (Meyer, 2015; Marty, 2017; Moracchini, 2018).

Impact Statement

This thesis tackles several questions within the topic of temporal-modal interaction of natural language operators. The central purpose of the thesis is to account for grammatical licensing of future reference by modal elements such as modal auxiliary verbs and attitude predicates. Beyond this, however, it also discusses adverbial clauses which permit future reference in the apparent absence of an appropriate modal operator. In addition, a number of novel observations are made concerning past-in-future readings of the perfect in permission statements. These observations are shown to reveal key properties common to various permission granting speech acts, as well as predicates which describe such acts.

Within the field of natural language syntax-semantics, this thesis will contribute to ongoing research on the semantics of the future—a topic showing some resurgence—as well as modality more generally. The explanations provided for the phenomena discussed are rooted in constraints on the logical form of linguistic structures. If correct, this implies that the grammar is both fundamentally logical and compositional. The broader impact of this thesis may be felt in fields such as natural language processing and artificial intelligence as increasingly more sophisticated semantic representations are being employed to improve natural language understanding and generation.

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Chapter 1

Introduction

1.1 Aims and scope

While many languages have a past tense and a present tense, it is unclear whether there is such a thing as a future tense. English is a case in point. English has morphemes which are generally taken to express a past tense and a present tense, but no dedicated morpheme to express futurity. The closest candidate is the modal auxiliary *will*. However, this auxiliary itself appears to inflect for present tense (*will*) or past tense (*would*), with [Abusch \(1998\)](#) proposing an abstract tenseless form *woll*. This alone is enough to suspect that *will* is not a tense *per se*. However, there are further reasons to be sceptical of this idea. The second such reason is that other modal auxiliaries can also introduce futurity (1).

- (1) a. Alice might find her keys soon.
- b. Charlie must go to bed at nine.

In (1a), the speaker is making a claim about a possible future state of affairs, given what he or she knows about the world, while (1b) describes an obligation which Charlie must carry out in the future (i.e., going to bed at nine). Although these modal auxiliaries carry distinct meanings above and beyond simple futurity, these examples show that the ability to introduce futurity is not exclusive to *will*. This already seems to raise some doubt that *will* is a dedicated future tense in English.

Thirdly, the modal *will* does not always have a future interpretation (e.g., Kaufmann, 2005; Giannakidou and Mari, 2018; Frana and Menéndez-Benito, 2019; Ippolito and Farkas, 2019; Mihoc et al., 2019, a.m.o).

- (2) a. Alice will be in her office already.
- b. [Upon hearing the doorbell] That will be Bobby now.

In these examples, rather than introducing futurity, *will* appears to be acting purely as a modal. These sentences do not tell us something about the actual state of affairs at some future time, but rather they tell us something about a plausible or highly likely state of affairs at the current time.

Further evidence comes from Klecha (2014). Amongst other things, he shows that like other modal auxiliaries, and unlike purely temporal operators, *will* is able to take part in *modal subordination* (Roberts, 1989). More specifically, if a discourse referent is introduced in a modal environment, then subsequent coreferential anaphora must also occur in a modal environment.

- (3) a. # Alice should start a hobby_i. It_i is fun.
- b. Alice should start a hobby_i. It_i might be fun.

Crucially, modal subordination is possible with *will* (4a). Compare this to the past tense or present perfect (4b).

- (4) a. Alice should start a hobby_i. It_i will be fun.
- b. # Alice should have started a hobby_i. It_i {was/has been} fun.

Given the above four facts, (i) *will* inflects for tense, (ii) *will* is not necessary for future shifting, (iii) *will* does not necessitate future shifting, and (iv) modal subordination is possible with *will* but not with purely temporal operators, we can conclude that *will* is not a future tense. Rather, the modal auxiliary *will* is likely a present tense realization of an abstract modal *woll* and is just one of a number of modals which are able to introduce futurity in a sentence.

With this in mind, we might ask whether all modal operators are equally able to license future shifting. Interestingly, the answer to this question is negative. When it comes to future licensing, not all modal operators are created equal. Take for instance the epistemic necessity modal *must*, which cannot license a future oriented reading (Enç, 1986; Stowell, 2004; Lekakou and Nilsen, 2008; Portner, 2009).

- (5) a. * Alice must find her keys soon. (epistemic)

- b. * Bobby must murder Charlie tomorrow. (epistemic)

The two central aims of this thesis are (i) to characterise exactly which modal environments have the ability to license the future, and which ones do not, and (ii) to provide a semantics for a covert future operator which will correctly derive the distribution of future shifting. To do so, we will address a number of phenomena. In Chapter 2, we will discuss the future licensing properties of modal auxiliaries. In Chapter 3 we will discuss attitude predicates with both infinitival complements and, to a lesser extent, finite complements. Chapter 3 will also provide a defense of our proposal that the future in English is encoded syntactically by a covert future marker *FUT* which is licensed in certain modal environments. In Chapter 4, we will take a slight detour and attempt to account for a previously unobserved pattern of past-in-future readings under performative deontic modals and commitment predicates. In Chapter 5, we see how the theory developed so far accounts for the presence or absence of future orientations in unmodalized adverbial clauses. We also argue that *when*-clauses in particular provide support for a local-licensing account like the one we develop below as opposed to a globally defined semantic or pragmatic constraint as is typically appealed to in the literature. Finally, Chapter 6 will discuss a few miscellaneous constructions which seem to conform to the predictions of our proposal, but which cannot be given a full treatment here.

The central focus of this thesis will be on, what we will call, the *contingent future* which is typically used in predictive contexts and is the type of futurity in the above examples. This is in contrast to the so-called *scheduled future* which looks morphologically like the simple present, or the present progressive (6a). This type of future can only be used when describing states of affairs which are in some sense planned (cf. 6b) (see Copley, 2009, 2008).

- (6) a. The Red Sox {play/are playing} tomorrow.
 b. # The Red Sox {win/are winning} tomorrow.

In order to provide a semantics for the contingent future which will derive the observed phenomena, it is worth considering what it means for a future state of affairs to be contingent.

1.2 Branching worlds

We suppose a domain of individuals \mathcal{D}_e , a domain of possible worlds \mathcal{W}_s and a domain of temporal intervals \mathcal{T}_i . A temporal interval t is a convex set of moments. The set of all moments is an uncountably infinite set which is totally ordered by the precedence relation. We define a partial order \prec on \mathcal{T}_i , where $t \prec t'$ iff for all moments $m \in t$ and $m' \in t'$, m precedes m' . In addition, we define the inverse relation \succ , where $t \succ t'$ iff for all moments $m \in t$ and $m' \in t'$, m' precedes m . Finally, $t \preceq t'$ iff for all $m \in t$ and $m' \in t'$, either m precedes m' or $m = m'$.

As is common in the literature on the interaction of tense and modality, we begin with the assumption that the grammar represents the world as *historical*. That is, the past is *historically necessary* in so far as it is fixed and can no longer be changed, whereas the future is open (e.g., [Kamp, 1979](#); [Thomason, 1984](#); [Condoravdi, 2002](#)). Worlds differ with respect to what propositions they make true at what times. As time moves forwards, the worlds diverge, with a fork indicating that the two worlds come to differ on whether or not they make true a given proposition and each branch representing a contingency—a possible outcome of an event.

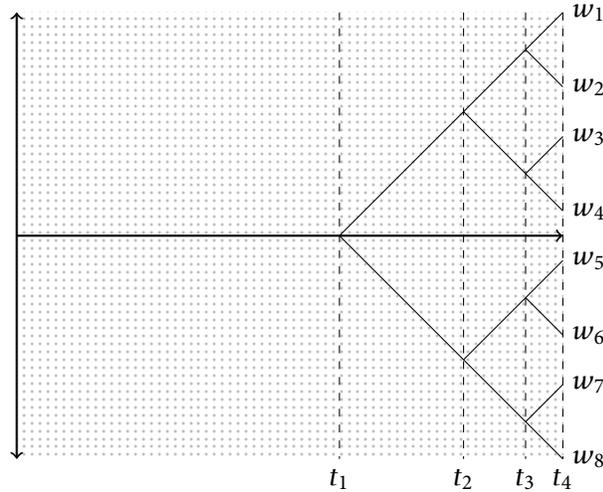


Figure 1: Branching of worlds over time

As an example, imagine the flip of a coin at t_1 which will land at t_4 , the worlds above the central axis (worlds w_1 to w_4) might all be worlds in which the coin comes up

heads, while the worlds below the central axis (worlds w_5 to w_8) are all worlds in which the coin does not come up heads (i.e., comes up tails). However, the worlds in these two classes may themselves be distinguished by additional occurrences between t_1 and t_4 . For instance perhaps among the heads worlds, w_1 to w_4 , the coin flipper either blinks or does not blink at t_2 , and so on.

If we adopt the assumption that the grammar represents the actual world as historical, then any reasonable candidate for the world should also be historical. In the type of semantics we will employ throughout this dissertation, a modal operator quantifies over a set of worlds which are candidates for the evaluation world according to some body of information, the Kratzerian *modal base* (Kratzer, 1977, 1981, 2012). A modal base is a representation of how the actual world is. That representation could be a realistic mental representation (e.g., an epistemic modal base), or a potentially unrealistic mental representation (e.g., a doxastic modal base), or a representation implicitly or explicitly agreed upon by a group (e.g., the common ground). It could even be a totally realistic representation of the actual world (a historical modal base). Each of these modal bases is an attempt at representing how the world is. Even in the case of belief, the doxastic alternatives are still taken by the attitude holder to be candidates for the actual world. Given that the actual world may develop into any one of the worlds among its historical alternatives, a modal base must include the historical alternatives for any of the worlds in that modal base. That is, any modal base is the grand union of the historical alternatives of each of the candidates for the world now, according to the body of information which defines the accessibility relation (Condoravdi, 2002; Werner, 2006; Lekakou and Nilsen, 2008).

1.3 Previous accounts of future licensing

An influential attempt to derive the temporal behavior of certain modal auxiliaries from their modal semantics is that of Condoravdi (2002). She begins with the observation that the modal *might* interacts with the perfect marker *have* in interesting ways. More specifically, Condoravdi (2002) claims that (7a) conveys epistemic possibility about a past event, while the counterfactual (7b) conveys a “metaphysical” possibility from some past time.

- (7) a. Alice might already have won the race.

- b. At that time, Bobby might still have won the race.

Condoravdi (2002) claims that this metaphysical reading is only available with future oriented prejacent. We cannot use the modal *might* to make a metaphysical claim about a past oriented prejacent. Her explanation is that the metaphysical reading of a modal is associated with a historical modal base, and since the historical alternatives of a world w at time t are indistinguishable from w at times at or before t , any non-future proposition which is true of one alternative will be true of all. Such a state of affairs would result in the metaphysical reading of *might* and *must* collapsing with a bare assertion when past oriented. To explain the unavailability of this reading, she proposes that the modal *might* has a diversity condition. It requires that there is some world in the modal base for which the prejacent is true, and others for which it is false. This derives the inability of metaphysical *might* to be past or present oriented since this diversity condition would be violated.

This notion of diversity is central to nearly every account of future licensing. However, there are roughly two camps which these accounts fall into. There are flavor based accounts which assume that diversity is a property of every modal base (Werner, 2006; Lekakou and Nilsen, 2008; Giannakidou and Mari, 2016, 2018), and the difference in future licensing is, broadly speaking, a result of the flavor of the modal base and/or ordering source. On the other hand, force based accounts assume that not all modals presuppose that the modal base is diverse with respect to the prejacent (Laca, 2015; Banerjee, 2018a,b; Williamson, 2019). These accounts, propose that diversity is associated with certain quantificational forces of modal operators, but not with others. They argue that those modals which have a diverse modal base are such that they can have a future oriented prejacent. It should be clarified that few accounts attribute future licensing properties of modal operators entirely to either the modal flavor or modal force of the operators in question. However, there is nonetheless a tendency to treat one of these factors as more relevant than the other. Let us briefly review some of the literature before outlining the proposal defended here.

1.3.1 Flavor accounts

Klecha (2016) is the most extreme example of a flavor based account. He claims that epistemics never permit a future oriented reading, and the instances of future readings for *might* is due to it being interpreted metaphysically. To do this, he assumes

that modal operators quantify, not over simple world-time pairs, but time-history pairs (where a history is itself a pair of a world and a temporal interval). His proposal is that epistemic modals only quantify over histories which end at the speech time, while metaphysical modals quantify over future histories which start just after the speech time. This hard codes the temporal properties directly into the modal base of the modals in question, raising the question why it should be that these flavors of modals should quantify over these particular types of histories. The explanation given for metaphysical modals is akin to that of [Condoravdi \(2002\)](#). The justification for treating epistemics as quantifying over histories which stop at the present is that, intuitively, we cannot know about the future. While [Klecha's](#) formal implementation is rather elegant, his proposal has at least two issues. The first of which is conceptual, and the second empirical.

Firstly, while the idea that the future cannot be known is certainly an appealing explanation for why some epistemic modals cannot embed the future, [Klecha's](#) particular implementation is potentially too strong. Although it is reasonable that we might not be able to know that something will be the case in the future, we can certainly know that something might be the case in the future. Slightly more formally, future states of affairs may not be *entailed* by what we know, but they can still be *compatible* with what we know. This is made clearer by looking at [Klecha's](#) empirical generalizations. In particular, he claims that the modals *must* and *have to* can be epistemic but never metaphysical. On his account, this means that they can be present or past oriented, but never future oriented. Conversely, modals such as *might* or *could* can be metaphysical and can therefore be future oriented. So according to [Klecha](#), the epistemic modals which express certainty cannot ever be interpreted metaphysically, while those that express possibility can be. But this divide just tracks the force of the modals; certainty on the one hand and possibility on the other. Based on [Klecha's](#) assumptions, it is unclear why *must* and *have to* could not also have a metaphysical reading, nor is there an explanation for why epistemic possibility modals are always able to have a metaphysical reading too. As such, his analysis reiterates the facts without providing a deeper explanation.

The second issue with [Klecha's](#) proposal is an empirical one. There is good reason to think that modals like *might* are in fact epistemic even when future oriented. This is because the metaphysical reading of epistemics take narrow scope with respect to other operators such as the perfect marker *have*, while epistemics do not.

The canonical contrast is repeated in (8) with the relevant scope configurations indicated.

- (8) a. Alice might already have won the race. ($\exists > \textit{have}$, $*\textit{have} > \exists$)
 b. At that time, Bobby might still have won the race. ($\textit{have} > \exists$)

Generally, quantificational subjects are also unable to scope over the modal when it is construed epistemically.¹ Given that a race can only have one winner, it is infelicitous to assert that it is possible that every runner won (9a). However, when the modal is construed metaphysically, the universal can take wide scope and the claim is that every runner is such that, at that time, they might go on to win the race (9b).

- (9) a. # Every runner might already have won the race. ($\# \exists > \forall$, $*\forall > \exists$)
 b. At that time, every runner might still have won the race. ($\forall > \exists$)

Now note that, on its future oriented reading, *might* nonetheless takes obligatory wide scope. The infelicity of (10) demonstrates that the universal *every runner* cannot take scope over *might*.

- (10) # Every runner might win the race tomorrow. ($\# \exists > \forall$, $*\forall > \exists$)

However, if future oriented *might* is always metaphysical, we should expect (10) to be completely sensible on the reading intended. The fact that it is not suggests that the default reading for future oriented *might* is nonetheless an epistemic one, calling into question Klecha's claim that there are no future oriented readings of epistemic modals.

A second previous account is that of Werner (2006) who attempts to derive the temporal interpretations of modals from two competing principles, (i) the disparity principle, and (ii) the non-disparity principle. The former of these is inviolable, while the latter can be violated. The disparity principle is Werner's name for the diversity condition, which he maintains holds for every modal base. He uses this to derive the future orientation of deontic modals. He proposes that deontic modals have a totally realistic modal base (the historical alternatives of the

¹Epistemics are notorious for their tendency to take wide scope—a behavior which von Stechow and Tringali (2003) call *epistemic containment*. However, Swanson (2010a) provides a number of examples in which epistemics can take narrow scope with respect to quantificational subjects. Whatever the status of the epistemic containment principle, the examples discussed in the main text do not afford a narrow scope reading of the modal on its epistemic reading.

actual world at the evaluation time). A Kratzerian ordering source (Kratzer, 1977, 1991, 2012) ranks these historical alternatives, and deontic modals quantify over the higher/highest ranked worlds. The obligatory future oriented nature of deontic modals then follows from the disparity principle in much the same way as Condoravdi's diversity condition forces metaphysical modals to be future oriented.

The second principle, the non-disparity principle, is somewhat harder to understand.² Werner states that "*a proposition must make no distinction between speech-time branching worlds*" (Werner, 2006, p.248) and "*only distinctions involving settled facts can be made, since speech-time branching worlds differ only by non-settled facts*" (p.249). However, unlike the first principle, this second principle must be violated in the case of deontic modals sentences. He notes that "*with a totally realistic modal base, distinctions can only be based on non-settled facts*" (p.249), and therefore the non-disparity principle must be ignored. Unfortunately, since there is no formal statement of the non-disparity principle, it is not obvious precisely how this will derive the data. However, assuming that it does, there is not much in the way of arguments for Werner's particular set of assumptions. Why should the non-disparity principle be violable? And why should it only be violated in favor of the disparity principle? These are stipulations which Werner does not provide clear motivation for. And, unlike disparity, non-disparity does not have precedence in the literature.

Finally, Werner (2006) states that *may* and *might* have future epistemic readings, but *will* (which he claims is their dual) does not. He concludes that "*non-future epistemic uncertainty is recorded in the modal base but future epistemic uncertainty is recorded in the ordering source*" (Werner, 2006, p.251). Here, Werner (2006) appears to assume that future oriented epistemics do not have an epistemic modal base, but rather a historical modal base. His idea seems to be that the epistemic flavor of these modals is due to their ordering source. It is not entirely clear what exactly is meant by this since it is not in keeping with standard terminology. But it seems that Werner (2006) would be forced to assume that future oriented epistemics like *might* can be metaphysical with an ordering source, while non-future epistemics like *must* cannot. Finally, as we saw above, this type of account gets the scope facts wrong for future oriented epistemic *might* which has a propensity to take widest scope.

²I do not entirely follow the this part of Werner's account, so I will rely on direct quotes in retelling it. This is partly due to the fact that no formal articulation of the non-disparity principle is provided, so it is not clear that it will derive what it purports to. I will assume that it does and will argue that Werner's assumptions are not well-motivated.

A third account, similar in spirit to Werner (2006), is that of Lekakou and Nilsen (2008). They aim to provide an analysis for the unavailability of future oriented readings of epistemic *must*. They treat an epistemic modal base as a collection of candidate courses of history compatible with what is known (the union of a set of sets of historical alternatives for each epistemic candidate for the actual world now). They then suppose that the ordering source for epistemic modals does not rank worlds, but rather ranks entire courses of history.³ When we try to embed a future oriented proposition φ_{fut} directly under epistemic *must*, Lekakou and Nilsen (2008) claim that one of either two situations will hold. Either (i) the evidence already entails φ_{fut} in which case the diversity condition cannot be met, or (ii) the evidence does not entail φ_{fut} and the most likely epistemic candidate could develop into a world with all sorts of unlikely states of affairs in which φ_{fut} is false, in which case, Lekakou and Nilsen (2008) claim, the sentence will be defined but false. Thus, they conclude that future oriented epistemic *must* can never be true. But notice that their conclusion only follows because they suppose that the likelihood ordering source ranks whole courses of history as opposed to individual worlds. However, this supposition is not innocent and it is included without justification (or formal implementation), and it is crucial to their story. Is it true that we cannot rank individual future possibilities in terms of likelihood? Consider the following scenario, and the corresponding partitioning on an epistemic state.

- (11) SCENARIO: *Little Bobby is scheduled to play world chess champion Magnus Carlsen in an open tournament at 2pm. We do not know whether Bobby has practiced, but it is slightly more likely that he has. Either way, it is almost certain that he will lose.*

World	Bobby practiced	Bobby wins
w_1	1	1
w_2	1	0
w_3	0	1
w_4	0	0

Table 1: Epistemic alternatives

³Lekakou and Nilsen (2008) work with entire courses of histories, as opposed to Klecha (2016)'s truncated histories.

Notice that, at the evaluation time, w_1 and w_2 are historical alternatives, as are w_3 and w_4 . [Lekakou and Nilsen](#)'s supposition appears to imply that because it is more likely that Bobby practiced than that he did not, the grammar is unable to recognize that w_1 is a more plausible outcome than w_4 . Since we can intuitively make such a comparison, I find it unnatural to stipulate that the grammar cannot.

Finally, recall that [Lekakou and Nilsen \(2008\)](#) suppose that the ordering source of deontic modals can (indeed must) distinguish between individual worlds. If the ordering source of a deontic modal were also to rank entire courses of history, then deontic necessity modals could not be defined and true with respect to a future oriented proposition either. So this supposed feature of the likelihood ordering source crucially cannot be shared by other ordering sources. In sum, then, the account of [Lekakou and Nilsen \(2008\)](#) relies on a supposition which is unnatural and which is necessarily specific to ordering sources for epistemic modals.

1.3.2 Force accounts

Force accounts propose that the (in)ability of a modal to embed a future oriented proposition is due to the nature of certainty ([Kaufmann, 2005](#); [Kaufmann et al., 2006](#); [Laca, 2015](#); [Banerjee, 2018a,b](#); [Williamson, 2019](#)).⁴

These accounts hold that not all modal bases are diverse with respect to their prejacent. Those that are homogeneous, are unable to license the future. The reasoning behind this is that since contingent states of affairs correspond to a branching of worlds, if the prejacent describes a contingent future state of affairs, then there should be a branch for which the prejacent is true, and one for which it is false. Whereas, if a modal operator encodes that the modal base is homogeneous with respect to a future oriented prejacent, it conveys a degree of certainty about future states of affairs which cannot be warranted.

The generalization here is that modal operators which universally quantify directly over a modal base should not embed future oriented prejacent. Now consider a set of worlds determined by applying an ordering source to a modal base, picking out the highest ranked worlds according to this secondary body of information. An

⁴[Banerjee \(2018a,b\)](#) and [Williamson \(2019\)](#) were developed independently but have a degree of similarity, although formal implementation differs. Both are preceded by [Laca \(2015\)](#) who provides a similar account for subjunctive complements to attitude verbs in Spanish. Although, once again, formal details differ.

ordering source filters out the lower ranked worlds in the modal base. This could have the effect of trimming off branches from the historical alternatives of a given world in the modal base. If so, then there will be historical alternatives of the best worlds which are not themselves included among the best worlds.

It may be the case that the worlds which are filtered out are those for which the prejacent does not hold. Imagine that we look at a modal base MB at t . Consider the world-time proposition p .

$$(12) \quad p = \lambda w.\lambda t. \exists t' \succ t : \llbracket \text{the coin comes up heads} \rrbracket(w)(t') = 1$$

While some of the worlds in the modal base will be p worlds (the coin comes up heads at some contextually relevant point), others will be $\neg p$ worlds (the coin does not come up heads at any contextually relevant point).

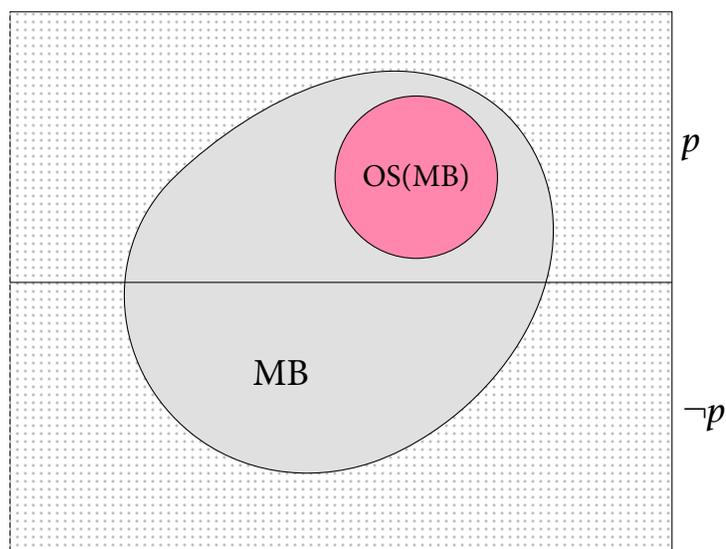


Figure 2: A diverse modal base wrt p

In this particular example, the modal base (MB) contains some p worlds and some $\neg p$ worlds. However, the best worlds according to the ordering source (OS(MB)) are all p worlds. Accordingly, we will see that modal operators which universally quantify over the highest ranked alternatives according to an ordering source may embed future oriented prejacent as they are associated with a modal base with contains worlds in which the prejacent is false. Likewise, for modal operators which

existentially quantify over the modal base.

The central proposal of this thesis is that this notion of contingency is stated as a definedness condition on a covert future operator *FUT*. To achieve this compositionally, we have two points to consider. Firstly, we have to determine what set of worlds are considered when evaluating contingency. Secondly, presuppositions are typically defined for worlds, not sets of worlds.

- (13) $\llbracket \text{Alice stopped smoking} \rrbracket(w)$
- a. is defined only if Alice used to smoke in w
 - b. if defined, = 1 iff Alice no longer smokes in w

So our contingency condition will have to be stated differently to a run-of-the-mill presupposition like that associated with *stop*. With these two points in mind, we will make use of a parameter on the denotation assignment function, the *modal context*.

1.4 Modal context

[Portner \(1997\)](#) introduces the idea of a *modal context*, a parameter on the denotation assignment function. The parameter is a set of worlds which is shifted to the modal base of an embedding modal operator. In [Portner's](#) account this is used to account for mood selection. However, this sort of parameter has also been used to explain certain puzzles surrounding embedded epistemic modals, which have been proposed to have a special architecture. [Yalcin \(2007\)](#) and [Anand and Hacquard \(2013\)](#) propose that epistemic modals quantify directly over worlds in the modal context. In matrix declaratives, the modal context is the epistemic alternatives of the speaker in the evaluation world, at the evaluation time.

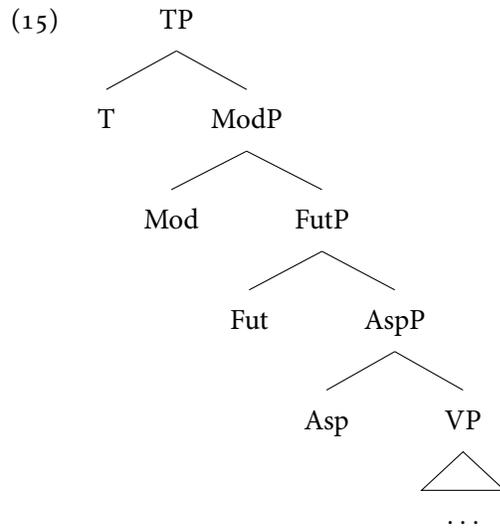
- (14) a. $\llbracket \text{must } \varphi \rrbracket^s(w_0)(t_0) = 1$ iff $\forall \langle w_1, t_1 \rangle \in s : \llbracket \varphi \rrbracket^s(w_1)(t_1) = 1$
 b. $\llbracket \text{might } \varphi \rrbracket^s(w_0)(t_0) = 1$ iff $\exists \langle w_1, t_1 \rangle \in s : \llbracket \varphi \rrbracket^s(w_1)(t_1) = 1$

While the notion of a modal context has been employed to account for phenomena such as mood selection and the distribution of embedded epistemics, it is clear that such a parameter could also be useful in accounting for other phenomena which are subject to variation depending on the modal environment in which they occur. In the present thesis, we will suggest that the distribution of *FUT* is one such phenomenon.

1.5 Proposal in brief

We adopt a compositional semantic framework like that in Heim and Kratzer (1998) which includes a function application rule and a (type general) modification rule. For the sake of exposition, we will represent predicate abstraction by including λ -operators which bind traces and/or pronouns in the object language.

The order of functional projections we assume places a covert future operator *FUT* in a FutP projection which sits below ModP, where modals are merged prior to undergoing head movement to T, and above AspP, where (im)perfective aspect is situated. The future operator is dissociated from modal auxiliaries (Matthewson, 2012; Giannakidou and Mari, 2018) but is licensed in their scope if they fit a certain modal profile which will be characterized more explicitly below. On this view, *will* (or *woll*) is a modal auxiliary which is able to license *FUT* but is distinct from it.



In addition, we make use of world and time pronouns in the object language which can be abstracted over (Percus, 2000; Beck and von Stechow, 2015). As is common, we use the same variable names in both the object and meta languages for the sake of readability. Additionally, we will often represent LFs in reduced form, omitting world and time variables as well as operators or covert predicates in those parts of the structure which are not relevant to the discussion at the time. Since we will only occasionally discuss the contribution of Aspect, we will generally omit AspP

from our representations.⁵ We assume at least the following available positions for abstraction over world and time variables.

$$(16) \quad [_{CP} \lambda w_0 \lambda t_0 C [_{TP} [T t_0] [_{ModP} \lambda t_1 [Mod w_0 t_1] [_{FutP} \lambda w_1 \lambda t_2 [Fut w_1 t_2] [_{VP} \lambda w_2 \lambda t_3 [V w_2 t_3]]]]]]]]$$

This type of extensional system needs to be accompanied by constraints on variable binding in order to prevent over-generation (see Percus, 2000). But the choice to adopt this system is largely inconsequential for our purposes, and the results obtained in what follows could equally be achieved with an intensional system (e.g., Heim and Kratzer, 1998; von Stechow and Heim, 2011).

The central proposal of chapters 2, 3, and 5 will be that the future operator *FUT* has a semantics which includes a contingency presupposition which is not defined for a world, but rather a set of worlds. Namely, the modal context against which it is evaluated. More specifically, we propose *FUT* is only licensed in modal contexts which are diverse with respect to the truth of their prejacent.⁶

$$(17) \quad \llbracket \text{FUT } \varphi \rrbracket^s(w_1)(t_1)$$

- a. is defined only if $\exists \langle w_2, t_2 \rangle \in s : \exists t_3 \succ t_2 : \llbracket \varphi \rrbracket^s(w_2)(t_3) = 1$
 $\wedge \exists \langle w_3, t_4 \rangle \in s : \neg \exists t_5 \succ t_4 : \llbracket \varphi \rrbracket^s(w_3)(t_5) = 1$
- b. if defined, = 1 iff $\exists t_6 \succ t_1 : \llbracket \varphi \rrbracket^s(w_1)(t_6) = 1$

While there is precedence for the notion of contingency of future affairs, this particular approach makes a number specific predictions which we will argue are borne out. For instance, we do not treat modals operators as future shifting devices, but rather as operators which may or may not license this dedicated future operator. This means that there is an additional scope position between modal operators and the future operator. We will see good evidence in Chapter 3 section 3.8 that this is borne out. Secondly, our constraint on future reference is a constraint on the

⁵The reader can think of, what we call, VP as an AspP containing a VP

⁶Throughout we assume that quantification over times is subject to contextual restriction. That is, we quantify over future times within a contextually supplied set of times *C*.

$$(i) \quad \llbracket \text{FUT } \varphi \rrbracket^{s,C}(w_1)(t_1)$$

- a. is defined only if $\exists \langle w_2, t_2 \rangle \in s : \exists t_3 \in C : t_3 \succ t_2 \wedge \llbracket \varphi \rrbracket^{s,C}(w_2)(t_3) = 1$
 $\wedge \exists \langle w_3, t_4 \rangle \in s : \neg \exists t_5 \in C : t_5 \succ t_4 \wedge \llbracket \varphi \rrbracket^{s,C}(w_3)(t_5) = 1$
- b. if defined, = 1 iff $\exists t_6 \in C : t_6 \succ t_1 \wedge \llbracket \varphi \rrbracket^{s,C}(w_1)(t_6) = 1$

To keep our formulae simpler, we omit this contextual restriction.

local environment of the future operator. This is in contrast to much of the literature in which constraints on future reference are typically stated at a global or post-grammatical level. We will see evidence in Chapter 5 section 5.6 that an approach like ours is to be preferred.

1.6 Grammar and logic

Throughout this work we appeal to constraints on the grammar which will rule out a number of constructions which are grammatically deviant. However, the type of deviance they share is of a particular nature. The constructions are not deviant because of arbitrary structural or categorical properties such as grammatical case, c-selection, or phi-feature agreement. They are deviant because the *logical forms* (LFs) of these constructions have certain properties which emerge as a product of the combination of one or more of the logical operators which make up the construction. Two grammatical principles we appeal to throughout this work are *Analyticity* and *Efficiency*.

The notion of *Analyticity* is outlined in section 1.6.1, where we will review the proposal that a sentence which is always true or always false is ungrammatical. Of course, stated as such, this constraint is descriptively inadequate. We will review two approaches to ironing out the details of this proposal. However, one can intuitively imagine why such a constraint might be in place. A sentence which is always true or always false fails to be informative.

Next, section 1.6.2 outlines a class of proposals which suggest that competition between two semantically equivalent LFs favors the structurally simpler one with the more complex form being judged as infelicitous or even ungrammatical. This proposal too has an intuitive appeal as a kind of economy constraint on favoring forms which convey more with less.

1.6.1 Analyticity

There is a long history behind the idea that logical forms which systematically give rise to a tautology or a contradiction are interpreted as ungrammatical or deviant. It has been invoked to account for phenomena including; the distribution of quantifiers in existential constructions (Barwise and Cooper, 1981), in exceptive constructions (von Stechow, 1993), and in comparative clauses (Gajewski, 2008, 2009), as

well as NPI licensing (Chierchia, 2013), weak islands (Abrusán, 2014), the distribution of epistemic modals under attitude verbs (Anand and Hacquard, 2013), and interrogative embedding (Theiler et al., 2018; Mayr, 2019; Roberts, 2019; Uegaki and Sudo, 2019), among other things.

The basic idea is most easily demonstrated with Barwise and Cooper’s (1981) proposal for the distribution of quantifiers in existential *there* constructions (18). Very roughly, weak quantifiers like *some* are acceptable in existential constructions (19a) while strong quantifiers such as *every* are degraded (19b).

- (18) a. There is some student who Alice likes.
 b. * There is every student who Alice likes.

Barwise and Cooper (1981) propose that the expletive *there* denotes the domain of entities D_e , which would give these sentences the semantics in (19a) and (19b) respectively.

- (19) a. $\llbracket \text{student who likes Alice} \rrbracket \cap D_e \neq \emptyset$
 b. $\llbracket \text{student who likes Alice} \rrbracket \subseteq D_e$

They observe that on this semantics, only (19a) is informative since it will be true only if the set of students who likes Alice is non-empty. (19b), on the other hand is always true whether there are any such students or not.

Of course, an immediate problem with this suggestion is that classical tautologies and contradictions simply do not appear to be ungrammatical. Indeed, in certain contexts they can even be felt to be informative.⁷

- (20) a. Boys will be boys.
 b. If you’re right, you’re right.
 c. It’s raining and it’s not raining.
 d. The table is red but it’s not red.
 e. My brother is an only child.

The plausibility of accounts which appeal to analyticity as an indicator of grammaticality will therefore hinge on defining an appropriate notion of *Analyticity* which

⁷ At the time, Barwise and Cooper (1981, p.183) claimed that their observation “hardly constitutes an explanation”. Similarly, von Stechow (1993, p.133) lamented that “there is nothing better on the market at this time”.

rules out the type of constructions discussed above, while not ruling out classical tautologies and contradictions of the sort in (20).

When it comes to formalizing such a constraint there have largely been two approaches. The first type of approach, originating in the work of Gajewski (2002, 2009) involves determining an LF's *logical skeleton* by essentially disregarding non-logical constituents such as open-class items like nouns and verbs, and then computing whether the logical skeleton is analytic. The second type of approach maintains that every constituent is interpreted, but the meanings of certain lexical items are more context dependent than others. On this approach, the classical tautologies in (20) are saved by contextual reinterpretation (Abrusán, 2014) or covert modification (Del Pinal, 2019) of certain predicates. Ultimately, either type of approach can suit our purposes. However, it is nonetheless worth considering each approach briefly and confirming that this is indeed the case. Let us start with the logical skeleton approach before moving onto the context dependent approach.

The most influential account of *Analyticity* is that of Gajewski (2002, 2009) and his notion of L(ogical)-Analyticity. The account can be summarized as follows.

(21) *L-Analyticity*

- a. A sentence is ungrammatical if its LF contains a L-analytic constituent.
- b. where a constituent α of type t is L-analytic iff α 's logical skeleton receives the denotation 1 (or 0) under every variable assignment for which it is defined.
- c. where α 's logical skeleton is determined by the process of
 - i. Identifying the maximal constituents containing no permutation invariant items (van Bentham, 1989).
 - ii. Replacing each such constituent with a distinct variable of the same type.

The logical skeleton of an LF is arrived at by substituting constituents whose denotations are not *permutation invariant* (van Bentham, 1989) with a variable of the same type. Informally, an item is permutation invariant if its meaning is preserved regardless of the model or changes made to the domain. Gajewski (2002, 2009) proposes that it is only the logical skeleton which then feeds into the computation of *Analyticity* (see also Fox and Hackl 2006 section 5). For example, in the classical contradiction repeated in (22), (at least) the predicate *red* is not permutation

invariant, and thus each token of the predicate will be substituted by distinct variables, avoiding an instance of L-Analyticity.

(22) The table is red, but it's not red.

In contrast, a quantifier like *every* is permutation invariant. Unfortunately, adopting an account of this type immediately runs into problems when dealing with attitude predicates and other modal operators, despite intuitions that *Analyticity* can adequately account for the embedding capabilities of certain attitude predicates (Anand and Hacquard, 2013; Abrusán, 2014; Theiler et al., 2018; Mayr, 2019). On standard assumptions, attitude predicates are not permutation invariant and so should be substituted with a variable in the logical skeleton, making them effectively invisible for the computation of L-Analyticity. The solution of Theiler et al. (2018) is to decompose attitude predicates syntactically into a logical, permutation invariant, component and a permutation variant component (see also Mayr, 2019). Taking a similar approach, a modal operator could select a modal base function \mathcal{M} and potentially an ordering source function \mathcal{O} as arguments (23).

(23) $\llbracket \text{PRED } \varphi \rrbracket^s(w_0)(t_0) =$
 $\lambda \mathcal{O} . \lambda \mathcal{M} . \lambda x . \forall \langle w_1, t_1 \rangle \in \max_{\mathcal{O}_{w_0, t_0}^x} (\mathcal{M}_{w_0, t_0}^x) : \llbracket \varphi \rrbracket^{\mathcal{M}_{w_0, t_0, x}}(w_1)(t_1) = 1$

L-Analyticity and syntactic decomposition of this type would be sufficient for our purposes. However, some readers may find such syntactic complications unattractive, and potentially implausible. What is more, adopting L-Analyticity requires that we endorse an additional level of representation (i.e., the logical skeleton) which is otherwise unmotivated. With these objections in mind, let us turn to the second type of approach.

The context dependent approach does away with the idea that there is an additional level of representation at which non-logical lexical items are not interpreted. Instead, it rests on the idea that open-class terms like the noun *boy* and the verb *rain* are subject to contextually dependent reinterpretation either by making denotation assignment heavily context dependent (Abrusán, 2014) or through the addition of covert modification (Del Pinal, 2019). The recent proposal of Del Pinal (2019) posits an abstract, context sensitive, modifier RESCALE which can be inserted into logical

forms, saving classically analytic sentences.⁸

- (24) a. The table is red, but it's not RESCALE_c red.
 ≈ The table is red, it's not (e.g., bright) red.
 b. My RESCALE_c brother is an only child.
 ≈ My (e.g., step) brother is an only child.

Crucially, this approach manages to correctly maintain the results for the canonical cases of *Analyticity*.⁹ Taking this sort of approach may also appear problematic when it comes to modal operators such as attitude predicates since they too can be subject to contextually determined reinterpretation.

- (25) a. I believe it and I don't believe it.
 b. You should come out tonight and you shouldn't.
 c. If you know it, then you know it.

For these examples, we would once again have to propose that a RESCALE operator is inserted to avoid analyticity. The question then would be whether we predict attitude predicates and modals to never contribute to the analyticity of a construction—an undesirable prediction. Thankfully, the answer appears to be no. [Abrusán \(2014\)](#) notes that, even though attitude predicates can be subject to modification and are probably context dependent, logical aspects of the attitude predicates are not affected. For instance, let us suppose that for the two tokens of the verb *believe* in (25a) the modal base of the attitude predicate is slightly different. Perhaps the worlds quantified over in the first case are those compatible with the speaker's beliefs for which she has any evidence (Dox) while the in the second case they are worlds compatible with the speaker's beliefs for which she has more reliable evidence (Dox'). The crucial point here is that the modal context in both cases will still be shifted to the modal base of the attitude.

- (26) a. $\llbracket \text{believe } \varphi \rrbracket^s(w_0)(t_0) =$
 $\lambda x. \forall \langle w_1, t_1 \rangle \in \text{Dox}_{w_0, t_0}^x : \llbracket \varphi \rrbracket^{\text{Dox}_{w_0, t_0}^x}(w_1)(t_1) = 1$

⁸For many classical tautologies to be interpreted informatively, they typically need to be accompanied with stress on the second occurrence of the relevant predicate, for example *The table is red but it's not RED_F*. This stress is reminiscent of contrastive focus. An interesting possible explanation for this might be that contrastive focus, which would ordinarily be placed on the modifier, is shifted onto the predicate it modifies due to RESCALE being phonologically null.

⁹A notable exception is [Fox and Hackl \(2006, p.571\)](#) who claim that contextual reinterpretation “will not be consistent with what is needed to maintain the proposals we've made”.

$$\text{b. } \llbracket \text{RESCALE}_c \text{ believe } \varphi \rrbracket^s(w_0)(t_0) = \lambda x. \forall \langle w_1, t_1 \rangle \in \text{Dox}_{w_0, t_0}^{x'} : \llbracket \varphi \rrbracket^{\text{Dox}_{w_0, t_0}^{x'}}(w_1)(t_1) = 1$$

As such, whether a modal operator is modified by RESCALE or not, it cannot make the modal context different from the modal base of the embedding operator. Since the instances of *Analyticity* which we observe throughout this work are cases in which *Analyticity* arises with only one token of a modal operator, the availability of RESCALE will not adversely affect our results.

In sum, there are two approaches to *Analyticity* that we could appeal to in what follows. The first relies on an additional abstract level of representation—the logical skeleton—and requires syntactic decomposition in order to ensure that the logical component of a modal operator remains visible at that level. The second approach involves contextually dependent shifts in meaning between tokens of open-class items. This approach is also compatible with the core of our proposal if we assume that RESCALE modifies the modal base in some way, while not interfering with the relation between the modal base and the modal context. Since it is of little importance which option we choose, I will not take a stand on the matter here.¹⁰

1.6.2 Redundancy and efficiency

It is often noted that the grammar seems to favor forms which convey more information with less linguistic material (Meyer, 2015; Marty, 2017; Moracchini, 2018). Central to this idea is the notion of competition between alternative forms. But which forms compete and how is the competition resolved? The answer to the first of these questions is notoriously difficult to pin down (e.g., Horn, 1972; Matsumoto, 1995; Sauerland, 2004; Katzir, 2007; Swanson, 2010b; Fox and Katzir, 2011, a.m.o). As for the second question there is generally a consensus that competition between two forms is resolved as follows: (i) out of two equally complex forms, prefer the more informative (i.e., the one which entails the other), (ii) out of two equally informative forms, prefer the less complex. These are similar in spirit to the Gricean maxims of *Quantity* and *Brevity* (Grice, 1989). In the present work, we will not be concerned with the first form of resolution which is widely associated with the phenomenon of scalar implicatures. But in Chapter 3, section 3.9, and throughout

¹⁰However, in Chapter 2 section 2.2.3, we will see examples in which the context is argued to be kept constant across two clauses. The resulting sentences could potentially be analytic on a RESCALE account. We address these matters as they arise in Chapter 2 fn.9.

Chapter 4 we will observe instances of the second: out of two equally informative forms, prefer the less complex. This is captured in its most general form by Meyer's (2015, p.493) principle of *Efficiency*.

(27) *Efficiency*

An LF φ is ruled out if there is a distinct competitor ψ such that:

- a. $\psi < \varphi$
- b. $\llbracket \psi \rrbracket \equiv \llbracket \varphi \rrbracket$

Where $<$ means 'strictly simpler' in the sense of Fox and Katzir (2011). Fox and Katzir's (2011) notion of structural simplicity is defined as follows.

(28) $\psi \lesssim \varphi$ if ψ can be derived from φ by successive replacements of subconstituents of φ with elements from:

- a. The lexicon
- b. Subconstituents of φ

If $\psi \lesssim \varphi$ and $\varphi \not\lesssim \psi$, then ψ is strictly simpler than φ (i.e., $\psi < \varphi$). According to *Efficiency*, given two LFs that have identical truth conditions, the structurally more complex one is ruled out. We will also see some evidence in Chapter 4 that contextual equivalence between two alternatives is not enough to make them compete. The two forms must be equivalent at the level of LF.¹¹

¹¹Paul Marty (pc) notes that it may be important distinguish between sentences which involve a classically redundant constituent on the one hand, and those which involve a systematic redundancy as a result of their logical structure. Just as the grammar is sensitive to a special notion of analyticity which is stated at the level of the logical skeleton, it may also be sensitive to a special notion of redundancy which is stated at the level of the logical skeleton.

Chapter 2

Modal (Auxiliary) Verbs

2.1 Introduction

In this chapter, we consider the future licensing properties of modal verbs and modal auxiliary verbs. Firstly, we outline the future licensing capabilities of epistemic modals, before showing how the proposed semantics for *FUT* in Chapter 1 derives the observed data. Next, we discuss performative and reportative uses of deontic modals. We attempt to account for these data using the *To Do List* account of Portner (2004, 2007, 2010). The account is similar in spirit to that proposed by Ninan (2005). However, we will see that when we try to implement such an approach formally some complications do arise.

2.2 Epistemic modals

2.2.1 The temporal orientation of epistemic modals

Epistemic modals are used to talk about the way the world is or could be, given what we know. With respect to future licensing, we find the following behaviour: ‘strong’ necessity modals cannot be future oriented, while ‘weak’ necessity modals and possibility modals can. Firstly, let us consider the following epistemic possibility modals, which all permit a reading in which the event time of the prejacent is located in the future.

(29) Mary {might/may/could} be sick tomorrow.

Even in the absence of temporal adverbials such as *tomorrow*, a future reading is nonetheless forced if the prejacent receives a perfective episodic reading of an eventive predicate.

(30) Mary {might/may/could} win.

This is likely due to the constraint against the simple present with eventive predicates in English and many other languages (Giorgi and Pianesi, 1997). Since a simultaneous reading is ruled out, the future oriented reading is forced. Next, consider the epistemic strong necessity modals in (31). These permit an epistemic reading when interpreted simultaneously.

(31) Mary {must/has to/can't} be at home (already).

However, when the prejacent is modified by a future adverbial like *tomorrow* an epistemic reading is impossible (Enç, 1986; Stowell, 2004; Lekakou and Nilsen, 2008; Portner, 2009).

(32) * Mary {must/has to/can't} be sick tomorrow. (epistemic)

Likewise, they cannot receive an epistemic reading when their prejacent consists of a perfective episodic eventive predicate.

(33) * Mary {must/has to/can't} win. (epistemic)

Finally, we can turn to so-called 'weak' necessity modals. While these are harder to construe with an epistemic reading, they nonetheless pattern with possibility modals rather than strong necessity modals (see especially Banerjee 2018a who independently proposes a similar account to the one developed here).

(34) Mary {should/ought to} be sick tomorrow. (epistemic)

(35) Mary{should/ought to} win. (epistemic)

What we see, then, is that the future licensing possibility of epistemic modals appear to be sensitive to the modal operator's force. Epistemic possibility modals and weak necessity modals can be future orientated, while epistemic strong necessity cannot be. These data are summarized in Table 2.

In the remainder of this section, we show how the proposed semantics for *FUT* derives the correct pattern of data for epistemic modals. In section 2.2.2, we will go

Strength	Modals	Present	Past	Future
Strong Necessity	<i>must, have to, can't</i>	✓	✓	*
Weak Necessity	<i>should, ought to</i>	✓	✓	✓
Possibility	<i>might, could</i>	✓	✓	✓

Table 2: The temporal orientation of epistemic modals

through the relevant modal operators and show how epistemic strong necessity in particular is at odds with the presupposition of *FUT*, while this is not the case for epistemics of other forces.

Following this, section 2.2.3 outlines an ongoing debate regarding the strength of epistemic necessity. It is central to our proposal that epistemic strong necessity really has a ‘strong’ semantics which entails epistemic certainty and, by extension, commitment to the truth of the prejacent. This position has a number of detractors whose arguments we must carefully evaluate.

2.2.2 The semantics of epistemic modals

Recall that we are proposing that *FUT* has the semantics in (36). The assertive component (36b) is rather unexceptional. It simply involves existential quantification over temporal intervals which follow the evaluation time. The second dimension of meaning is the contingency presupposition (36a). Since future states of affairs are unsettled, there must be some worlds in the modal context for which there is a future time at which the prejacent is true, and some for which there is no future time at which the prejacent is true.¹

- (36) $\llbracket \text{FUT } \varphi \rrbracket^s(w_1)(t_1)$
- a. is defined only if $\exists \langle w_2, t_2 \rangle \in s : \exists t_3 \succ t_2 : \llbracket \varphi \rrbracket^s(w_2)(t_3) = 1$
 $\wedge \exists \langle w_3, t_4 \rangle \in s : \neg \exists t_5 \succ t_4 : \llbracket \varphi \rrbracket^s(w_3)(t_5) = 1$
 - b. if defined, = 1 iff $\exists t_6 \succ t_1 : \llbracket \varphi \rrbracket^s(w_1)(t_6) = 1$

Now consider the domain semantics for epistemic *must* (37) proposed in Yalcin (2007). Epistemic *must* is defined just in case the definedness conditions of its prejacent are satisfied throughout the modal context *s*, and, if defined, it denotes the

¹I am using the term ‘prejacent’ here to mean the prejacent of *FUT* not the prejacent of the modal, since *FUT* is of course part of the prejacent of the modal.

truth value 1 just in case every world in the modal context is a world in which the prejacent is true.

- (37) $\llbracket \text{must } \varphi \rrbracket^s(w_0)(t_0)$
- a. is defined only if $\forall \langle w_1, t_1 \rangle \in s : \langle w_1, t_1 \rangle \in \text{dom}(\llbracket \varphi \rrbracket^s)$
 - b. if defined, = 1 iff $\forall \langle w_2, t_2 \rangle \in s : \llbracket \varphi \rrbracket^s(w_2)(t_2) = 1$

In unembedded cases the body of information which determines the modal context s is determined by what Yalcin (2007) calls the *conversational tone* of a group of interlocutors. This may be the body of information understood to be shared knowledge, belief, or even fiction.²

Now let us consider what happens when we embed the future operator *FUT* under an epistemic modal. Assuming that the prejacent of *FUT* has no relevant presuppositions, we arrive at the following semantics when *FUT* φ is embedded under *must*—an ungrammatical construction.

- (38) $\llbracket \text{must FUT } \varphi \rrbracket^s(w_0)(t_0)$
- a. is defined only if $\exists \langle w_1, t_1 \rangle \in s : \exists t_2 \succ t_1 : \llbracket \varphi \rrbracket^s(w_1)(t_2) = 1$
 $\wedge \exists \langle w_2, t_3 \rangle \in s : \neg \exists t_4 \succ t_3 : \llbracket \varphi \rrbracket^s(w_2)(t_4) = 1$
 - b. if defined, = 1 iff $\forall \langle w_3, t_5 \rangle \in s : \exists t_6 \succ t_5 : \llbracket \varphi \rrbracket^s(w_3)(t_6) = 1$

Informally, the future operator requires that the modal context include both worlds in which φ is true at a future time and worlds for which it is not true at any future time, while epistemic *must* requires that φ is true at a future time in all such worlds. Specifically, the second line of the presupposition in (38a) is incompatible with the truth conditions in (38b). The resulting construction can never be defined and true, an instance of the type of ungrammaticality discussed in section 1.6.1 of Chapter 1. A similar story can be told for the other epistemic necessity modals *have to* and *can't*. However, *can't* φ will be true only if there are no φ worlds among the modal context. When the prejacent contains *FUT*, the resulting construction can similarly never be defined and true. We thus manage to account for our first observation: epistemic strong necessity modals cannot embed *FUT*.

In contrast to epistemic necessity modals, epistemic possibility modals such as *might* and *could*, do not require that the prejacent be true throughout the informa-

²There are also situations in which we may want to say that the modal context can be determined by a private attitude such as personal knowledge.

tion state supplied by s . These modals perform a test on the modal context s . They return the truth value 1 just in case s is compatible with the prejacent.

- (39) $\llbracket \text{might } \varphi \rrbracket^s(w_0)(t_0)$
- a. is defined only if $\forall \langle w_1, t_1 \rangle \in s : \langle w_1, t_1 \rangle \in \text{dom}(\llbracket \varphi \rrbracket^s)$
 - b. if defined, = 1 iff $\exists \langle w_2, t_2 \rangle \in s : \llbracket \varphi \rrbracket^s(w_2)(t_2) = 1$

Consequently, *FUT* can be embedded in the prejacent of *might* since its contingency presupposition can be satisfied.

- (40) $\llbracket \text{might FUT } \varphi \rrbracket^s(w_0)(t_0)$
- a. is defined only if $\exists \langle w_1, t_1 \rangle \in s : \exists t_2 \succ t_1 : \llbracket \varphi \rrbracket^s(w_1)(t_2) = 1$
 $\wedge \exists \langle w_2, t_3 \rangle \in s : \neg \exists t_4 \succ t_3 : \llbracket \varphi \rrbracket^s(w_2)(t_4) = 1$
 - b. if defined, = 1 iff $\exists \langle w_3, t_5 \rangle \in s : \exists t_6 \succ t_5 : \llbracket \varphi \rrbracket^s(w_3)(t_6) = 1$

Here, the contingency presupposition of the *FUT* (40a) does not conflict with the modal semantics of *might*. The truth conditions in (40b) are met if some s worlds are worlds in which φ is true at a later time. Of course, this leaves open the availability of s worlds for which φ is not true at a later time, satisfying the requirement imposed by the contingency presupposition of *FUT*.

Note, however, that our semantics for future oriented *might* is always true whenever defined. We therefore predict that an epistemic possibility modal with a future oriented prejacent should also be ruled out by some form of *Analyticity*. At first sight, this appears to be a problem. However, this is akin to a widely recognized consequence of the *Veltman*-style analysis of epistemic modals (*Veltman, 1996*) as well as its domain semantic offspring (*Yalcin, 2007*). On a semantics for *might* according to which it performs a test on an information state, an assertion of *might* φ is never informative. In fact, it is contextually trivial. To see why, consider the denotation of *might* φ construed as a set of world-time pairs.

- (41) $\{ \langle w, t \rangle \mid \exists \langle w', t' \rangle \in s : \llbracket \varphi \rrbracket^s(w')(t') = 1 \}$

Depending on whether s is compatible with the denotation of φ , this set will either be the domain of worlds, \mathcal{W}_s , or the empty set, \emptyset . Thought of as a function, this proposition is either a constant function from world-time pairs to the truth value 1 or a constant function to 0. Consequently, assertion of *might* φ will be true for all worlds in the context or none of them. This contextual analyticity is not logical analyticity, so epistemic assertions are not predicted to be ungrammatical per se.

However, if this were the whole story then they should, at the very least, be uninformative and, on most accounts, infelicitous.

In a bid to explain why epistemic assertions are felt to be informative, or at the very least non-trivial, proposal have been developed according to which an epistemic assertion partitions an information state relative to some question (Yalcin, 2011; Sherman, 2018), highlights a possibility by drawing attention to it (Ciardelli et al., 2009), or performs a speech act of instructing the interlocutor of a potential change to the context (Mandelkern, 2020a). These stories offer an explanation for the discourse function of epistemic assertions beyond informativity. However, they all involve technical complications which would take us outside the scope of this work. Nevertheless, one thing which is clear is that constraints on triviality and (un)informativity should be stated in terms beyond truth values. This would then provide a plausible explanation for why epistemic possibility statements are non-trivial in the general case, and non-analytic when embedding *FUT*. Crucially, if this extra dimension of meaning were shared by epistemic *must*, it would not save the contradiction derived by embedding *FUT* under epistemic *must*. The intuition underlying this story is that a sentence which is true, but systematically uninformative, may nonetheless serve some discourse function besides restricting the shared space of live alternatives—such as highlighting a live possibility. Conversely, there is no sense in which a sentence which systematically eliminates every alternative from the context can be useful.³

Finally, to account for the acceptability of future orientated prejacent of epistemic weak necessity modals we appeal to the idea that weak necessity is interpreted as such due to the promotion of an ordering source (von Fintel and Iatridou, 2008; Rubinstein, 2012). Accordingly, a modal like epistemic *should* universally quantifies over only the maximally normal or likely of the epistemic alternatives.⁴

³Cases of irony, or traditional contradictions, are not relevant examples of this situation since they are not instances of *Analyticity* as described in Chapter 1.

⁴We pick out this set of worlds using the max operator of von Fintel (1999) and von Fintel and Heim (2011). Where P is a set of propositions and W a set of worlds.

- (i) a. $\max_P(W) = \{\langle w', t' \rangle \in W \mid \neg \exists \langle w'', t'' \rangle \in W : \langle w'', t'' \rangle <_P \langle w', t' \rangle\}$
 b. where $\langle w'', t'' \rangle <_P \langle w', t' \rangle$ iff $\{p \in P \mid \langle w', t' \rangle \in p\} \subset \{q \in P \mid \langle w'', t'' \rangle \in q\}$

- (42) $\llbracket \text{should } \varphi \rrbracket^s(w_0)(t_0)$
- a. is defined only if $\forall \langle w_1, t_1 \rangle \in s : \langle w_1, t_1 \rangle \in \text{dom}(\llbracket \varphi \rrbracket^s)$
 - b. if defined, = 1 iff $\forall \langle w_2, t_2 \rangle \in \text{max}_{\text{LIKELY}_{w_0, t_0}}(s) : \llbracket \varphi \rrbracket^s(w_2)(t_2) = 1$

Such a semantics allows for some worlds among the epistemic alternatives for which the prejacent is not true. However, those worlds are simply less likely than those for which it is true. Consequently, a speaker is not felt to have contradicted themselves by uttering a sentence like (43).

- (43) It should be raining, but it might not be.

Epistemic weak necessity modals, therefore, are able to embed *FUT* without giving rise to a contradiction. Such a configuration will presuppose that there are some worlds among the modal context for which there is a future time at which the prejacent holds, and some for which there is no future time at which the prejacent holds. Finally, it will be true only if all of the most likely alternatives are such that there is a future time at which the prejacent holds.⁵

- (44) $\llbracket \text{should FUT } \varphi \rrbracket^s(w_0)(t_0)$
- a. is defined only if $\exists \langle w_1, t_1 \rangle \in s : \exists t_2 \succ t_1 : \llbracket \varphi \rrbracket^s(w_1)(t_2) = 1$
 $\wedge \exists \langle w_2, t_3 \rangle \in s : \neg \exists t_4 \succ t_3 : \llbracket \varphi \rrbracket^s(w_2)(t_4) = 1$
 - b. if defined, = 1 iff $\forall \langle w_3, t_5 \rangle \in \text{max}_{\text{LIKELY}_{w_0, t_0}}(s) :$
 $\exists t_6 \succ t_5 : \llbracket \varphi \rrbracket^s(w_3)(t_6) = 1$

In summary, what distinguishes epistemic strong necessity modals from weak necessity and possibility modals is that the modal base of an epistemic strong necessity modal only contains worlds for which the prejacent is true. The modal base of an epistemic possibility or weak necessity modal, on the other hand, may contain worlds in which the prejacent is false. Since the semantics of an epistemic strong necessity modal conflicts with the contingency presupposition of *FUT*, we correctly predict that *FUT* cannot be embedded under strong necessity modals, while it can be embedded under epistemic possibility and weak necessity modals.

⁵Valentine Hacquard (pc) notes that there is potentially a degree of redundancy here. The presupposition introduced by *FUT* ends up being identical to the diversity presupposition of modal operators with an ordering source. However, I would like to offer a way of construing these presuppositions which makes them seem less redundant. We could understand the presupposition of *FUT* as testing whether the modal context is diverse with respect to the modal's prejacent. The diversity presupposition of epistemic *should* ensures that it passes this test. However, epistemic strong necessity modals like *must* fail this test.

2.2.3 On the strength of epistemic strong necessity modals

In order to derive the distribution of *FUT* we made an assumption about the semantics of epistemic *must*, and epistemic strong necessity in general. We assumed that epistemic strong necessity involves universal quantification directly over the worlds in *S*. However, this assumption has been questioned because such a semantics has a number of consequences which *prima facie* appear to be at odds with common intuitions about epistemic *must* statements. Namely, we appear to predict that *must* statements should be stronger than they are felt to be. Consider the following pair.

- (45) a. It is raining.
b. It must be raining.

Depending on one's assumptions regarding assertion, (45b) should be at least as strong as (45a), if not stronger. If, for instance, we assume that the bare declarative (45a) is used to assert that it is raining in the actual world, then the *must* sentence (45b) will be stronger since it asserts that it is raining in a superset of worlds (barring omniscience). On the other hand, if one assumes that a bare assertion in fact involves a covert epistemic necessity operator (Kratzer, 1986; Kaufmann, 2005; Meyer, 2015, a.m.o), then *ceteris paribus* these sentences should be equivalent. However, many authors have noted that we tend to feel that (45b) is weaker than (45a) not stronger (Karttunen, 1972; Lyons, 1977; Groenendijk and Stokhof, 1975; Kratzer, 1991; Giannakidou and Mari, 2016; Lassiter, 2016). This is an empirical point, and it is one which deserves consideration.⁶

In modelling the perceived weakness of a *must* statement when compared to a bare assertion, Giannakidou and Mari (2016, p.8) suggest that all modal auxiliaries have an ordering source, proffering the following generalization “All modal bases are non veridical spaces” where “veridical spaces are homogeneous whereas non veridical spaces are non-homogeneous”. On the present account, this would have the undesirable consequence that all modals should license *FUT*. As such, the suggestion that all modal bases are ‘non veridical’—in Giannakidou and Mari’s somewhat

⁶An issue which often goes hand-in-hand with discussion of the perceived weakness of *must* is the status of the evidence for the prejacent. For instance, von Stechow and Gillies (2010) suggest that *must* φ carries the presupposition that φ is established indirectly (see also Mandelkern, 2016). However, since it is possible that *must* could be weak and presuppose that its prejacent is established indirectly (as in Lassiter, 2016), we take this issue to be of less relevance, focusing instead on arguments that *must* is strong.

unorthodox sense—is incompatible with our account so far. Their generalization is partly motivated by the putative observation that *must* φ does not entail that the speaker knows φ . Obviously, if we can show that *must* φ does in fact entail that (the speaker thinks she knows that) φ , then this would call into question the empirical motivation for the assumption that *must* is non veridical.⁷

An oft-cited piece of evidence that *must* is at least sometimes strong is that it can appear in the conclusion of a deduction. What is important to note is that, in such a context, the presence of epistemic *must* in the conclusion does not give rise to any perceived weakness. Example (46) is based on Lassiter’s (2014, p.4) example (5), and example (47) is von Fintel and Gillies’s (2010, p.362) example (12).

- (46) x is prime.
 x is even.
 So, x must equal two.
- (47) The ball is in A or in B or in C.
 It is not in A.
 It is not in B.
 So, it must be in C.

Examples of this sort, have been argued to demonstrate that a *must* statement is not always weaker than a bare assertion. There is no perceived weakness in the conclusion reached in (46) or (47). In both examples, a bare assertion in the conclusion would be both acceptable and completely justified. If *must* were weaker than a bare assertion, then its use here should give rise to a feeling of uncertainty, counter to fact. Lassiter (2014) accompanies his example with the claim that, to his knowledge, no proponents of a weak semantics for epistemic *must* have claimed that it *entails* a lack of certainty. Since then, however, at least Giannakidou and Mari (2016, 2018) and Goodhue (2017) have claimed precisely that. Consequently, these authors are forced to attribute the acceptability of *must* in deductive contexts to a different flavor of modality. However, it is hard to see the justification for proposing a different flavor of modality for these deductive contexts. Indeed, Mandelkern (2016) essentially proposes that all uses of epistemic *must* are of this type. In particular, he notes

⁷In Chapter 3, we adopt a Kratzerian semantics for attitude predicates which involve a modal base and, for certain predicates, an ordering source. It is clear that Giannakidou and Mari do not intend their generalization to extend to the modal bases of attitude predicates. For instance, they cite the attitude predicate *know* as an instance of a veridical modal operator.

that when the relevant premises are not known to the interlocutor, the use of a *must* statement “needs elaboration” (Mandelkern, 2016, p.2). Moreover, even if deductive *must* is of a different flavor to epistemic *must*, it is not clear how this will fit with Giannakidou and Mari (2016)’s claim that all modal bases are, in their terms, ‘non veridical’ (i.e., diverse with respect to the prejacent). Even if the modal base of *must* in (46) is alethic, it will still need to be homogeneous with respect to the proposition that *x* equals two.

At the very least, then, it seems incorrect to say that epistemic *must* always involves a lower degree of commitment than epistemic certainty. However, we should also consider the weaker claim that although epistemic *must* normally has an ordering source, it does not need to have one. Suppose that *must* can have an ordering source which could be described as stereotypical, likely, normal, or something else to that effect. To assert *must* φ would be to assert that all the most typical, likely, or normal epistemic alternatives are such that φ is true. If this were so, then it should be possible for a speaker to assert a *must* statement, while also conceding that the prejacent may be false for some untypical, unlikely, or abnormal reason. However, this does not seem to be possible.

- (48) A: Charlie must have passed his driving test by now.
B: What if a vulture flew down and pecked his eyes out?
A: # Sure that’s possible. But, sill, he must have passed.

Confronted with this sort of datum, a proponent of the ordering source camp might reasonably try to come up with a pragmatic story for why such an exchange is infelicitous. However, note that we find that this type of exchange is perfectly felicitous with an epistemic weak necessity modal such as *should* (49).

- (49) A: Charlie should have passed his driving test by now.
B: What if a vulture flew down and pecked his eyes out?
A: Sure that’s possible. But, still, he should have passed.

Moreover, if A concedes the unlikely possibility of Charlie being subject to a vulture attack, then A can retract the *must* claim, offering instead a *should* claim.

- (50) A: Charlie must have passed his driving test by now.
B: What if a vulture flew down and pecked his eyes out?
A: Sure that’s possible. But, still, he should have passed.

Of course, the exchanges in (49) and (50) are predicted to be felicitous on the semantics for *should* given above for precisely the reason that (48) is (incorrectly) predicted to be felicitous on the ordering source account of epistemic *must*. These data not only call into question an ordering source of typicality, likelihood, or normalcy for epistemic *must*, but they also add weight to the suggestion that this is precisely what is going on in the case of an epistemic weak necessity modal like *should*.

In support of his claim that *must* is at least sometimes weak, Lassiter (2014, 2016) reports some naturally occurring examples in which a *must* statement is conjoined with an admission of uncertainty. The following example is based on Lassiter's (2016, p.126) example (36).⁸

(51) It must be an old DTS diesel setup, but I'm not certain.

But compare this to a generalized quantifier like *everyone*. Despite its strong semantics, *everyone* is rarely used with the intention of quantifying over every person in the broadest possible sense. Rather, it is typically used to universally quantify over some contextually relevant and salient subset of people. This domain restriction is defeasible in that it can always be pushed back in such a way as to expand the domain of quantification.

(52) A: Everyone hated my performance.

B: I doubt that *everyone* hated it. Only the people who heard it hated it.

The typical assumption made for quantifier phrases such as *everyone* is that they have their strongest possible meaning, with some sort of pragmatic restrictions on the domain of quantification, which we exclude from the logical content of the determiner. Angelika Kratzer (pc) notes similar facts with epistemic *must*, in which contextual restriction is defeasible and can be contested, pushing the speaker back on their claim.

(53) A: It must be an old DTS diesel setup.

⁸Lassiter finds a fair number of this sort of examples online (2016, p.125-27) examples (26-39). The complete context of the sentence is as follows.

- (i) I have an injected TB42 turbo and don't like the current setup. There is an extra injected [sic] located in the piping from the throttle body. Must be an old DTS diesel setup but I'm not certain. Why would they have added this extra injector?

B: I doubt that it *must* be an old DTS diesel setup. It might be a wild hallucination.

von Fintel and Gillies (2018) propose that Lassiter's examples, in which a *must* statement is followed up with a confession of a lack of certainty, are precisely of this sort. In their own words, they suggest that the speaker is "expanding the modal horizon" (von Fintel and Gillies, 2018, p.10).

To show that the relative acceptability of Lassiter's examples is attributable to a change of contextual factors, von Fintel and Gillies (2018) note that it is possible to keep a context fixed across two clauses by embedding one inside a fronted *although* clause. When we do this, we find that the sentences are notably infelicitous. Example (54) is von Fintel and Gillies's (2018, p.12) example (16).⁹

(54) # Although I'm not certain, it must be an old DTS setup.

Additionally, if a speaker is made to endorse both conjuncts simultaneously, the resulting sentences are notably odd. Again, (55) is von Fintel and Gillies's (2018, p.11) example (15).

(55) A: That must be an old DTS diesel setup but I'm not certain. Why would they have added this extra injector?

B: So given that you're not certain, do you still think it must be an old DTS diesel setup?

A: # Like I said: it must be and I'm not certain.

Intuitively, it seems as though many of Lassiter (2016)'s examples involve a speaker changing their mind, correcting themselves, or entertaining two incompatible bodies of information simultaneously. As we have seen, when this is controlled for by

⁹If this is indeed an instance of context being kept constant across two clauses, this raises a potential issue for the contextually dependent reinterpretation approach to analyticity (e.g., Abrusán, 2014; Del Pinal, 2019). More specifically, the following sentence might be predicted to be analytic if the context fixes the meaning of *rain* across the two clauses.

(i) Although it's raining, it's not raining.

While this sentence still feels like a classical tautology, it is clearly not ungrammatical as a result of *Analyticity*. It would appear that there are three stances we could take; (i) abandon the contextually dependent reinterpretation account of *Analyticity*, (ii) abandon the idea that the *although* construction fixes the context across the two clauses, (iii) claim that some aspect of the context is being kept fixed such that (54) gives rise to a classical contradiction, but not to the extent that it renders the sentence analytic.

fixing the context across the two conjuncts, the examples are notably infelicitous. This would suggest that apparent exceptions to epistemic certainty may indeed be changes in the domain of quantification and not part of the logical makeup of the quantifiers in question.

While the debate on the strength of *must* is still ongoing, I think that the position we have adopted above is not only sufficiently ‘alive’ to be justified as an assumption, but is also well supported by the facts. A final point worth making is that, to the extent that the present proposal is successful, the inability of epistemic strong necessity modals to license *FUT* may be taken as further evidence in favor of a strong semantics for *must*.

2.2.4 A word on *will*

In the introduction, we saw some uses of *will* which had a modal interpretation without a future orientation.

- (56) a. Alice will be in her office already.
b. [Upon hearing the doorbell] That will be Bobby now.

The precise nature of the modality expressed by *will*, and other markers used for expressing the future cross-linguistically, is currently the topic of much research (e.g., Giannakidou and Mari, 2018; Frana and Menéndez-Benito, 2019; Ippolito and Farkas, 2019; Mihoc et al., 2019). And although we will not contribute much to the topic here, this project would be incomplete without addressing how *will* fits into the picture we are presenting.

Giannakidou and Mari (2013, 2016, 2018) claim that the modal *will* on its so-called ‘epistemic’ reading is synonymous with epistemic *must*. However, much recent evidence suggest that this is not so. The following example, based on Ippolito and Farkas’s (2019, p.461) example (7), highlights a striking difference between epistemic *will* and *must*. Ippolito and Farkas note that if a doctor were to use epistemic *will* instead of *must* in giving their diagnosis, then it would sound like little more than a guess as opposed to an informed conclusion.

- (57) SCENARIO: *Upon returning from a trip to Italy, Alice develops a persistent dry cough and a fever. She calls her local general practitioner. Who advises her not to attend the hospital, stating (57a,57b).*
a. It must be the novel coronavirus.

- b. # It will be the novel coronavirus.

Additionally, while epistemic *must* is felicitous in deduction contexts, epistemic *will* is somewhat odd (Ippolito and Farkas, 2019; Mihoc et al., 2019).

- (58) *x* is prime.
x is even.
So, *x* will equal two.
- (59) The ball is in A or in B or in C.
It is not in A.
It is not in B.
So, it will be in C.

Furthermore, sentential modifiers such as *probably*, can co-occur with epistemic *will*, whereas they are strikingly bad with epistemic *must*.

- (60) a. Alice will (probably) be there already.
b. Bob must (*probably) be there already.

Based on these facts, it should already be clear that whatever the modal contribution of *will*, it is not equivalent to that of epistemic *must*.¹⁰ To account for the relative weakness of *will*, Mihoc et al. (2019) propose that *must* can either have an ordering source or not, whereas *will* must have an ordering source.¹¹ They also suggest that perhaps *will* has a modal base which is derived from an empty conversational background. This last suggestion would certainly render a *will* statement less reliable than a *must* statement, and thus might explain the infelicity of *will* in the doctor scenario (57b). However, it would be incompatible with the observation that *will* cannot have a counterfactual prejacent (Ippolito and Farkas, 2019).

- (61) SCENARIO: *Alice is the sole survivor of a terrible plane crash. Prior to the impact she was thrown from her seat, and landed in a pile of snow in such a way that she was totally unscathed. Upon retelling the story she says (61a,61b)*
- a. # I will have died, but I didn't.

¹⁰Ippolito and Farkas (2019) also provide evidence that the epistemic future in Italian is stronger than epistemic possibility, and these facts carry over to epistemic *will* in English. We will not review that evidence here. Instead, we direct the reader to the source material.

¹¹More accurately, Mihoc et al. (2019) say that *must* can have an empty ordering source which amounts to the same thing.

- b. # I will be dead, but I'm not.

Suppose that the modal base of *will* is derived from an empty conversational background. This means that the modal base of *will* includes worlds in which Alice died during the plane crash.¹² Given that the assumptions which make up the ordering source no doubt determine that Alice's dying was a more likely outcome than her survival, then this sentence should be both felicitous and true. However, it is distinctly marked.

Nevertheless, the analysis of Mihoc et al. (2019) is almost compatible with the theory developed above. However, we have argued in section 2.2.3 that *must* does not have an ordering source, and giving *will* a semantics which allows it to rank all possible worlds seems problematic. On the other hand, Ippolito and Farkas (2019) build their semantics on Yalcin's (2016) semantics for weak necessity modals. They propose that *will* has a doxastic component akin to a modal base, and an ordering based on normalcy which is indexed to the speaker in declaratives and the addressee in questions (see also Frana and Menéndez-Benito, 2019). This sort of proposal would suit our purposes here. Crucially, epistemic uses of *will* are weaker than epistemic uses of *must*. If so, this is compatible with *will*'s ability to license *FUT*.

2.3 Deontic modals

2.3.1 The temporal orientation of deontic modals

While epistemic modals are used to talk about ways the world is or could be given what is known, deontic modals are used to talk about how the world ought to be. They express what is preferable according to a set of rules or norms. Within this category of modality, however, we distinguish between those uses of deontic modals which *report* what is obliged or permitted given a set of rules, and those uses which *perform* a speech act of updating that set of rules. We will therefore call these two classes *reportative* and *performative* (uses of) deontic modals respectively. This distinction is widely recognized—if not theoretically, then at least descriptively (Kamp, 1973; Lewis, 1979; van Rooy, 2000; Ninan, 2005; Portner, 2009; Lauer, 2015, a.m.o).

Be that as it may, what we are calling reportative uses of deontic modals can

¹²The intersection of the empty set of propositions is equal to the domain of which all propositions are a subset (Hajnal and Hamburger, 1999) i.e., $\bigcap\{p \mid \perp\} = \mathcal{W}$.

be used to simply describe what an individual is obliged (62a,63a) or permitted (62b,63b) to do given some set of rules.

- (62) a. Charlie is obliged to tidy his room.
b. Charlie is permitted to eat a cookie.
- (63) a. Charlie is under an obligation to tidy his room.
b. Charlie has permission to eat a cookie.

A reportative deontic sentence, as a description of states of affairs, can be either true or false. For instance, the sentence in (62a) can be disputed as false if Charlie is not subject to such an obligation.

- (64) A: Charlie is obliged to tidy his room.
B: That's not true! He told me he was free all day.

Performative deontic sentences, on the other hand, seem less amenable to such a treatment. Consider (65) uttered by a mother, Alice, to her son, Bobby. Given this context, it is odd for Bobby to claim that the deontic statement is false *per se*.

- (65) A: You must tidy your room!
B: # That's not true! I'm free all day.

On the other hand, Bobby may be able to protest that Alice's presupposition of authority is unjustified.

- (66) A: You must tidy your room!
B: You can't tell me what to do.

Provided that the speaker is in a position of authority, and the hearer respects that authority, it seems that a performative sentence is true in virtue of its being uttered. A performative use of a deontic modal, then, requires a relation of authority of one individual over another. The individual in a position of authority, we will call the *deontic authority*, and the individual of whom the authority is in charge we will call the *deontic patient*.¹³

A point worth making is that a reportative deontic modal can typically be used performatively as well. When we say that a modal itself is performative, we mean

¹³Lewis (1979) gives these roles the names 'master', and 'slave' respectively.

that it appears to necessarily be interpreted performatively. That any modal is necessarily interpreted performatively is a slightly contentious issue, and it will depend in part on what we mean when we say “performative”. In section 2.3.3, we propose that performative modals have certain properties which are part of their semantic content, and are not conditioned by the context in which they are used. It is these properties which govern the modals’ temporal behavior, and it is the necessary presence of these properties we are referring to when calling a modal “performative”.

2.3.1.1 Reportative deontic modals

Reportative deontics are typically adjectival passive forms of infinitive-embedding verbs such as *oblige*, *require*, *permit*, and *allow*. However, we can also include in this class weak necessity modals such as *should* (as noted by Ninan 2005). While a performative necessity modal such as deontic *must* imposes an obligation, the weak deontic necessity modal *should* can be interpreted as simply a suggestion.

(67) A: You must tidy your room!

B: # I’ll think about it.

(68) A: You should tidy your room.

B: I’ll think about it.

With respect to their temporal orientation, reportative deontic modals can have either a simultaneous, future, or past orientation. This can be seen for the weak necessity modal *should* below.

(69) a. Alice should be here (now).

b. Bobby should come tomorrow.

c. Charlie should have left already.

Similarly, the adjectival passive *be permitted* can have either a simultaneous (70a), future oriented (70b), or past oriented (70c) complement.

(70) a. Alice is permitted to be here (now).

b. Bobby is permitted to come tomorrow.

c. Charlie is permitted to have left already.

Unlike epistemics, we find that reportative deontic necessity modals may also be future oriented (71b), as well as simultaneous (71a) and past oriented (71c).

- (71) a. Alice is obliged to be here (now).
 b. Bobby is obliged to come tomorrow.
 c. Charlie is obliged to have left already.

2.3.1.2 Performative deontic modals

Performative deontic modals, like reportative deontic modals, can license the future regardless of the force of the modal.

- (72) a. You must tidy your room later!
 b. You may eat a cookie tomorrow.

However, Ninan (2005) observes that prejacent to performative deontic modals cannot be past oriented (73). Nor can they be interpreted simultaneously (74).

- (73) a. * You must have tidied your room yesterday! (deontic)
 b. * You may have eaten a cookie earlier. (deontic)
- (74) a. * You must be at school (already)! (deontic)
 b. * You may be back at home (already). (deontic)

The sentences in (73) are infelicitous whether or not the addressee has tidied his or her room, or eaten a cookie. Likewise, the sentences in (74) are infelicitous whether or not he or she is already at school or at home. So while reportative modals can, but need not, be future oriented, performative deontic modals of any force *must* be future oriented. These data are summarized in table 3.

Flavor	Modals	Present	Past	Future
Reportative	<i>obliged, allowed, should</i>	✓	✓	✓
Performative	<i>must, may</i>	*	*	✓

Table 3: The temporal orientation of deontic modals

In the following section, we will attempt to derive the obligatorily future oriented interpretation of performative deontic modals.

2.3.2 An option-based ordering for deontic modals

Deontic modals are typically treated as quantifying over worlds which are in some sense best or better than others according to some preference or reprehensibility ranking. Once again, we will employ Kratzer's (1977; 1981; 2012) doubly relativized modal semantics to capture this. First of all, we should consider what worlds constitute the modal base of these verbs.

As discussed in the introduction, it has often been assumed that deontic modals are associated with a historical modal base—also called a totally realistic or metaphysical modal base (e.g., Werner, 2006; Lekakou and Nilsen, 2008).¹⁴ On this approach, the obligatorily future oriented behavior of performative deontic modals is attributed to the fact that past and present oriented propositions are trivially true or false throughout all the worlds in the modal base since they form an equivalence class at every time up to the speech time. As a result, any ranking imposed by the ordering source is vacuous, and existential and universal modal propositions end up equivalent. These undesirable consequences are obviated by associating these modal operators with a diversity presupposition (Condoravdi, 2002), according to which the modal base must contain some worlds for which the prejacent is true, and others for which it is false. For a totally realistic modal base, this is only satisfied when the modal prejacent is future oriented.

While this account is plausible, Ninan (2005) attempts to provide an account for the temporal properties of deontic modals which does not rely on this assumption. Instead, he adopts the *To Do List* account of Portner (2004, 2007, 2010) which proposes that the modal base of performative deontic modals is equated with the worlds compatible with the common ground. This cannot receive a similar explanation to that just outlined since the modal base can be diverse with respect to past and present oriented propositions, provided there is no agreement on their truth value between the deontic authority and deontic patient. In what follows, we will attempt to formalize this second type of approach. The resulting picture is notably more complicated than the traditional approach. However, we will see at least one reason to think that it might be preferable.

With this in mind, let us treat the accessible worlds which make up the modal base of deontic modal expressions as those which are compatible with what is shared or mutual belief between the deontic authority, α and the deontic patient β . These

¹⁴This suggestion goes back at least as far as Lewis (1979).

are worlds compatible with the propositions which both α and β are committed to, the worlds compatible with what α and β take to be *common ground* (Stalnaker, 1978).

$$(75) \quad \text{Acc}_{w,t}^{\alpha,\beta} = \bigcap \{p \mid p \text{ is common ground between } \alpha \text{ and } \beta \text{ in } w \text{ at } t\}$$

These accessible worlds are ranked according to an ordering source. We follow Portner (2004, 2007, 2010) in construing the ordering source of deontic modals as a sort of list. Portner calls this list a *To Do List*. One way to conceive of this list is as a set of options available to β . These options should not be construed as a record of what β can or must do. Rather, they should be understood as *determining* what β can or must do. Suppose that, for some issue, there is a single option on β 's list which does not conflict with any of the other option. Since β only has one option available to him, he must realize that option. By way of contrast, when there are two incompatible options φ and ψ available to β , then β can realize one option or the other. Some of the best worlds according to that list will be φ worlds and some will be ψ worlds.¹⁵

Let's take a look at a toy example to give us an idea of how this works. Assume that the list of options made available to some deontic patient β by a deontic authority α (at t in w) is the following.

$$(76) \quad \text{TDL}_{w,t}^{\alpha,\beta} = \left\{ \begin{array}{l} \{\langle w', t' \rangle \mid \neg \exists t'' \succ t' : \beta\text{-eat-cookie}(w')(t'')\} \\ \{\langle w', t' \rangle \mid \exists t'' \succ t' : \beta\text{-eat-cookie}(w')(t'')\} \\ \{\langle w', t' \rangle \mid \exists t'' \succ t' : \beta\text{-tidy-room}(w')(t'')\} \end{array} \right\}$$

From this, we can determine the set of maximally ideal, or best, worlds in Acc using the \max function from von Fintel (1999) and von Fintel and Heim (2011).

$$(77) \quad \begin{array}{l} \text{a. } \max_{\text{TDL}_{w,t}^{\alpha,\beta}}(\text{Acc}_{w,t}^{\alpha,\beta}) = \\ \quad \{\langle w', t' \rangle \in \text{Acc}_{w,t}^{\alpha,\beta} \mid \neg \exists \langle w'', t'' \rangle \in \text{Acc}_{w,t}^{\alpha,\beta} : \langle w'', t'' \rangle <_{\text{TDL}_{w,t}^{\alpha,\beta}} \langle w', t' \rangle\} \\ \text{b. where } \langle w'', t'' \rangle <_{\text{TDL}_{w,t}^{\alpha,\beta}} \langle w', t' \rangle \text{ iff} \\ \quad \{p \in \text{TDL}_{w,t}^{\alpha,\beta} \mid \langle w', t' \rangle \in p\} \subset \{p \in \text{TDL}_{w,t}^{\alpha,\beta} \mid \langle w'', t'' \rangle \in p\} \end{array}$$

¹⁵There are a few differences between the semantics employed here and that of Portner (2004, 2007, 2010). Firstly, Portner's semantics is dynamic whereas ours is static. Secondly, Portner treats the *To Do List* as a set of properties, whereas we treat it as a set of propositions (or more accurately properties of times).

The best worlds (or more accurately world-time pairs) will be those accessible worlds for which there is no better accessible world. Where w'' is better than w' only if the set of propositions in the list of options which w'' makes true is a proper superset of the set of propositions in the list of options which make w' true. Suppose that there are four accessible worlds, as shown in table 4.

World	β tidies room	β eats cookie
w_1	1	1
w_2	1	0
w_3	0	1
w_4	0	0

Table 4: Accessible worlds

Clearly, the worlds in which the room is not tidied (w_3, w_4) will be excluded from the best worlds because the worlds in which the room is tidy (w_1 and w_2) are better (i.e., make a superset of propositions from $TDL_{w,t}^{\alpha,\beta}$ true). Between w_1 and w_2 , however, there is no ranking because neither world makes more propositions from $TDL_{w,t}^{\alpha,\beta}$ true than the other. In this case, the best worlds will be w_1 and w_2 . This means that all the best worlds are such that the β tidies his room, and there is some best world w_1 in which β eats a cookie, and some best world w_2 in which β does not eat a cookie.

2.3.3 The semantics of performative deontic modals

In this section, we attempt to characterize some of the attributes of performativity. In particular, we suggest that the defining feature of a performative speech act is that it involves an appendment to the list of options available to the deontic patient by the deontic authority. In capturing this, we adopt important contributions from Portner’s (2004; 2007; 2010) *To Do List* account, but couched in a static semantics. Next, we formalize a principle called *Reasonableness*. We propose that this principle follows from a constitutive rule of performativity proposed by Lewis (1979). Finally, we demonstrate how this principle correctly predicts that performative modals are necessarily future oriented (i.e., must embed *FUT*).

Performative deontic modals such as *must* or *may* have traditionally been argued to be control verbs, although this position has come under fire Wurmbrand

(1999). Here, we will side with the position that performative deontic modal auxiliaries are raising predicates. Throughout, we will treat the deontic authority argument as fixed to the speaker in the context (represented as *sp* in the logical forms below). However, we will not treat the deontic patient as necessarily the subject, nor do we treat the hearer as necessarily the deontic patient. This is because of facts such as the following. Imagine, Bobby's mother Alice is talking to a babysitter and she utters (78). If Bobby were fourteen or fifteen years old, then the babysitter could perhaps understand (78) as constraint on Bobby's options (78a). Bobby is now obliged to go to bed before nine o'clock, and the babysitter may relay or enforce this obligation.¹⁶ However, if Bobby were one year old, then the babysitter would no doubt understand (78b) as an obligation being imposed on the babysitter herself. The babysitter's options now necessitate that they put Bobby in bed by nine.

- (78) Bobby must be in bed by nine o'clock.
- a. \rightsquigarrow Bobby is now obliged to be in bed by nine o'clock
 - b. \rightsquigarrow The hearer is now obliged to put Bobby in bed by nine o'clock

On the first interpretation, the subject is the deontic patient, whereas on the second interpretation, the hearer is the deontic patient despite not being the subject. This already calls into question a control analysis of *must* and *may* sentences. Further examples in which the grammatical subject and the deontic patient are not coextensive occur with inanimate subjects. Here the deontic patient is the hearer, and the preajacent denotes the option being updated.

- (79) a. The car must be back before ten o'clock.
b. The book may be borrowed for another ten days.

In what follows, then, we will keep the deontic authority fixed to the speaker (*sp*) while the deontic patient is determined by the variable assignment function *g* applied to a variable *i*. However, in the majority of cases we will look at, it will be the hearer who is both the subject of the sentences as well as the deontic patient.

¹⁶By some counts this might not be considered a performative use. However, at least Ninan (2005) would be forced to group this reading together with clearly performative uses since it is also bad with past readings of perfect *have*. For this reason, we are forced to make the same categorization.

2.3.3.1 Updating options and the performative presupposition

In engaging in a performative deontic speech act, the deontic authority makes a change as to what is permitted or obliged. Prior to an act of obliging φ , the proposition φ was not an obligation. Prior to permitting φ , the proposition φ was not permitted. One way of thinking about this is that at the time immediately prior to the time of evaluation ($t - 1$), the corresponding reportative deontic sentence would be false, while at t it is true. The list of options changes as a consequence of the utterance, and, provided the deontic authority's status is not contested by the deontic patient, the sentence appears to be true in virtue of it being uttered. For this to be the case, the speaker must be in a position to change the list of options. That is, the speaker must be the deontic authority.

Following the mechanism of list updating given in [Portner \(2010\)](#), the change made to the list of options by an act of obliging or permitting is the same. Namely, the prejacent is simply appended to the list of options. The difference between these acts lies in the initial conditions of the list. Consider first a performative obligation (8o). The sentence will be true only if the prejacent is an obligation at t (8ob). However, prior to the utterance (at $t - 1$) it was not obliged. This prior state of the list we treat as a definedness condition on the use of a performative modal (8oa-ii).

- (8o) $\llbracket \text{must}_i \varphi \rrbracket^{g,S}(w_0)(t_0)$
- a. is defined only if
 - i. $\forall \langle w_1, t_1 \rangle \in \text{Acc}_{w_0, t_0-1}^{sp,g(i)} : \langle w_1, t_1 \rangle \in \text{dom}(\llbracket \varphi \rrbracket^{\text{Acc}_{w_0, t_0-1}^{sp,g(i)}}$
 - ii. $\neg \forall \langle w_2, t_2 \rangle \in \max_{\text{TDL}_{w_0, t_0-1}^{sp,g(i)}} (\text{Acc}_{w_0, t_0-1}^{sp,g(i)}) :$
 $\llbracket \varphi \rrbracket^{g, \text{Acc}_{w_0, t_0-1}^{sp,g(i)}}(w_2)(t_2) = 1$
 - b. if defined, = 1 iff
 $\forall \langle w_3, t_3 \rangle \in \max_{\text{TDL}_{w_0, t_0}^{sp,g(i)}} (\text{Acc}_{w_0, t_0}^{sp,g(i)}) : \llbracket \varphi \rrbracket^{g, \text{Acc}_{w_0, t_0}^{sp,g(i)}}(w_3)(t_3) = 1$
 - c. where $\text{TDL}_{w_0, t_0}^{sp,g(i)} = \text{TDL}_{w_0, t_0-1}^{sp,g(i)} \cup \{\lambda w_4. \lambda t_4. \llbracket \varphi \rrbracket(w_4)(t_4) = 1\}$

This sentence can only be defined and true if the list of options has changed in some way. Since the deontic authority has the ability to append the list of options, and since the deontic authority is the speaker, the hearer infers from the utterance that the list is being appended (or else the utterance would be either undefined or false). The way in which the list changes is by adding the prejacent as an option (8oc).

Crucially, it must not conflict with another option on the same issue (i.e., there must be no incompatible options on the list). To see why, consider (81).

(81) You must tidy your room.

This is only going to be defined and true if there was previously no option on the list which entailed the prejacent, or which entailed the negation of the prejacent. In a context in which the prejacent was already obliged, the sentence would not be defined. Instead, a reportative modal would be more appropriate.¹⁷ Whereas in a context in which the list of options at $t - 1$ features a proposition which entails the negation of the prejacent, the sentence would be defined but it would be false. The following list of options at $t - 1$ and t would be candidates for lists which would make (81) defined and true on the semantics given in (80), assuming t is the speech time.¹⁸

$$(82) \quad \begin{array}{l} \text{a. } \text{TDL}_{w,t-1}^{\alpha,\beta} = \left\{ \begin{array}{l} \{\langle w', t' \rangle \mid \neg \exists t'' \succ t' : \beta\text{-eat-cookie}(w')(t'')\} \\ \{\langle w', t' \rangle \mid \exists t'' \succ t' : \beta\text{-eat-cookie}(w')(t'')\} \end{array} \right\} \\ \text{b. } \text{TDL}_{w,t}^{\alpha,\beta} = \left\{ \begin{array}{l} \{\langle w', t' \rangle \mid \neg \exists t'' \succ t' : \beta\text{-eat-cookie}(w')(t'')\} \\ \{\langle w', t' \rangle \mid \exists t'' \succ t' : \beta\text{-eat-cookie}(w')(t'')\} \\ \{\langle w', t' \rangle \mid \exists t'' \succ t' : \beta\text{-tidy-room}(w')(t'')\} \end{array} \right\} \end{array}$$

At $t - 1$ some of the best worlds would be worlds in which the deontic patient did not tidy his room. However, after the update at t , there is only one option available to the deontic patient concerning the issue of tidying his room. As we saw before, this will mean that the deontic patient is obliged at t to tidy his room. Although this is only a very simple model, it gives a good idea of how list updating works in the case of obligation. Next consider the case of permission. To get a performative permission modal, all we need to do is swap out the universal quantifiers for existential quantifiers.

¹⁷Suppose the deontic authority says something like the following.

- (i) How many times do I have to I tell you? You must tidy your room!

In this case, we have to assume that, rather than the prejacent already being on the list of options, the deontic patient has failed to comply in adding it to the list. If so, then this is not an instance of adding the same proposition to the list twice. But rather it is a breakdown of authority. The deontic patient is not playing the game. The presuppositions proposed here are ones which assume that the deontic participants fulfil their roles.

¹⁸For now, we assume that the entries on the list are future oriented. Although we will not see why that is so until the next section.

- (83) $\llbracket \text{may}_i \varphi \rrbracket^s(w_0)(t_0)$
- a. is defined only if
 - i. $\forall \langle w_1, t_1 \rangle \in \text{Acc}_{w_0, t_0-1}^{sp, g(i)} : \langle w_1, t_1 \rangle \in \text{dom}(\llbracket \varphi \rrbracket^{\text{Acc}_{w_0, t_0-1}^{sp, g(i)}})$
 - ii. $\neg \exists \langle w_2, t_2 \rangle \in \max_{\text{TDL}_{w_0, t_0-1}^{sp, g(i)}} (\text{Acc}_{w_0, t_0-1}^{sp, g(i)}) :$
 $\llbracket \varphi \rrbracket^{g, \text{Acc}_{w_0, t_0-1}^{sp, g(i)}}(w_2)(t_2) = 1$
 - b. if defined, = 1 iff
 $\exists \langle w_3, t_3 \rangle \in \max_{\text{TDL}_{w_0, t_0}^{sp, g(i)}} (\text{Acc}_{w_0, t_0}^{sp, g(i)}) : \llbracket \varphi \rrbracket^{g, \text{Acc}_{w_0, t_0}^{sp, g(i)}}(w_3)(t_3) = 1$
 - c. where $\text{TDL}_{w_0, t_0}^{sp, g(i)} = \text{TDL}_{w_0, t_0-1}^{sp, g(i)} \cup \{\lambda w_4. \lambda t_4. \llbracket \varphi \rrbracket(w_4)(t_4) = 1\}$

Note that the change made to the list of options is the same. The difference lies in the initial state of the list of options at $t_0 - 1$. In this case, the sentence can be defined and true only if the list of options at $t_0 - 1$ features an option which entails the negation of the prejacent (and no option which entails the prejacent). That is, the prejacent must be prohibited according to the list of options at $t_0 - 1$. Once again, consider an example sentence.

- (84) You may eat a cookie.

Given the semantics in (83), a performative utterance of (84) at t could be both defined and true if the list of options were to undergo a change like that in (85).

- (85) a. $\text{TDL}_{w, t-1}^{\alpha, \beta} = \left\{ \begin{array}{l} \{\langle w', t' \rangle \mid \neg \exists t'' \succ t' : \beta\text{-eat-cookie}(w')(t'')\} \\ \{\langle w', t' \rangle \mid \exists t'' \succ t' : \beta\text{-tidy-room}(w')(t'')\} \end{array} \right\}$
- b. $\text{TDL}_{w, t}^{\alpha, \beta} = \left\{ \begin{array}{l} \{\langle w', t' \rangle \mid \neg \exists t'' \succ t' : \beta\text{-eat-cookie}(w')(t'')\} \\ \{\langle w', t' \rangle \mid \exists t'' \succ t' : \beta\text{-eat-cookie}(w')(t'')\} \\ \{\langle w', t' \rangle \mid \exists t'' \succ t' : \beta\text{-tidy-room}(w')(t'')\} \end{array} \right\}$

These facts hang together neatly. A permission sentence presupposes prior prohibition, asserts permission, and can only be defined and true if the prejacent is added as an option.¹⁹ This system of list-updating is already quite restrictive. However,

¹⁹Another potential way the list might change in such a way as to render a permission sentence defined and true, is by deletion as opposed to appendment. In permitting the option φ , we could delete the prohibition which forbids φ from the list of options. Precisely this sort of suggestion is considered in Lewis (1979). There, Lewis (1979) shows that this suggestion runs into numerous problems. The *To Do List* account avoids these problems.

there are a number of ways in which a list might be changed which, although logically consistent with this system, are nonetheless unreasonable in practice. We will end up proposing two further restrictions; one in the following section, and one in Chapter 4. Both of these restrictions can be seen as consequences of a rule governing performative exchanges originally given by Lewis (1979). The constraint proposed in the following section, *Reasonableness*, ends up deriving Ninan's observation in a natural and intuitive way which is similar in rationale to the informal account offered by Ninan (2005) himself.

2.3.3.2 Reasonableness

We have seen that the list of options can be modified from one time to the next via appendment. Indeed, this is precisely the function of performative deontic sentences. The result of such an appendment is that the best worlds determined by that list of options also changes. But, there are many ways in which the best worlds might change from $t - 1$ to t which are logically possible but nonetheless completely unreasonable in practice. In this section, we will propose a constraint on how the best worlds change from one time to the next which will ensure that any update is practically reasonable. The main notion of *Reasonableness* that we propose is based on a rule of Lewis's (1979) famous language game.

“The Slave [deontic patient] tries to see to it that the actual world is within the sphere of permissibility [\approx the best worlds] at all times.”

(Lewis, 1979, p.22)

This rule is formulated as a requirement on the actions of the deontic patient. However, we are concerned with the linguistic acts of obliging and permitting, not the actions of the deontic patient *per se*. So we might reasonably ask whether this rule has any consequences for the deontic authority and the types of obligations or permissions she could issue. Indeed, we will suggest that when the deontic authority imposes obligations and grants permissions, she must ensure that it is at least possible for the deontic patient to keep the actual world among the best worlds. More specifically: the deontic authority does not modify the best worlds in a way that renders it impossible for the deontic patient to keep the actual world within the best worlds at all times. Formulated as such, this rule has a number of consequences. Firstly, it could be argued to provide an explanation the infelicity of the following obligations and permissions (Farkas, 1988; Jackendoff and Culicover, 2003).

- (86) a. # You must be tall!
 b. # You may resemble your father.

The infelicity of the obligation in (86a) could be attributed to the fact that, no matter how hard the deontic patient tries, the truth of the prejacent is outside of his control. Whether the actual world ends up among the best worlds cannot be influenced by the deontic patient, and thus the deontic authority is imposing an infelicitous obligation. Note that the story for (86b) is a little more complicated. Since the deontic patient is not obliged to resemble his father, it could be argued that the actual world may still end up among the best worlds provided the deontic patient fulfils his other obligations. Recall from our semantics, however, that in order for a permission sentence to be defined, prior prohibition is presupposed. The presupposition of (86b), therefore, is that the deontic patient was prohibited from resembling his father. Once again, whether the actual world is among the best worlds prior to the utterance could not have been influenced by the deontic patient, and thus the deontic authority is presupposing an infelicitous prohibition.²⁰

Another consequence which follows from our version of Lewis's rule is, what we will call, the principle of *Reasonableness* which we formulate below. Now, in order to see what kind of principle we need, it is worth first reiterating that, by definition, the deontic authority α and the deontic patient β mutually believe that the actual world is among the accessible worlds *Acc*. However, assuming the β is obedient, as implied by Lewis's rule, they will also mutually believe that the actual world is among the best worlds at any given time. However, they do not know which of these worlds the actual world is. Now in order for α to be reasonable she must not change the list of options in such a way that it is impossible for β to keep the actual world among the best worlds, or else α would be making it impossible for β to be a compliant deontic patient, undermining the whole enterprise. So, we might say that for the deontic authority α to be reasonable, every best world at $t - 1$ must have some way to become a best world at t .

The next question, then, is how to capture the notion of each best worlds at $t - 1$ having "some way to become" a best world at t . To help us here, let us appeal to the historical accessibility relation discussed in Chapter 1. Recall that the historical alternatives of a world w at time t are those worlds which are identical with w up until

²⁰We do not try to formalize these intuitions here as it would be orthogonal to the purposes of this thesis.

t , but may differ from w after t . We might say then, that the historical alternatives of a world at a time are all ways that the world may end up at a later time. With that in mind, let us propose the following formalization of the notion that every best world at $t - 1$ has some way to become a best world at t .

(87) *Reasonableness:*

$$\begin{aligned} &\text{For any } \alpha, \beta, w, t : \mathcal{R}_{w,t}(\alpha, \beta) \Leftrightarrow \\ &\forall \langle w', t' \rangle \in \max_{\text{TDL}_{w,t-1}^{\alpha,\beta}} (\text{Acc}_{w,t-1}^{\alpha,\beta}) : \\ &\quad \exists \langle w'', t'' \rangle \in \text{Hist}_{w',t'} : \langle w'', t'' \rangle \in \max_{\text{TDL}_{w,t}^{\alpha,\beta}} (\text{Acc}_{w,t}^{\alpha,\beta}) \end{aligned}$$

This says that for any deontic authority, deontic patient, world, and time, the deontic authority is reasonable to the deontic patient in that world at that time, $\mathcal{R}_{w,t}(\alpha, \beta)$, iff every best world (-time pair) at $t - 1$ has at least one historical alternative which is a best world at t . This will ensure that whichever world among the best at $t - 1$ is the actual world, it will have some way to become a best world at t . If this condition were violated, it may not be possible for β to keep the actual world among the best worlds after the list of options has been updated.

Now let us see what effect this condition has on prejacent with different temporal properties. Assume the denotation for the perfect given in [Pancheva and von Stechow \(2004\)](#).

$$(88) \quad \llbracket \text{have}_{\text{perfect}} \rrbracket = \lambda P_{\langle i,t \rangle} . \lambda t . \exists t' \preceq t : P(t')$$

With this in mind, consider why the perfect cannot be embedded in the complement of a performative deontic modal with a past oriented reading. Take the following sentences as our test cases.

- (89) a. * You must have tidied your room yesterday.
 b. * You may have eaten a cookie yesterday.

When we put together everything that has been said above, the semantics we arrive at for (89a) is given in (90).

- (90) $\llbracket \text{You must have tidied your room yesterday} \rrbracket^s(w_0)(t_0)$
 a. is defined only if
 i. $\neg \forall \langle w_1, t_1 \rangle \in \max_{\text{TDL}_{w_0,t_0-1}^{sp,h}} (\text{Acc}_{w_0,t_0-1}^{sp,h}) :$
 $\quad \exists t_2 \preceq t_1 : t_2 \subseteq \text{yesterday} \wedge \text{tidy-room}(h)(w_1)(t_2)$
 ii. and $\mathcal{R}_{w_0,t_0}(sp, h)$

- b. if defined, = 1 iff $\forall \langle w_2, t_3 \rangle \in \max_{\text{TDL}_{w_0, t_0}^{sp, h}} (\text{Acc}_{w_0, t_0}^{sp, h}) :$
 $\exists t_4 \preceq t_3 : t_4 \subseteq \text{yesterday} \wedge \text{tidy-room}(h)(w_2)(t_4)$

These truth conditions do not make it immediately clear where the trouble lies. So it is worth taking a minute to walk through how *Reasonableness* rules out such a situation. Firstly, the performative presupposition requires that not all the best worlds at $t - 1$ are worlds in which the hearer tidied his room yesterday (it was not obliged prior to the utterance time), while the truth conditions require that every best world at t must be a world in which he did tidy his room yesterday. If we stop here, there is logically no problem with this obligation. Perhaps to get the best worlds at t , we just discard the worlds in which the room was not tidied yesterday. But what if it turns out that, in the actual world, the deontic patient didn't tidy his room yesterday? After all he wasn't obliged to. In this case, we would be discarding the actual world. It would not be possible for the deontic patient to keep the actual world among the best t . More formally, suppose we take a best world at $t - 1$ in which the deontic patient did not tidy his room yesterday, w_j . All the historical alternatives of w_j will also be worlds in which the deontic patient did not tidy his room yesterday since these worlds are identical to w_j at every time up to and including t , and thus none of them can be a best world at t . So w_j proves an exception to the presupposition of *Reasonableness*, and the sentence cannot be defined. Crucially, this is a systematic issue which arises whenever the prejacent is either past oriented or simultaneous.

The case of a performative permission will be more or less the same.

(91) $\llbracket \text{You may have eaten a cookie yesterday} \rrbracket^s(w_0)(t_0)$

a. is defined only if

- i. $\neg \exists \langle w_1, t_1 \rangle \in \max_{\text{TDL}_{w_0, t_0-1}^{sp, h}} (\text{Acc}_{w_0, t_0-1}^{sp, h}) :$
 $\exists t_2 \preceq t_1 : t_2 \subseteq \text{yesterday} \wedge \text{eat-cookie}(h)(w_1)(t_2)$

ii. and $\mathcal{R}_{w_0, t_0}(sp, h)$

- b. if defined, = 1 iff $\exists \langle w_2, t_3 \rangle \in \max_{\text{TDL}_{w_0, t_0}^{sp, h}} (\text{Acc}_{w_0, t_0}^{sp, h}) :$
 $\exists t_4 \preceq t_3 : t_4 \subseteq \text{yesterday} \wedge \text{eat-cookie}(h)(w_2)(t_4)$

Prior to the utterance time, the prejacent was prohibited; none of the worlds in the best worlds at $t_0 - 1$ are worlds in which the hearer ate a cookie yesterday. Obviously, this means that none of the best worlds at $t_0 - 1$ can become worlds in which the hearer did eat a cookie yesterday. Thus, a performative past-oriented permission is ruled out by *Reasonableness* in much the same way as a past-oriented obligation.

What is crucial to note, of course, is that none of these problems arise when the prejacent is future oriented. Let us go through the reasoning with a permission sentence.

- (92) $\llbracket \text{You may FUT eat a cookie tomorrow} \rrbracket^s(w_0)(t_0)$
- a. is defined only if
 - i. $\forall \langle w_1, t_1 \rangle \in \text{Acc}_{w_0, t_0-1}^{sp, h} :$
 $\langle w_1, t_1 \rangle \in \text{dom}(\llbracket \text{FUT you eat a cookie tomorrow} \rrbracket^{\text{Acc}_{w_0, t_0-1}^{sp, h}})$
 - ii. $\neg \exists \langle w_2, t_2 \rangle \in \max_{\text{TDL}_{w_0, t_0-1}^{sp, h}} (\text{Acc}_{w_0, t_0-1}^{sp, h}) :$
 $\exists t_3 \succ t_2 : t_3 \subseteq \text{tomorrow} \wedge \text{eat-cookie}(h)(w_2)(t_3)$
 - iii. and $\mathcal{R}_{w_0, t_0}(sp, h)$
 - b. if defined, = 1 iff $\exists \langle w_3, t_4 \rangle \in \max_{\text{TDL}_{w_0, t_0}^{sp, h}} (\text{Acc}_{w_0, t_0}^{sp, h}) :$
 $\exists t_5 \succ t_4 : t_5 \subseteq \text{tomorrow} \wedge \text{eat-cookie}(h)(w_3)(t_5)$

Here, there are no best worlds at $t_0 - 1$ in which the hearer eats a cookie tomorrow. However, when we take one of the best worlds, it will have a historical alternative in which the hearer does eat a cookie tomorrow. This alternative was not among the best worlds at $t_0 - 1$, as it was not an option available to the hearer at that time. We could imagine it as a path from one of the best worlds at $t_0 - 1$ which was closed off. Now, in order to make the assertion true, the best worlds at t_0 have been expanded to include this alternative. The option is added, and as a result this path opens up to the deontic patient. Future oriented permissions, then, adhere to *Reasonableness*. Indeed, future oriented prejacent are the only sort of prejacent that can satisfy the performative presupposition, the truth conditions, and *Reasonableness*.

Lastly, note that a future oriented performative obligation may be amenable to a simpler explanation. Consider (93).

- (93) You must tidy your room tomorrow.

The presupposition of (93) requires that there are some best worlds at $t - 1$ in which the hearer does not tidy his room tomorrow. In order to make the assertion true, we can simply discard those worlds. As a result, all the remaining best worlds at t will be worlds in which the hearer does tidy his room tomorrow. In essence, obligation need not involve more than simply contracting the set of best worlds. An important consequence of *Reasonableness* is that we can contract (or expand) the set of best worlds forwards (i.e., with respect to future oriented propositions), but

we cannot contract (or expand) the set of best worlds backwards (i.e., with respect to past oriented or simultaneous propositions). In summary, we have seen that the formalization of *Reasonableness* given above can be used to accurately constrain the temporal orientation of performative modals. Since the historical alternatives of a world w are those worlds which share a past and present with w , and since the actual world is taken to be historical in nature, the only way of ensuring that the actual world is among the best at any given time, is by working under the assumption that the deontic authority is reasonable in the sense that the every best world at $t - 1$ has some way to become a best world at t . This proposal differs from a previous proposal which I made in Williamson (2019). There, I suggested that in order for a performative deontic sentence to be defined, the prejacent must be historically unsettled. That suggestion makes different predictions to the one suggested here. However, these differences are not relevant for Ninan's data. In Chapter 4, we will see some reasons to prefer the present formalisation of *Reasonableness*, as opposed to the one given in Williamson (2019).

Finally, what we have said in this section will play an important role in Chapter 3 section 3.6, as well as Chapter 4. In Chapter 4, we will introduce another principle called *Compliance*, which we argue is also closely connected to Lewis's (1979) rule. This rule of *Compliance* will be shown to interact with the performative presupposition in such a way as to derive the (un)availability of past-in-future readings of perfect *have* when it co-occurs with *FUT* in prejacent to performative modals.

2.3.4 The semantics of reportative deontic modals

Recall that reportative deontics, such as those in (94) are temporally free, allowing future oriented prejacent, simultaneous prejacent, and past oriented prejacent with the perfect marker *have*.²¹

- (94) a. Bobby is obliged to tidy his room.
 b. Bobby is allowed to eat a cookie.
 c. Bobby should tidy his room.

On almost every semantics proposed for reportative deontics, they should be able to license *FUT*. What is perhaps more difficult to account for is how they also license

²¹They are, however, subject to general constraints such as the ban on simultaneous eventive predicates Giorgi and Pianesi (1997)

non-future oriented prejacent. Unfortunately, we do not develop a complete account here, we will address a number of problems for both the traditional accounts which treat the modal base of deontics as totally realistic or historical, as well as *TDL* based accounts which treat the modal base as derived in some way from the common ground.

The first thing to note is that when reportative deontics embed a past oriented or simultaneous prejacent, the prejacent can be construed as counterfactual, or as true.

- (95) a. Bobby is obliged to have tidied his room, so it's {good that he did/bad that he didn't}.
- b. Bobby is allowed have eaten a cookie, so it's {fine that he did/a shame that he didn't}.
- c. Bobby should have tidied his room, so it's {good that he did/bad that he didn't}
- (96) a. Bobby is obliged to be at school, so it's {good that he is/bad that he isn't}.
- b. Bobby is allowed to be here, so {let him stay/go get him}.
- c. Bobby should be at school, so it's {good that he is/bad that he isn't}

In all of these examples, then, the modal base must include some counterfactual worlds. According to accounts which posit a totally realistic modal base, we could say that the temporal perspective of these modals is in the past, much like *Condoravdi's* (2002) proposal for metaphysical modals. Notice, however, that we cannot adopt such an account wholesale. Specifically, there is no perfect marker *have* to scope over the modals in (96), and we might feel uncomfortable suggesting that *have* is scoping outside of its clause in (95). We could potentially say that *should* is really within the scope of a past tense, and the past participles *obliged* and *allowed* in (96) also involve some past shifting despite the present tense on the copula.

However, what about the *TDL* account? The traditional account ties the obligatory future orientation of performative deontics to the nature of the modal base, while the *TDL* account ties it to the ordering source and how it is updated. The *TDL* can only be updated with future oriented prejacent, and if the temporal perspective of the modal is now, we shouldn't expect simultaneous or past oriented prejacent. We could propose a similar approach to that discussed above. These

sentences involve some explicit or implicit past shifting which anchors the *TDL* to an earlier time. As for the modal base, suppose the accessible worlds determined by the common ground of the deontic patient and deontic authority entail the falsity of the prejacent. We could propose then that the modal base of reportative deontics is equivalent to the mutually accessible worlds minimally expanded to include those worlds which are maximally similar to the accessible worlds and for which the prejacent is true.

I think that these stories are reasonable accounts for *be obliged* and *be allowed*. However, there is another possible explanation for *be allowed* on the *TDL* account. Recall that a performative permission updates a *TDL*, changing a prohibition into a permission, through the addition of a new option made available to the deontic patient. A reportative permission may involve no such update. As long as the *TDL* of a deontic patient β contains neither p nor $\neg p$ (or something which entails p or $\neg p$), the *TDL* will nonetheless determine that β is permitted to realize p . In this case, we do not expect any update of the *TDL*, nor do we expect *Reasonableness* to be presupposed. As such, the *TDL* may be anchored to the speech time (i.e., have a present perspective). However, once again, the modal base may have to be expanded beyond the mutually accessible worlds, depending on whether the prejacent is known to be true or false.

Next, consider reportative *should*. Following von Fintel and Iatridou (2008) and Rubinstein (2012), the modal *should* involves the promotion of an additional ordering source which, unlike the *TDL*, need not be restricted to future oriented prejacent. On the *TDL* account, we can say that the best worlds are partially determined by the *TDL* and partially by the additional propositions which further restrict the best worlds. What an individual is permitted to do according to his *TDL*, he is recommended to do when additional considerations are taken into account.

Interestingly, it appears that the temporal perspective of the secondary ordering source need not be anchored to the same time as the temporal perspective of the modal base and the primary ordering source. Consider the following sentence.

- (97) SCENARIO: *Bobby was not required to clean his room, so he didn't. Later that day, Alice slipped on one of his toys and fell over, breaking her leg.*
- a. (Given what we know now) Bobby should have tidied his room.

Here, the modal base involves counterfactual worlds, since we know that Bobby did not tidy his room. So on the traditional accounts, the temporal perspective of the

modal base is past. However, the ordering source is arguably anchored to the speech time, since it is only given current considerations that tidying his room proved to be better than not tidying it. However, we could potentially say that the ordering source is also anchored to an earlier time, but that we are including in that ordering source propositions concerning future states of affairs which were entirely unknowable at the time (see [Portner 2009](#) for some discussion of these data).

As is clear from the above discussion, reportative deontics require something more to be said about how the modal base is determined. This is true of the traditional account, which would have to shift the temporal perspective of the historical modal base into the past (even in cases where the perfect cannot be taking scope over the modal), as well as the *TDL* account, which would have to say something about how the common ground is expanded as well as how the ordering source is determined.

However, we mentioned earlier that there is at least one reason to prefer building our semantics on a modal base which is not totally realistic. Consider the following sentences with a performative deontic necessity modal embedding a past-in-future reading of the perfect.

- (98) SCENARIO: *Alice calls her son, Bobby, from work. She does not know whether Bobby has tidied his room. She says*
- a. You must have tidied your room before I get home.

In this context, Alice is unaware of the state of Bobby's room. There is a possibility he has tidied it, but he was not obliged to. By uttering this sentence she is placing him under a sort of conditional obligation. If he has tidied his room, then the actual world is already among the best worlds. However, if he has not tidied his room, then he must do so. So while we have seen extensive evidence that a deontic authority cannot oblige a deontic patient to undertake an action in the past, it appears she can oblige him to undertake some action within a time period which extends into the past, so long as it also extends in to the future. This is consistent with *Reasonableness* since the deontic patient has the ability to keep the actual world among the best worlds if it is not already. Consider, however, if the modal base was totally realistic. In this case, such a sentence should be infelicitous if the patient has already tidied his room, regardless of whether the authority is aware of this or not (!). This is because every world in the modal base would be one in which the prejacent is already true. The only context, then, in which this should be felicitous is one in which the deontic

authority already knows the obligation has not been satisfied. But this does not quite correspond to our intuitions here. I take this to be potential evidence that we want the modal base to consist of more than just the historical alternatives of the actual world at the speech time. In Chapter 4, we discuss performative deontic sentences of this sort in great detail.

2.4 Conclusion

This chapter has shown how the compositional semantics for *FUT*, proposed in the introduction, interacts with modal (auxiliary) verbs. We have shown how the contingency presupposition of *FUT* interacts with modal operators in such a way as to rule out future oriented prejacent to certain modals, while permitting them with others. We have also attempted to formalize an account of the future orientation of deontic modals which builds on Portner (2004, 2007, 2010) and Ninan (2005).

Chapter 3

Attitude Predicates and Infinitives

3.1 Introduction

In this chapter, we extend our investigations to attitude predicates which select infinitival complements. We saw in the previous section how only certain modal auxiliaries were able to license reference to contingent future events. In this section, we will suggest that since infinitival complements are unable to license modal auxiliaries (Stowell, 2004; Iatridou and Zeijlstra, 2013), the semantics of the selecting verb itself will be responsible for the licensing of *FUT*.¹ Certain verbs will be unable to embed *FUT* either as a result of their at-issue content or their presupposition. We will see that attitude verbs which have been proposed to have a semantics akin to those modal auxiliaries which are able to embed *FUT* are likewise able to embed *FUT*. And in much the same way as performative modal auxiliaries necessitated *FUT* in their prejacent, attitude predicates which encode transfer of obligation or permission are also necessarily future oriented. The resulting picture is that the distribution of future orientation in infinitival complements is dictated by the modal force and flavor of the embedding verb in much the same way as we have seen for modal auxiliaries.

¹It should be noted that there are certain infinitives which always receive a modal interpretation, while nonetheless lacking an overt modal element (see for instance Bhatt 2006; Hackl and Nissenbaum 2012; White 2014). I find it unlikely that these instances of covert modality are due to covert modal auxiliaries. More plausibly, they are the result of some other conditioning factor.

The chapter proceeds as follows. Firstly, we outline three classes of infinitive selecting predicates; simultaneous predicates, future oriented predicates, and optionally future oriented predicates. Then in section 3.3, we provide a Kratzerian semantics for attitude predicates akin to the modal semantics adopted for auxiliaries in the previous chapter. In sections 3.4-3.6, we show how we derive the three classes of infinitive embedding predicates. Next, section 3.7 shows a small number of potential counter examples. In section 3.8 we defend our assumption that futurity is introduced by a covert temporal operator *FUT* as opposed to the embedding verb. Finally, in section 3.9, we take a brief look at future oriented finite complements which don't feature a modal auxiliary. These data are compatible with the present account but problematic for accounts which propose a covert *woll* in future oriented infinitives.

3.2 The temporal orientation of infinitives

Infinitival complements to attitude predicates fall into three possible types based on their temporal orientation.² There are those which have an obligatorily simultaneous reading, where the time of the eventuality in the embedded clause is understood to overlap with that of the matrix clause (99a). There are those which are obligatorily future oriented, where the embedded eventuality is understood to follow that of the matrix clause (99b). And finally, there are those which have an optionally future oriented reading, where the time of the eventuality in the embedded clause is usually understood to follow that of the matrix clause, but under certain conditions they may also be understood to overlap (99c).³

- (99) a. Alice {believed Bobby/claimed/was glad/pretended} to be at the party.
 b. Bobby {promised/asked/ordered Charlie} to be at the party.

²Infinitives are also found in adverbial clauses and as complements to predicates which are not attitude predicates (e.g., aspectual verbs, implicative verbs, and evaluative predicates). We will have nothing to say about these types of infinitives. This chapter serves to show that the theory of *FUT* developed above extends straightforwardly to infinitival complements to attitude predicates. I believe it should also extend to other types of infinitives. However, for reasons of space, I leave such an investigation to future research.

³The simultaneous reading of (99c) requires a very specific context and is hard access out-of-the-blue for reasons discussed later. See also Williamson (2017) for lengthy discussion of when this reading is available.

- c. Charlie {hoped/expected/wanted} to be at the party.

Abusch (2004) observed this trifurcation for passive ECM constructions of the form *x is V-ed to P*. She called the verbs in each class: B-verbs, F-verbs, and P-verbs respectively (the following judgments reflect Abusch’s classification).⁴

- (100) a. Alice is believed to be at the party ({already/*tomorrow}).
 b. Bobby is forecast to be at the party ({tomorrow/*already}).
 c. Charlie is predicted to be at the party ({tomorrow/already}).

Yet, despite insights such as those of Katz (2001), Abusch (2004), von Stechow (2005), Wurmbrand (2014), and others, Portner (2018) notes that work on the temporal orientation of infinitives is still fragmentary. Additionally, the majority of work on infinitival tense is primarily concerned with the status of the infinitival subject (i.e., PRO, trace, or ECM subject), with only secondary interest in temporality (e.g., Stowell, 1982; Pesetsky, 1992; Landau, 2000; Martin, 2001; Grano, 2015a; Pearson, 2016). In this chapter, we will mostly put the question of the infinitival subject aside and focus primarily on addressing the data in (99) and (100).

3.3 A Kratzerian semantics for attitude predicates

Since Hintikka (1969) the verb *believe* is generally assumed to be a universal quantifier over doxastically accessible worlds (those worlds compatible the attitude holder’s beliefs). In our semantics, it will quantify over world-time pairs which are candidates for the actual world and the actual time, NOW, given what the attitude holder believes.

$$(101) \quad \llbracket \text{believe } \varphi \rrbracket (\alpha)(w_0)(t_0) = 1 \text{ iff } \forall \langle w_1, t_1 \rangle \in \text{Dox}_{w_0, t_0}^\alpha : \llbracket \varphi \rrbracket (w_1)(t_1) = 1$$

However, if we treat bouletic predicates like *want* in a similar manner, we predict that they should exhibit similar entailment patterns to *believe* (Stalnaker, 1984;

⁴Abusch called F-verbs as such because she took the predicate *forecast* to typify these verbs. However, for most people, *forecast* seems to behave much like *predict* in also permitting simultaneous readings.

- (i) A: What is the weather like outside?
 B: It is forecast to be raining.

Heim, 1992).

- (102) a. I believe Alice will get better.
 \Rightarrow I believe Alice is sick.
 b. I want Alice to get better.
 $\not\Rightarrow$ I want Alice to be sick.⁵

To account for this difference in behavior, Heim adopts an ordering semantics for bouletic predicates such as *want* and *hope*. She proposes that bouletic predicates rank belief worlds according to the attitude holder's desires. We can say that a world w' is closer to the ideal than w'' if it makes more of the attitude holders desires true (103a). She then generalizes this notion to an ordering between sets of worlds (103b).

- (103) a. $\langle w', t' \rangle <_{\text{DES}_{w,t}^\alpha} \langle w'', t'' \rangle$ iff
 $\{p \in \text{DES}_{w,t}^\alpha \mid \langle w'', t'' \rangle \in p\} \subset \{p \in \text{DES}_{w,t}^\alpha \mid \langle w', t' \rangle \in p\}$
 b. $p <_{\text{DES}_{w,t}^\alpha} q$ iff $\forall \langle w', t' \rangle \in p, \langle w'', t'' \rangle \in q : \langle w', t' \rangle <_{\text{DES}_{w,t}^\alpha} \langle w'', t'' \rangle$

Based on this, Heim proposes a semantics for a bouletic predicate such as *hope* which is roughly as follows.⁵

- (104) $\llbracket \text{hope}_{\text{Heim}} \varphi \rrbracket (\alpha)(w_0)(t_0)$
 a. is defined only if $\exists \langle w_1, t_1 \rangle \in \text{Dox}_{w_0, t_0}^\alpha : \llbracket \varphi \rrbracket (w_1)(t_1) = 1$
 $\wedge \exists \langle w_2, t_2 \rangle \in \text{Dox}_{w_0, t_0}^\alpha : \llbracket \varphi \rrbracket (w_2)(t_2) = 0$
 b. if defined, = 1 iff
 $\forall \langle w_3, t_3 \rangle \in \text{Dox}_{w_0, t_0}^\alpha :$
 $\text{Sim}_{w_3, t_3}(\text{Dox}_{w_0, t_0}^\alpha \cap \llbracket \varphi \rrbracket) <_{\text{DES}_{w_0, t_0}^\alpha} \text{Sim}_{w_3, t_3}(\text{Dox}_{w_0, t_0}^\alpha - \llbracket \varphi \rrbracket)$
 c. where $\text{Sim}_{w,t}(p) =$
 $\{\langle w', t' \rangle \in p \mid t' = t \wedge w' \text{ resembles } w \text{ no less than any other } w'' \in p\}$

According to Heim's semantics, *hope* φ will be true iff the attitude holder believes that the most similar worlds compatible with her beliefs for which φ is true are more desirable than the most similar worlds compatible with her beliefs for which φ is not true. This type of approach to bouletic predicates has been very popular and

⁵Heim's semantics is couched in a dynamic *context change* semantics. For consistency, we have translated this into a static semantics in (104). Moreover, Heim does not include quantification over times.

has been adopted in one form or another by numerous authors (e.g., Villalta, 2008; Anand and Hacquard, 2013, a.m.o).

Another approach to bouletic predicates is that of von Fintel (1999). Instead of comparing the doxastic alternatives in which φ is true with those in which φ is false, von Fintel suggest picking out the subset of the doxastic alternatives which are maximally desirable.

$$(105) \quad \max_{\text{DES}_{w,t}^\alpha} (\text{Dox}_{w,t}^\alpha) = \{ \langle w', t' \rangle \in \text{Dox}_{w,t}^\alpha \mid \neg \exists \langle w'', t'' \rangle \in \text{Dox}_{w,t}^\alpha : \langle w'', t'' \rangle <_{\text{DES}_{w,t}^\alpha} \langle w', t' \rangle \}$$

A predicate like *hope*, universally quantifies over these alternatives. On this account, the truth conditions for *hope* φ are met iff all the maximally desirable doxastic alternatives are φ worlds.

$$(106) \quad \llbracket \text{hope}_{\text{von Fintel}} \varphi \rrbracket (\alpha)(w_0)(t_0)$$

- a. is defined only if $\exists \langle w_1, t_1 \rangle \in \text{Dox}_{w_0, t_0}^\alpha : \llbracket \varphi \rrbracket (w_1)(t_1) = 1$
 $\wedge \exists \langle w_2, t_2 \rangle \in \text{Dox}_{w_0, t_0}^\alpha : \llbracket \varphi \rrbracket (w_2)(t_2) = 0$
- b. if defined, = 1 iff $\forall \langle w_3, t_3 \rangle \in \max_{\text{DES}_{w_0, t_0}^\alpha} (\text{Dox}_{w_0, t_0}^\alpha) : \llbracket \varphi \rrbracket (w_3)(t_3) = 1$

On this semantics, *hope* φ presupposes that the attitude holder is uncertain whether φ , thereby avoiding the undesirable Stalnaker/Heim inferences in (102b), it also asserts that φ is true in all the most desirable belief worlds.

Given that we have attitude predicates such as *believe* on the one hand which do not appear to have an ordering source, and therefore do not have a diversity presupposition, and we have predicates such as *hope* on the other which do seem to require an ordering semantics and a diversity presupposition, it might already be clear what our predictions will be with respect to embedding *FUT*. In the following two sections, we will show how this type of semantics correctly accounts for the embedding of *FUT* under obligatorily simultaneous and optionally future oriented predicates. Then, in section 3.6, we cover obligatorily future oriented predicates.

3.4 Simultaneous predicates

Recall that the following predicates are unable to embed a future oriented infinitive (where *be glad* is representative of the entire class of emotive factives).

$$(107) \quad \text{Alice} \left\{ \begin{array}{l} \text{believed Bobby} \\ \text{claimed} \\ \text{was glad} \\ \text{pretended} \end{array} \right\} \text{to} \left\{ \begin{array}{l} \text{be a doctor} \\ \text{*win the match tomorrow} \end{array} \right\}$$

There are also numerous simultaneous infinitive embedding verbs which are typically (or always) used in their passive form when embedding infinitives.

$$(108) \quad \text{* Alice was} \left\{ \begin{array}{l} \text{known} \\ \text{thought} \\ \text{reported} \\ \text{declared} \end{array} \right\} \text{to} \left\{ \begin{array}{l} \text{be a doctor} \\ \text{*win the match tomorrow} \end{array} \right\}$$

The story we provide for these are more or less the same. The majority of these predicates, such as *believe*, do not involve an ordering semantics, and involve universal quantification over a modal base. The emotive factives, such as *be glad*, do involve an ordering semantics. However, they also involve a presupposition which is identical to the assertive content of *believe*.

3.4.1 *Believe*

On a standard Hintikkan semantics for *believe*, its denotation functions as a universal quantifier over the doxastic alternatives of the agent. To this semantics, we add the shifting modal context adopted in Chapter 1. In (109), the modal context against which the attitude predicate's complement is interpreted is shifted to the modal base of the embedding operator.

$$(109) \quad \llbracket \text{believe } \varphi \rrbracket^s(\alpha)(w_0)(t_0) = 1 \text{ iff} \\ \forall \langle w_1, t_1 \rangle \in \text{Dox}_{w_0, t_0}^\alpha : \llbracket \varphi \rrbracket^{\text{Dox}_{w_0, t_0}^\alpha}(w_1)(t_1) = 1$$

Now, if *believe* has a complement of the form *FUT* φ , then the presupposition of the future operator contradicts the assertion.

$$(110) \quad \llbracket \text{believe FUT } \varphi \rrbracket^s(\alpha)(w_0)(t_0) \\ \text{a. is defined only if} \\ \exists \langle w_1, t_1 \rangle \in \text{Dox}_{w_0, t_0}^\alpha : \exists t_2 \succ t_1 : \llbracket \varphi \rrbracket^{\text{Dox}_{w_0, t_0}^\alpha}(w_1)(t_2) = 1 \\ \wedge \exists \langle w_2, t_3 \rangle \in \text{Dox}_{w_0, t_0}^\alpha : \neg \exists t_4 \succ t_3 : \llbracket \varphi \rrbracket^{\text{Dox}_{w_0, t_0}^\alpha}(w_2)(t_4) = 1 \\ \text{b. if defined,} = 1 \text{ iff} \\ \forall \langle w_3, t_5 \rangle \in \text{Dox}_{w_0, t_0}^\alpha : \exists t_6 \succ t_5 : \llbracket \varphi \rrbracket^{\text{Dox}_{w_0, t_0}^\alpha}(w_3)(t_6) = 1$$

As mentioned in Chapter 1 section 1.6.1, this sort of systematic contradiction has been argued to result in ungrammaticality.⁶ A similar story to *believe* can be told for *be thought* and *be known*, with the latter universally quantifying over an epistemic modal base.

3.4.2 Claim

Anand and Hacquard (2009) give an event semantics for *claim* φ , according to which *claim* is taken to consist of an asserting event, with the goal of updating the common ground with φ . In this case, the context set (i.e., the worlds compatible with the common ground) in the subject's goal worlds will entail the complement of the verb *claim*. Putting aside the event semantics, we might propose something along the lines of (111).

- (111) $\llbracket \text{claim } \varphi \rrbracket^s(\alpha)(w_0)(t_0) = 1$ iff
- a. $\llbracket \text{say } \varphi \rrbracket(\alpha)(w_0)(t_0) = 1$
 - b. $\forall \langle w_1, t_1 \rangle \in \text{Goals}_{w_0, t_0}^\alpha : \forall \langle w_2, t_2 \rangle \in \text{cs}_{w_1, t_1} : \llbracket \varphi \rrbracket^{\text{cs}_{w_1, t_1}}(w_2)(t_2) = 1$

If the infinitival complement of *claim* in (111) is of the form *FUT* φ , then the presupposition would be such that the context set (cs) in α 's goal worlds is diverse with respect to *FUT* φ . The second conjunct of the assertion, however, would require that cs in α 's goal worlds is uniform with respect to *FUT* φ .

3.4.3 Be glad and emotive factives

The emotive factive *be glad* has a preference semantics, and so should have a diversity condition on its modal base. However, *be glad* also presupposes belief (Schlenker, 2003b). That is, α is glad that φ presupposes α believes that φ . This presupposition can be seen to project in entailment cancelling environments (e.g., the *family-of-sentences* paradigm (Chierchia and McConnell-Ginet, 1990; Tonhauser et al., 2013)).

- (112) a. Alice is not glad that she's here.

⁶Patrick Elliot (pc) wonders whether the presupposition of *FUT* will need to project out of attitude contexts so that we do not make the weaker prediction that the attitude holder simply has an inconsistent belief. This is not necessary here because of the manner in which the presupposition of *FUT* is stated. Specifically, it makes no reference to the world of evaluation, but rather makes reference to a local modal context.

- b. If Alice is glad that she's here, she'll tell us.
- c. Alice might be glad that she's here.
- d. Is Alice glad that she's here?
 \rightsquigarrow Alice believes she is here.

It is important to note that the factivity of *be glad* (and most other emotive factives) is preserved when the complement is non-finite.

- (113)
- a. Alice is not glad to be here.
 - b. If Alice is glad to be here, she'll tell us.
 - c. Alice might be glad to be here.
 - d. Is Alice glad to be here?
 \rightsquigarrow Alice believes she is here.

The modal base of emotive factives, then, cannot be doxastic or else the presupposition of *be glad* will always result in a contradiction. If the attitude holder believes φ , there cannot be any worlds for which φ is false among the doxastic alternatives. Consequently, the attitude holder would be glad about any proposition which he or she believed (von Fintel, 1999). Rather, the modal base of *be glad* must be a superset of the doxastic alternatives which includes some worlds in which φ is false. The important point for our purposes is that *be glad* will not be able to embed *FUT* φ due to the following definedness conditions.⁷

- (114) $\llbracket \text{be glad FUT } \varphi \rrbracket^s(\alpha)(w_0)(t_0)$ is defined only if
 $\forall \langle w_1, t_1 \rangle \in \text{Dox}_{w_0, t_0}^\alpha : \llbracket \text{FUT } \varphi \rrbracket^{\text{Dox}_{w_0, t_0}^\alpha}(w_1)(t_1) = 1$

This says that *be glad FUT* φ can only be defined when *believe FUT* φ is true. But as we have seen above this can never be the case, meaning that *be glad FUT* φ can never be defined.

At first, the emotive factive *be excited* appears to be a problem for this proposal. It is factive, and yet individuals are typically excited about future events. However, note that infinitival complements to *be excited* can only be about the future when the complement involves a scheduled event. When we try to embed a genuine instance of the contingent future, the sentence is degraded.

⁷There are a number of proposals we could adopt for the assertive semantics of *be glad* (e.g., Heim, 1992; von Fintel, 1999; Villalta, 2008) any would be sufficient for our purposes. The relevant point is that *be glad* presupposes belief.

- (115) a. Alice is excited to {meet/be meeting} Bobby later.
b. * Bobby is excited to {win/be winning} the match tomorrow.

So, even the apparently problematic *be excited* seems to conform to the generalization that emotive factives are unable to embed *FUT*. A pattern predicted by the present proposal.

Finally, another potential counterexample is found in the predicate *be happy*. This predicate is factive with a finite complement and also appears to be factive with some infinitival complements.

- (116) a. Alice is not happy to be here.
b. If Alice is happy to be here, she'll tell us.
c. Alice might be happy to be here.
d. Is Alice happy to be here?
 ↔ Alice believes she is here

However, *be happy* has another use with an infinitival complement which is more or less synonymous with *be willing*. On this reading, it can be future oriented (117), but is likewise no longer factive (118).

- (117) Alice is happy to babysit tomorrow.
 ≈ Alice is willing to babysit tomorrow.

- (118) a. Alice is not happy to babysit.
b. If Alice is happy to babysit, she'll tell us.
c. Alice might be happy to babysit.
d. Is Alice happy to babysit?
 ↯ Alice believes she will babysit.

Whether we attribute these data to lexical ambiguity of *be happy* or not, they are nonetheless compatible with the present proposal. The take home message being that a factive presupposition is incompatible with the embedding of *FUT*.

3.4.4 Pretend

The verb *pretend* cannot embed future oriented infinitives (Pearson, 2016). In earlier work (Williamson, 2019), I incorrectly suggested that this was because *pretend*

presupposes that the attitude holder believes that the complement is false. However, this analysis is likely wrong. Specifically, the falsity of the complement can be at-issue.

- (119) SCENARIO: *Alice is being audited, and two tax officers are trying to determine whether Alice lives with her son Bobby, as she claims, or she is committing tax fraud. One officer utters one of (119a-119d) to the other.*
- a. Alice is not pretending to live with Bobby.
 - b. If Alice is pretending to live with Bobby, we'll find out.
 - c. Alice might be pretending to live with Bobby.
 - d. Is Alice pretending to live with Bobby?

If these sentences presupposed that she did not live with Bobby, then they would be infelicitous in the context provided since it is precisely the nature of her living conditions which is under discussion. As such, we should include that the complement is false as part of the at-issue meaning of *pretend*, not as part of the background meaning. Now, consider another scenario.

- (120) SCENARIO: *Two tax officers are reviewing Alice's self assessment. Alice does not live with her son Bobby, nor has she ever previously claimed to. However, due to a coffee stain on her form, it is unclear whether she has ticked the box claiming to have a dependant. One officer utters one of (120a-120d) to the other.*
- a. Alice is not pretending to live with Bobby.
 - b. If Alice is pretending to live with Bobby, we'll find out.
 - c. Alice might be pretending to live with Bobby.
 - d. Is Alice pretending to live with Bobby?

Here, the tax officers know that Alice does not live with Bobby. However, what they are trying to ascertain is whether or not she is claiming to be living with Bobby. So it appears that there are two at-issue components to the meaning of *pretend*: (i) a claim, (ii) the falsity of that claim. If so, then we might consider *pretend* to be roughly synonymous with *falsely claim*. In that case, (119a,120a) could be paraphrased with (121).

- (121) Alice is not falsely claiming to live with Bobby.

This sentence would be true if Alice is claiming truthfully to live with Bobby. Or it would be true if she does not live with Bobby, but is not claiming to.⁸ With that in mind, let us give *pretend* a similar semantics to *claim* but with the added condition that the complement of the verb is false.^{9,10}

- (122) $\llbracket \text{pretend } \varphi \rrbracket^s(\alpha)(w_0)(t_0) = 1$ iff
- a. $\llbracket \text{say } \varphi \rrbracket(\alpha)(w_0)(t_0) = 1$
 - b. $\forall \langle w_1, t_1 \rangle \in \text{Goals}_{w_0, t_0}^\alpha : \forall \langle w_2, t_2 \rangle \in \text{cs}_{w_1, t_1} : \llbracket \varphi \rrbracket^{\text{cs}_{w_1, t_1}}(w_2)(t_2) = 1$
 - c. $\llbracket \varphi \rrbracket^s(w_0)(t_0) = 0$

Now given a semantics such as this, *pretend FUT* φ will never be true for essentially the same reasons as *claim FUT* φ . We have thus seen that the predicates which take simultaneous infinitival complements all share an important property: they all involve a modal base which is uniform with respect to the truth or falsity of the complement. If this complement includes a *FUT* which is not itself embedded under another modal operator, then the resulting construction will be analytic in the sense discussed in Chapter 1 section 1.6.1.

3.5 Optionally future oriented predicates

Let us turn our attention to the optionally future oriented predicates *want*, *hope*, and *expect*. The presuppositions of these predicates not only account for their possible future orientations, but also constrain the conditions under which they can embed simultaneous infinitives (Banerjee, 2017; Williamson, 2017).

⁸There is also the third possibility that she does live with Bobby but she does not claim to.

⁹This is one of those instances in which the common ground cannot simply be equated with the set of mutually believed propositions by the relevant interlocutors, since the person pretending does not believe his or her claim to be true. Rather, as Stalnaker notes, the common ground is the set of propositions which the discourse participants are publicly committed to.

¹⁰This denotation for *pretend* is probably too restrictive. Since uses of *pretend* such as in (i) are commonplace, both in English and cross linguistically.

- (i) Alice is pretending to climb a mountain.

With this in mind, it is perhaps more appropriate to give *pretend* a semantics which involves the agent undertaking an under-specified action with the goal of adding the complement to the common ground. Note also that, further to fn.9, none of the relevant individuals to whom Alice is pretending need actually believe she is climbing a mountain. Alice's goal is simply that they play along.

3.5.1 Hope and expect

The following semantics for *hope* is that of von Fintel's (1999), discussed above.

- (123) $\llbracket \text{hope } \varphi \rrbracket^s(\alpha)(w_0)(t_0)$
- a. is defined only if $\exists \langle w_1, t_1 \rangle \in \text{Dox}_{w_0, t_0}^\alpha : \llbracket \varphi \rrbracket^{\text{Dox}_{w_0, t_0}^\alpha}(w_1)(t_1) = 1$
 $\wedge \exists \langle w_2, t_2 \rangle \in \text{Dox}_{w_0, t_0}^\alpha : \llbracket \varphi \rrbracket^{\text{Dox}_{w_0, t_0}^\alpha}(w_2)(t_2) = 0$
 - b. if defined, = 1 iff
 $\forall \langle w_3, t_3 \rangle \in \text{max}_{\text{DES}_{w_0, t_0}^\alpha}(\text{Dox}_{w_0, t_0}^\alpha) : \llbracket \varphi \rrbracket^{\text{Dox}_{w_0, t_0}^\alpha}(w_3)(t_3) = 1$

The presupposition of this verb ensures that the modal base is diverse with respect to φ , while the assertive content involves quantification over a subset of the modal base (the most desirable doxastic alternatives). Given this semantics, *hope* is correctly predicted to be able to embed *FUT*.

Next, consider the verb *expect*. Katz (2001) proposes a semantics for *expect* which is roughly as follows.

- (124) $\llbracket \text{expect}_{\text{Katz}} \varphi \rrbracket(\alpha)(w_0)(t_0) = 1$ iff
 $\forall \langle w_1, t_1 \rangle \in \text{Dox}_{w_0, t_0}^\alpha : \exists t_2 \succ t_1 : \llbracket \varphi \rrbracket(w_1)(t_2) = 1$

Two things are worth noting here. Firstly, this semantics involves universal quantification directly over the belief worlds of the attitude holder. Secondly, the quantification over future times is built directly into the verb as opposed to a future operator. In contrast, consider a semantics which is more or less identical to *hope* modulo replacing the bouletic ordering source with one of likelihood.

- (125) $\llbracket \text{expect } \varphi \rrbracket^s(\alpha)(w_0)(t_0)$
- a. is defined only if $\exists \langle w_1, t_1 \rangle \in \text{Dox}_{w_0, t_0}^\alpha : \llbracket \varphi \rrbracket^{\text{Dox}_{w_0, t_0}^\alpha}(w_1)(t_1) = 1$
 $\wedge \exists \langle w_2, t_2 \rangle \in \text{Dox}_{w_0, t_0}^\alpha : \llbracket \varphi \rrbracket^{\text{Dox}_{w_0, t_0}^\alpha}(w_2)(t_2) = 0$
 - b. if defined, = 1 iff
 $\forall \langle w_3, t_3 \rangle \in \text{max}_{\text{LIKELY}_{w_0, t_0}^\alpha}(\text{Dox}_{w_0, t_0}^\alpha) : \llbracket \varphi \rrbracket^{\text{Dox}_{w_0, t_0}^\alpha}(w_3)(t_3) = 1$

Evidence for this affinity between *hope* and *expect* comes in several forms. Most notably, their doxastic uncertainty requirements can be seen in examples like the following (cf. *want*), based on Scheffler (2008). If the attitude holder believes either φ or $\neg\varphi$, then it is infelicitous to expect or hope φ . This is straightforwardly accounted for if *expect*, like *hope*, has a doxastic uncertainty requirement.

- (126) A: It is raining.

- B: I want it to be / That is what I want.
 B': # I hope it is / I expect it to be.
- (127) A: It is raining.
 B: I want it not to be / That is not what I want.
 B': # I hope it isn't / I expect it to not be.

Furthermore, these predicates both asymmetrically embed epistemic modals (Anand and Hacquard, 2013). They may embed epistemic possibility modals, but not epistemic necessity modals (see Williamson (2017, fn.11) for a formalisation of how to capture this with a von Stechow-style semantics). The most suggestive evidence, however, is that English *hope* and *expect* are translated as one and the same verb in several Romance languages (e.g., *esperar* in Spanish). We can capture this by fixing the modal base, while the ordering source is partially determined by a contextually supplied conversational background.

- (128) $\llbracket \text{esperar}_i \varphi \rrbracket^{\mathcal{S}, \mathcal{G}}(\alpha)(w_0)(t_0)$
- a. is defined only if $\exists \langle w_1, t_1 \rangle \in \text{Dox}_{w_0, t_0}^\alpha : \llbracket \varphi \rrbracket^{\text{Dox}_{w_0, t_0}^\alpha}(w_1)(t_1) = 1$
 $\wedge \exists \langle w_2, t_2 \rangle \in \text{Dox}_{w_0, t_0}^\alpha : \llbracket \varphi \rrbracket^{\text{Dox}_{w_0, t_0}^\alpha}(w_2)(t_2) = 0$
 - b. if defined, = 1 iff
 $\forall \langle w_3, t_3 \rangle \in \max_{g(i)_{w_0, t_0}^\alpha}(\text{Dox}_{w_0, t_0}^\alpha) : \llbracket \varphi \rrbracket^{\text{Dox}_{w_0, t_0}^\alpha}(w_3)(t_3) = 1$

With this semantics for *expect*, it is no surprise that it too can embed future oriented infinitives. Interestingly, this semantics also constrains the distribution of simultaneous infinitival complements to these verbs. Pesetsky (1992) notes that *expect* can embed a simultaneous ECM complement and when it does it means something akin to *believe but not know*.¹¹

- (129) I expect there to be flowers on the table.

Abusch (2004) makes a similar observation for *predict* in passive ECM constructions.

- (130) Mary is predicted to be pregnant.

¹¹While our semantics does not correspond exactly to Pesetsky's informal characterization, it is analogous.

Williamson (2017) shows that *expect* and *hope* can embed simultaneous complements only when their doxastic uncertainty requirement holds. This is more likely to be the case with ECM complements (for *expect* or *predict*). However, control complements can also be interpreted simultaneously given the appropriate context.¹²

- (131) SCENARIO: *Alice is running for office. She has not viewed the polls, nor has she heard any news. Bobby asks her how she thinks she is doing. She replies*
- a. I {hope/expect} to be winning (already).
 - b. I {hope/expect} to have won by a landslide (by now).

A similar observation for simultaneous subjunctive complements to *esperar* is found in Laca (2015).

3.5.2 *Want*

That *want* has an ordering semantics and can embed *FUT* is not surprising. What is perhaps more interesting is how it differs from the verb *hope*. In contrast to *hope*, *want* has often been argued to lack a doxastic component (Anand and Hacquard, 2013), or to have a modal base which is a superset of the doxastic alternatives, containing some non-belief worlds (Rubinstein, 2017). Unlike *hope*, this allows *want* to embed a proposition which the attitude holder believes to be impossible (132a) (Heim, 1992), or true (132b) (Iatridou, 2000).

- (132) a. I want this weekend to last forever.
 b. I live in Bolivia because I want to live in Bolivia.

It is thus less constrained in that it can embed simultaneous infinitives even when the attitude holder is certain of the truth (132b) or falsity (133) of the complement.

- (133) Mary wanted to be sitting on a beach somewhere, but she was stuck in the office.

We have seen here that *hope*, *expect*, and *want* permit the embedding of *FUT*, but do not necessitate it. In the next section, we will see that there are a class of predicates

¹²Williamson (2017) suggests that, due to PRO's interpretation *de se* (Chierchia, 1989), the uncertainty requirement is easier to fulfil with an ECM complement than with a control complement. It is intuitively less common for an individual to be uncertain whether a property currently holds of herself, while she can often be uncertain whether such a property holds of another individual, or herself at a future time.

which must embed *FUT* and that this correlates with other behavior particular to this class of verbs.

3.6 Obligatorily future oriented predicates

Given that *forecast* is not an obligatorily future oriented predicate in English (see fn.4 above), it appears that the generalisation tying together this class is that they involve commitment to act (whether private or public). They are all *commitment predicates* (Sag and Pollard, 1991) (list adapted from Grano 2017b, see also Grano 2015b).

- (134) a. Verbs of private commitment: *aim, choose, decide, endeavour, intend, plan*
b. Verbs of public commitment: *agree, offer, pledge, promise, swear, threaten*
c. Verbs of influence: *advise, ask, command, order, persuade, convince, urge*

Like, performative deontic modals, commitment predicates are infelicitous with complements that describe states of affairs which are not under the control of the understood subject of the embedded infinitive (Farkas, 1988; Jackendoff and Culicover, 2003).

- (135) a. # Alice {promised/asked/decided} to be tall.
b. # Bobby {promised/asked/decided} to resemble his father.

Compare this to the other verbs we have considered above.

- (136) a. Alice {hoped/wanted/expected} to be tall.
b. Bobby {hoped/wanted/expected} to resemble his father.
- (137) a. Alice {claimed/pretended/believed Bobby} to be tall
b. Bobby {claimed/pretended/believed Charlie} to resemble his father.

For these verbs, we can propose a similar story to that of performative modals in Chapter 2 section 2.3. Namely, they involve a *To Do List* semantics (Grano, 2015b). When an option is added to the *To Do List*, it is done so according to *Reasonableness*. Consequently, every option on the deontic patient's *TDL* must involve a future reference time. What differs among these predicates is the choice of deontic authority and deontic patient, as well as the sort of world in which the *TDL* is updated.

For instance, a verb of private commitment such as *aim* or a verb of public commitment such as *agree* asserts that the deontic authority placed the prejacent on his own *TDL* at some point. In the former case, this was done privately and in the latter case publicly. Whereas, a verb of influence such as *advise* will assert that all of the worlds compatible with the goals of the advisor are such that the person being advised places the complement on his own *TDL*. Since the semantics for each of these verbs involves an update of the *TDL*, each will be obligatorily future oriented in order to comply with *Reasonableness*.

3.7 Potential counter examples

There are three potential counterexamples to the above generalisations that I am aware of: *try*, *suspect*, and *be certain*. Firstly, Grano (2017b) groups commitment predicates together with the verb *try* as a verb of intention. If so, we might naively expect that it should be obligatorily future oriented, counter to fact.

(138) Mary tried to win (*tomorrow).

But there is good reason to believe that *try* is not a commitment predicate. For instance, Jackendoff and Culicover (2003) note that the predicate *understand physics* cannot be embedded under verbs such *promise*, *ask*, or *decide*. However, it can readily be embedded under *try*.¹³

- (139) a. # Alice {promised/asked/decided} to understand physics.
 b. Bobby tried to understand physics.

More problematic is the verb *suspect*. Intuitively, it feels as though *suspect* should receive a treatment similar to *expect*. However, we would then predict that it can embed *FUT*, counter to fact.

- (140) a. * Alice suspects Bobby to win tomorrow.
 b. Bobby suspects Charlie to be the murderer.

Two possible means of addressing this datum come to mind. Firstly, perhaps we could say that a diverse modal base is a necessary but not sufficient condition for

¹³For more on *try* see Sharvit (2003) and Grano (2011, 2017a).

licensing *FUT*. Going down this route would require a detailed analysis of additional difference between *expect* and *suspect*.¹⁴ The second solution, suggested by Angelika Kratzer and Daniel Rothschild (pc), would be to say that *suspect*'s apparent weakness, compared to a verb like *believe*, is not necessarily indicative of an ordering semantics, but rather is attributable to the modal base simply being a subset of the doxastic alternatives (similar to how, in the general case, doxastic alternatives are a subset of epistemic alternatives). If this were so, then *suspect* would not be a counterexample to the present proposal. It would simply have its own modal base made up of worlds compatible with the attitude holder's suspicions. My intuition tells me that the first route is more plausible. However, I will have to leave this problem for future research.

Lastly, it intuitively appears that we predict that the raising predicate *be certain* should be obligatorily simultaneous. Rather, it behaves like its weaker, optionally future oriented counterpart, *be likely* in also allowing future orientation.

(141) Alice is {likely/certain} to win tomorrow.

It is possible, however, that *be certain* does not have a quantificational structure comparable to *believe* or modals like epistemic *must*. Rather, it is a probability operator which maps its prejacent to the maximal degree on a probability scale (e.g., [0, 1]). Portner (2009, pp.73-79) notes that, while we need a compositional account of such operators, they are fundamentally different from run-of-the-mill modals. Of course, whether these facts are consistent with the current proposal ultimately

¹⁴On very preliminary investigation there are at least two differences, but it is far from clear how they would help us here. Firstly, *suspect* can take an *of* complement, while *expect* cannot.

- (i) a. Alice suspects Bobby of eating the cookies.
- b. * Alice expects Bobby of eating the cookies.
- (ii) a. Bobby is suspected of a crime.
- b. * Bobby is expected of a crime.

Secondly, there are some differences in their derived forms.

- | | |
|------------------------------|------------------------------|
| (iii) a. suspected/expected | d. suspicious/*expicious |
| b. suspicion/*expicion | e. very suspect/*very expect |
| c. expectation/*suspectation | f. the suspect/*the expect |

Again, it is unclear what these differences could tell us about *suspect*'s inability to license *FUT*.

depends on what turns out to be the most appropriate way to model probability operators.

In summary, we have seen how our proposed semantics for *FUT* nicely derives the temporal orientation of infinitival complements to attitude predicates. We also observed that there are only one or two potential counterexamples. Considering that attitude verbs are a (semi-)open class, this is quite promising. Before concluding, we will take some time in the next section to see some evidence that the future is encoded by a temporal operator which is separate from the modal operators which license it.

3.8 In defense of a covert temporal operator

Recall that the examples in (99) repeated in (142) motivated a three way distinction between infinitival complements to attitude predicates.

- (142) a. Alice {claimed/pretended/was glad/believed Bobby} to be at the party.
 b. Bobby {promised/asked/ordered Charlie} to be at the party.
 c. Charlie {hoped/expected/wanted} to be at the party.

Of course, the infinitival complements themselves are ostensibly identical in each case. Until now, we have been assuming that the posteriority in (142b-142c) is derived via the presence of a covert temporal operator *FUT*. However, this assumption is itself not uncontroversial. In the literature, there have largely been two schools of thought concerning how to bridge this disparity between surface form and interpretation. The most commonly adopted approach, and the one which was employed above and will be defended in this section, is to posit a covert future operator (e.g., Abusch, 2004; von Stechow, 2005; Wurmbrand, 2014; Grano, 2015a). This group of proposals I will refer to as *syntactic accounts* because they propose that, while these complements look identical, there is in fact covert material present in the future oriented complement which is absent in the simultaneous complement. Early proponents of this account treat this extra material as a form of covert *irrealis* Tense (e.g., Stowell 1982; Martin 2001), while more recent accounts propose a covert future operator typically identified as a covert version of the modal *woll* (Abusch, 2004; Wurmbrand, 2014; Grano, 2015a). In order to prevent overgeneration of future oriented infinitives, syntactic accounts often make an appeal (either

explicit or implicit) to the lexical semantics of the selecting verb in order to limit the distribution of the covert future operator (Stowell, 1982; Landau, 2000; Abusch, 2004; Wurmbrand, 2014; Grano, 2015a).¹⁵

As mentioned, many recent syntactic approaches treat the future operator as a covert instantiation of Abusch's (1998) *woll* (see especially Wurmbrand 2014; Grano 2015a). However, this suggestion raises a number of questions: firstly, why should it be the case that an overt *woll* can appear in finite complements to predicates like *believe* and *claim* (143a) but a covert *woll* cannot occur in infinitival complements to the same predicates (143a)?

- (143) a. Alice claims that she will win tomorrow.
b. * Alice claims to win tomorrow.

Secondly, why should infinitival complements to predicates like *expect* feature a covert *woll* but not, for instance, a covert deontic *must*?

- (144) Alice expected to finish her work before bed.
a. \approx Alice expected she would finish her work before bed.
b. $\not\approx$ Alice expected she must finish her work before bed.

Since the proposal present here does not attribute the futurity of infinitivals to the presence of a covert *woll*, it is not subject to either of these objections. The modal *woll* can be embedded in finite complements to a verb such as *claim*, but *FUT* cannot be embedded in infinitival complements to the same verb due to its contingency presupposition. This explains the contrast in (143). Next, since we assume that no modal auxiliary verbs of any sort can occur (overtly or covertly) in infinitives, we have no problem explaining why (144) cannot have the unattested reading in (144b). Finally, in section 3.9, we see some examples of future oriented finite clauses which do not contain any modal operators. There, it is noted that these data are problematic for the covert *woll* story, but are consistent with *FUT*.

Besides the syntactic route, a less common approach is to suggest that the infinitival complements in (142) do not differ in structure or meaning. Accounts adopting this approach build the posteriority of future orientated infinitivals directly into the selecting verb itself (Katz, 2001; Pearson, 2016, 2017). Accordingly, I will call these accounts *semantic accounts*.

¹⁵However, unlike the present work, there is rarely any serious attempt to cash this out.

(145) *Proposal 1. Syntactic Accounts*

$$\llbracket \text{woll}/\text{FUT} \rrbracket(t_1) = \lambda P_{\langle i,t \rangle}. \exists t_2 \succ t_1 : P(t_2)$$

(146) *Proposal 2. Semantic Accounts*

$$\llbracket \text{Pred}_{\text{fut. oriented}} \rrbracket(w_0)(t_0) = \lambda P_{\langle s,it \rangle}. \lambda x. \forall \langle w_1, t_1 \rangle \cdots : \exists t_2 \succ t_1 : P(w_1)(t_2)$$

In this section, I aim to highlight a number of considerations which, taken together, suggest that a syntactic account like Proposal 1, in combination with the semantic licensing conditions outlined above, should be preferred to a semantic account like Proposal 2. In comparing these approaches, we should consider a number of factors. Among these are the empirical predictions of each proposal, the number of assumptions needed to make each work, and their general plausibility.

3.8.1 Evidence from the scope of negation with deontic modals

The first datum to consider shows that it is (at least sometimes) necessary to assume that there is a discrete future operator *FUT* which is detached from modal operators. Specifically, it appears that we can only get the correct scopal configuration of deontic modals, negation, and future shifting, if we propose an intermediate scope position between the quantification over worlds and the quantification over future times—a configuration which would not be possible if the future shifting was built into the modal operator. The relevant configuration involves a negation and a deontic necessity modal. Take the sentence in (147a).

(147) a. You must not misbehave at the restaurant tonight.

b. $\forall > \neg > \exists$

The only reading we can get here is one in which the negation (\neg) scopes between the deontic necessity modal *must* (\forall) and the future operator *FUT* (\exists) (147b). If future shifting were built into the modal operator itself, then we would predict that the universal force of the modal and the existential quantification over future times should scope together. The two possible scope positions of the negation then would be as in (148a) and (148b) respectively.

(148) a. $\neg > \forall > \exists$

b. $\forall > \exists > \neg$

The scope configuration in (148a) would occur if negation scoped over the modal. On this configuration, the truth conditions of the sentence in (147a) could be roughly paraphrased as: there is no obligation for there to be a future time at which you misbehave at the restaurant tonight. This is obviously not an attested reading of (147a). The second scope configuration in (148b) would occur if negation scoped under the modal operator. It would render (147a) roughly equivalent to: you are obliged for there to be a future time at which you do not misbehave at the restaurant. This reading is less obviously incorrect, but it is still much too weak. The hearer would satisfy this obligation if he were to misbehave for most of the time at the restaurant, provided there was at least some time for which he did not misbehave.

Based on this data, then, it looks as though we need to detach quantification over future times from modal operators to obtain the correct scopal configuration for at least some modal sentences. If we grant that this is sometimes necessary, it would not be unreasonable to assume, as we have done so far, that this is the case more generally.

3.8.2 Representing the attitude holder's now

Just as Proposal 2 does not afford a scope position between quantification over worlds and quantification over times, it also makes the attitude holder's candidate for the actual time—his or her subjective *now*—inaccessible for binding variables within the attitude predicate's complement. Proposal 1, on the other hand, makes such a configuration possible. To my knowledge, there is only one serious attempt to provide an empirical argument in favor of Proposal 1 over Proposal 2. This is the argument found in Abusch (2004). I will not go over her argument here as it is quite intricate and the judgements are subtle. Instead, I would like to offer a novel argument from temporal adverbials which seems to support the syntactic representation of the attitude holder's *now*.

Before we start, however, it should be stated that this argument does not go quite as far as to show that the infinitival needs to contain a covert future operator *per se*. Rather, we could assume, as Katz (2001) does, that attitude predicate binds both the reference time of its complement as well as the attitude holder's candidate for *now*, as shown in (149).

$$(149) \quad \llbracket \text{expect}_{\text{Katz}} \rrbracket (w_0)(t_0) = \\ \lambda P_{\langle s, \langle i, it \rangle \rangle} \cdot \lambda x. \forall \langle w_1, t_1 \rangle \in \text{Dox}_{w_0, t_0}^x : \exists t_2 \succ t_1 : P(w_1)(t_1)(t_2)$$

Katz (2001) makes this assumption due to compositional issues surrounding embedded tenses. Similarly, Pearson (2017) modifies her semantics to include an additional lambda-operator in the embedded clause responsible for binding the attitude holder's NOW in response to an earlier version of this work (Williamson, 2017). Nevertheless, let us take a second to convince ourselves that the naive approach in (146) cannot be correct. After this, more targeted arguments will be leveled against specific semantic accounts.

The argument here will rest on two different temporal adverbials, which have been the subject of a certain amount of work (Schlenker, 1999, 2003a; Anand and Nevins, 2004). They are *in n days* and *n days later*. Since the adverbs in question place the reference time, for instance two days, after another time, we can give them more or less the same semantics.

$$(150) \quad \left[\left[\left\{ \begin{array}{l} \text{in two days} \\ \text{two days later} \end{array} \right\} \right] \right] = \lambda t. \lambda P. \lambda t'. t' = t + 2 \text{ days} \wedge P(t')$$

What differentiates these adverbials is the type of temporal pronoun each one can take as its first argument. The adverb *n days later* has been argued to pick up on an antecedent time in the discourse, returning a time which is *n* days after that antecedent time. Whereas, Schlenker (1999) proposed that the temporal argument of *in n days* must be bound either by an operator in the matrix clause corresponding to the speech time or by an embedded operator introduced by an attitude predicate corresponding to the NOW of the attitude holder, a so-called *de nunc* reading. The claim that these are the only possible readings has been disputed by Anand and Nevins (2004) who claim that it can also have an anaphoric reading.¹⁶ While this may be the case for some speakers, it will be sufficient for our argument to go through that *in n days* can at least have a reading which places the reference time *n* days after the attitude holder's NOW. Take, for instance, the sentence in (151a) which has both a reading on which Alice expected that she would receive a letter two days after

¹⁶Anand and Nevins (2004) maintain that the following sentence is perfectly acceptable with *in precisely two days* as well as *two days later*.

- (i) I met Alice a week ago. {In precisely two days/two days later} she was sick.

For me, this sentence is slightly dubious with the temporal adverbial *in precisely two days*, and I don't find it equivalent to *two days later* here. I only get the so-called durative reading (see Anand and Nevins, 2004, fn.16) here which, as the authors note, is made odd with the addition of *precisely*. However, it is possible that for some speakers *in two days* does have an anaphoric reading.

the speech time (151b). However, it also has a *de nunc* reading, on which Alice expected that she will receive a letter two days after the time which she then believed it to be—her subjective NOW—represented in (151c).

- (151) a. On Friday, Alice expected to get a letter in two days.
 b. [λt_0 Alice expected (at t_1 on Friday) [λt_2 to get a letter (at $t_0 + 2$ days)]]
 c. [λt_0 Alice expected (at t_1 on Friday) [λt_2 to get a letter (at $t_2 + 2$ days)]]

However, we must be careful to distinguish the reading on which *in two days* takes the subjective NOW of the attitude holder (t_2) as its antecedent as opposed to simply an anaphoric reading on which *in two days* takes the matrix reference time (t_1), which contains the time of Alice’s expecting, as its antecedent.

To show that *in two days* can indeed take the attitude holder’s NOW as its antecedent here we need to devise a scenario in which Alice is mistaken about what day it is, in which case her NOW will not correspond to the matrix reference time. The scenario supplied in (152) does just this.

- (152) SCENARIO: *Alice has a habit of drinking heavily to forget embarrassing situations, which occur almost daily. During a particularly embarrassing week, Alice drinks on both Wednesday and Thursday. As a result, she forgets the entirety of both days. When she awakes on Friday, she believes it to still be Wednesday. She proceeds to utter (152a).*
- a. “I’m going to finally get that letter on Sunday”
 b. On Friday, Alice expected to get a letter in four days.
 c. On Friday, Alice expected to get a letter two days later.

Notice that both the sentences in (152) can describe the above scenario. This is to be expected if the adverbial *in four days* can be interpreted as four days from the attitude holder’s subjective NOW, which for Alice is Wednesday. Notice that on an anaphoric reading, *in four days* would incorrectly place the receiving of the letter four days

Secondly, they note that whether *in two days* takes the speech time or the subjective NOW as its argument depends on the tense of the clause (see Anand and Nevins, 2004, ex.48 and 49) which the authors claim raises doubts for its status as a shifting indexical. Although the authors do concede that there may be additional complicating factors at play here (see Anand and Nevins, 2004, fn.17). While I am not convinced that Schlenker’s original classification needs to be discarded, the additional possibility of an anaphoric reading for some speakers does not affect the main point of our argument. It is sufficient that *in two days* can have a *de nunc* reading like the one discussed in the text.

from Friday, on Tuesday, in Alice’s expectation worlds. But since this sentence is true in the context given, it must at least have a *de nunc* reading.

This is good evidence that the adverbial *in n days* can have a reading which picks out the time *n days* after the attitude holder’s subjective NOW. By extension, it is a solid argument that we need to represent the NOW of the attitude holder syntactically in future oriented infinitives in order to bind the temporal argument of *in n days*.

As mentioned, these data lead Pearson to revise her 2016 position in favor of an account which binds both the NOW of the attitude holder as well as the reference time of the embedded clause (Pearson, 2017). In the following subsection, it will be shown that, even with this assumption, both Katz (2001) and Pearson (2016) face a number of problems.

3.8.3 Accounts without covert operators

3.8.3.1 Katz (2001)

As mentioned, Katz (2001) suggests that *expect* not only controls the top most time variable, but also lexically specifies precedence between the attitude holder’s NOW and the embedded reference time. His semantics in (153) is repeated from (149).

$$(153) \quad \llbracket \text{expect}_{\text{Katz}} \rrbracket (w_0)(t_0) = \\ \lambda P_{\langle s, \langle i, it \rangle \rangle} . \lambda x. \forall \langle w_1, t_1 \rangle \in \text{Dox}_{w_0, t_0}^x : \exists t_2 \succ t_1 : P(w_1)(t_1)(t_2)$$

Katz maintains that *expect* can never take a non-future complement. For him, simultaneous finite complements are highly marked.¹⁷ He suggests that, for those speakers who allow it, the verb *expect* is ambiguous and when it takes a simultaneous complement it means something akin to “*strongly believe*” (fn.1). Let us grant that, for some speakers, *expect* may always be future oriented. If so, we still need to propose covert operators in infinitival complements to *hope*. Consider the fact that *hope* can embed a present tense complement (154a), a sequence of tense (SOT) complement (154b), and a relative past tense complement (154c) as well as future oriented infinitives (154d).

- (154) a. I hope Alice is feeling better {already/now}.
 b. Bob hoped that Charlie was still alive. (SOT)

¹⁷This judgement does not appear to be shared elsewhere in the literature nor among any of the speakers I have consulted.

- c. I hope you arrived home safely last night.
- d. Diane hopes to receive a letter in two days.

If we were to build posteriority into the lexical semantics of *hope* to account for (154d), then the finite clauses (most notably the past tense complement in (154c)) will be unaccounted for. Ideally, we would refrain from appealing to lexical ambiguity here also. The present proposal provides a straightforward means of covering these uses of *hope* and *expect* with only one lexical entry each.

3.8.3.2 Pearson (2016)

Pearson (2016), like Katz, takes the locus of posteriority to be within the selecting verb itself. Unlike Katz, she treats future orientation as part of a more general grammatical phenomenon. She argues that propositional attitude predicates may introduce *extensions*. The impetus behind Pearson's analysis is accounting for a non-canonical control relation called *partial control* (Landau, 2000, 2013). This control relation is only licensed by a subset of control predicates and is characterized by the infinitival subject *PRO* being interpreted as a group which properly contains the individual denoted by the controller. The presence of the collective predicate *gather* in (155a), and the modifier *together* in (155b), ensures that *PRO* is interpreted as semantically plural. The minimally different sentences with so-called exhaustive control predicates (155c) and (155d) are unacceptable.¹⁸

- (155) a. Alice_i {asked/promised} PRO_{i+} to gather in the hall.
 b. Bob_i {wanted/hoped} PRO_{i+} to live together.
 c. * Charlie_i {tried/managed} PRO_{i+} to gather in the hall.
 d. * Diane_i {claimed/pretended} PRO_{i+} to live together.

Since some of the earliest work to recognize the importance of partial control (Landau, 2000), it has been suggested that control verbs can license partial control if they permit temporal displacement. This is typically diagnosed by the possibility of mismatching temporal adverbials in the matrix and embedded clauses. The following examples, taken from Pearson (2016), show that the simultaneous predicates *claim* and *pretend* do not license mismatching temporal adverbials (156a-156b), while future oriented and past oriented predicates do (156c-156d).

¹⁸The verbs *claim* and *pretend* are not typically treated as exhaustive control predicates in the literature as they can license partial control in certain instance which will be discussed.

- (156) a. * Yesterday, Alice {claimed/pretended} to go to the cinema tomorrow.
 b. * Today, Bob {claimed/pretended} to go to the cinema last week.
 c. Yesterday, Charlie {hoped/expected} to go to the movies tomorrow.
 d. Diane will {remember/regret} going to the movies yesterday.

Pearson proposes that control clauses are unspecified for temporal orientation, and PRO for semantic number. Instead, she develops a mechanism of *extension* to account for the covariation between partial control and temporal displacement.

(157) *Extension*

For any pair of world-time-individual triples $\langle w, t, x \rangle$ and $\langle w', t', y \rangle$, $\langle w', t', y \rangle$ is an extension of $\langle w, t, x \rangle$ iff for every α, β such that α is a coordinate of $\langle w, t, x \rangle$ and β is a coordinate of $\langle w', t', y \rangle$ of the same type as α , either:

- (i) $\alpha \prec \beta$;
 (ii) $\beta \prec \alpha$ or
 (iii) $\alpha \leq \beta$ ¹⁹

The partial control relation and temporal displacement of the embedded clause are possible only if the verb is able to shift the coordinates of the centered world triple.

While aspects of this account are appealing, there is reason to believe that the notion of extension is not a lexical one after all. Firstly, the simultaneous predicates *claim* and *pretend* can license non-simultaneous readings when overt temporal markers such as perfect *have*, or the progressive occur in the embedded clause. Crucially, as Pearson herself notes (pp.713-14), the presence of these temporal markers can also license partial control, as demonstrated by the acceptability of the collective predicate *gather* in (158a) and the adverb *together* in (158b).

- (158) a. The chair pretended to have gathered last week.
 b. (Bob said that) Alice claimed to be living together.

While these facts are noted, they are nonetheless put to the side in Pearson's exposition. However, there is a serious tension between these facts and the proposal that extensions are lexical. The verbs in (158) are the same as those in (155d). What has

¹⁹The precedence relation \prec is only defined for \mathcal{T}_i , while the 'part of' relation \leq is defined for \mathcal{D}_e and \mathcal{T}_i , but not \mathcal{W}_s . For any two individuals $a, b \in \mathcal{D}_e$, $a \leq b$ iff $a + b = b$, and for any two times $t, t' \in \mathcal{T}_i$, $t \leq t'$ iff $t \subseteq t'$.

changed is the presence of temporal operators, not the verbs. In (158), the temporal operators are overt. However, we might wonder whether partial control in future oriented infinitives is somehow licensed by the presence of a *covert* temporal operator. The data in (158) could even be taken as potential evidence supporting this conclusion.²⁰

So far in this section, we have covered some of the advantages of positing a covert temporal operator in infinitives. In the next subsection, I will address, what I take to be, a less attractive aspect of such an account. The goal of this discussion is to show that the perceived weaknesses of this account are by no means fatal.

3.8.4 Transitive constructions

A *prima facie* advantage of a semantic account (Proposal 2) over a syntactic account (Proposal 1) is that verbs such as *expect* appear to be future oriented even in transitive constructions with non-clausal complements. For instance, there appears to be no clausal complement to *expect* in (159) yet the expectation still seems concerned with something in the future (i.e., getting a cheque).

(159) Mary is expecting a cheque.

There is a long tradition of analyzing such constructions as involving an abstract clausal complement which contains a covert predicate $\emptyset_{have/get}$ (Ross 1976; den Dikken et al. 1996; Larson et al. 1997; Harley 2004 *inter alia*)

(160) Mary_i is expecting [PRO_i $\emptyset_{have/get}$ a cheque].

The motivation for this type of analysis is extensive and well-documented (see references above). But we can consider just two of the more straightforward pieces of

²⁰A tempting explanation for this could be that, in the absence of auxiliary verbs such as perfect *have* or the progressive *be+ing*, infinitives are bare VP complements and perhaps have no syntactic subject at all. When overt or covert material is present in the TP complex, there is a syntactic position for a covert subject which may somehow license partial control. This is similar in spirit to the proposal of Wurmbrand (2012, 2002). However, in Wurmbrand 2014, she proposes that even simultaneous complements to *claim* contain a TP projection which would fail to account for the lack of partial control in these complements in the absence of temporal operators. Much would remain to be addressed about my suggestion. In particular, the complex facts surrounding the ϕ -features of the covert subject in partial control complements would remain unexplained (see especially Landau 2015, 2016 for some idea of just how complex these issues are).

evidence. Firstly, (161) shows that transitive *expect* is able to license two mismatching temporal adverbials (McCawley, 1979), typically taken to be indicative of two reference times. The frame adverbial *yesterday* restricts the time of the expectation, while *next week* is modifying some covert event which can be paraphrased by *to get a cheque*. This is to be expected if the construction is in fact bi-clausal but not if it is mono-clausal.

(161) Yesterday, Mary was expecting a cheque next week.

The second piece of evidence exploits a scope ambiguity which arises with the adverb *again*. Consider the following scenario.

(162) SCENARIO: *Alice is expecting to be sued for a second time. The first time she was sued, it was a surprise and she was not expecting a lawsuit.*

a. Alice is expecting a lawsuit again.

The reading on which *again* modifies the matrix verb is false (or potentially a presupposition failure) in this scenario because it is not the case that Alice expected a lawsuit before, this is the first time that it is expected. The previous time it was a surprise. Rather the felicitous reading is one on which *again* modifies the covert predicate $\emptyset_{\text{have/get}}$.

Provided we take these arguments to be convincing, we have good reason to propose a covert clause in intensional transitive constructions. This is equally true for both Proposal 1 and Proposal 2 above. The only further assumption that we need to make is that this covert clause can host *FUT*. If so, then, contrary to appearances, transitive constructions do not necessarily favor a semantic account over a syntactic account.

In this section, we have reviewed some arguments in favor of representing *FUT* as a distinct syntactic head in the clausal spine. We first noted that negation can take scope between the quantification over worlds and the quantification over times in negated deontic necessity sentences. We then saw that there was reason to think that we should represent the *NOW* of the attitude holder in the embedded clause—a situation which follows straightforwardly on syntactic accounts, but which must be added as a complication in semantic accounts. Next, we raised some specific arguments against the semantic accounts of Katz (2001) and Pearson (2016). Finally, we discussed future oriented intensional transitive constructions which at first seem like good evidence for semantic accounts.

All of the arguments we have reviewed in this section are arguments in favor of syntactic accounts over semantic accounts. However, they do not distinguish between the present proposal and proposals which treat the covert future operator as a silent modal *woll*. In the next section, we will note some data which are compatible with the present *FUT* account, but which raise problems for a silent *woll* approach.

3.9 Finite complements

3.9.1 Covert *woll* vs. *FUT*

While we have focused here on infinitives, Klecha (2016) discusses some interesting cases of embedded finite clauses which can have a future oriented reading without the help of an embedded modal. This phenomenon is possible in finite complements to some predicates which can embed infinitives (such as *hope*), but it also occurs with some sentential predicates which cannot embed infinitives (such as *pray* and *be conceivable*).

- (163) a. Alice hopes that Charlie wins tomorrow.
b. I pray that Bobby wins tomorrow.
c. It is conceivable that Bobby wins tomorrow.

Crucially, we seem to find more or less the same generalization that we have proposed above for infinitival complements. That is, attitude predicates which involve universal quantification over the modal base, such as *believe*, are unable to license a finite future complement.

- (164) * Alice believes that Charlie wins tomorrow.

As a minimal pair, we can see that *be possible* licenses a future finite clause, whereas *be impossible* cannot.

- (165) a. It is possible that Alice wins tomorrow.
b. ?? It is impossible that Alice wins tomorrow.

This is hardly surprising on the present account. *Be possible* likely involves existential quantification over its modal base, while *be impossible* involves universal (or rather a negated existential) quantification over the same set of worlds.

A point worth emphasizing here, however, is that future oriented finite complements, like that in (163a), provide further evidence that the operator responsible for future shifting in English is not a covert *woll*. In earlier work (Williamson, 2017), I adopted that position and suggested that a plausible explanation for why *woll* must be covert in the case of a non-finite clause is because modal auxiliaries do not have a non-finite exponent. They never occur below other heads in the extended verbal projection such as the perfect (166a), the progressive (166b), or even other modal auxiliaries (166c). And since modal auxiliaries always undergo head movement to T, they are always inflected for tense.

- (166) a. * Alice has might(ed) climb(ed) the stairs.
 b. * Bobby is musting (to) tidy his room.
 c. * Charlie will can call his mum.

Perhaps it is because they are always inflected for tense that they lack non-finite exponents all together.

- (167) * to {will/can/must/etc.}

In Williamson (2017), I suggested that the lack of a non-finite exponent is a plausible explanation for why *woll* would be covert in infinitives. While this is a reasonable explanation for infinitives, it is at odds with the future oriented finite complements above. There too, the complements are future oriented and would presumably also feature a covert *woll*. However, there is no longer any reason why *woll* should be covert here since the clause features a finite T.

I think these data raise serious questions for accounts which propose a covert *woll* as a means of deriving futurity. In combination with the objections outlined at the start of 3.8, it is clear that the present approach has many advantages over positing a covert *woll*, with no immediate disadvantages.

3.9.2 Competition between past and present tenses

In Klecha's (2016) discussion, the data examined involves a configuration in which the main clause and the embedded clause match in tense. However, the present account should also predict that we should be able to have mismatching tenses in the two clauses and, provided *FUT* is licensed, we should still get future shifting. This prediction is partly borne out. The verb *pray* in a past tense main clause can

take a present+*FUT* complement (168a), but a present tense in the main clause is bad with a past+*FUT* embedded clause (168b).

- (168) a. We were so desperate that we all got together last night and we prayed that Bobby wins tomorrow.
b. * We are so desperate that we pray that Bobby won tomorrow.

For now, we will simply stipulate a constraint that *FUT* cannot appear in a deictic or a relative past tense clause without an appropriate modal—a constraint which will be seen again in Chapter 5 when we discuss conditional antecedents.

Next, consider the case in which a past tense clause embeds another past tense clause. In this case, the embedded clause can presumably undergo tense deletion.²¹ What we find is that the event in the embedded clause (i.e., *Bobby won*) can occur after the main clause event (169a), but not after the speech time (169b).

- (169) a. We were so desperate that we all got together last week and we prayed that Bobby won yesterday.
b. * We were so desperate that we all got together last night and we prayed that Bobby won tomorrow.

Here, we cannot appeal to the constraint proposed above, banning past tenses with *FUT*. Instead, an alternative explanation is needed. A plausible explanation is that the embedded clause in (170a) competes with (170b) giving rise to a (locally evaluated) scalar implicature (e.g., Chierchia, 2004, et seq.).

- (170) a. We prayed [that PRES *FUT* Bobby wins].
b. We prayed [that PAST *FUT* Bobby won].

The important thing to note is that (170a) is strictly stronger than (170b). The former is only compatible with Bobby winning after the speech time, while (170b) is compatible with Bobby winning either before or after the speech time. When the weaker alternative (170b) is used, it is strengthened, with the domain of quantification being restricted to only those times which are prior to the speech time.²²

²¹Or whatever theory of Sequence of Tense the reader prefers.

²²This competition must be local enough that it is unaffected by the addition of the adverbial *tomorrow* in (168a,169b).

3.9.3 Competition between finite and non finite complements

We saw above that *hope* can embed future oriented infinitives as well as unmodalized future oriented finite clauses. In contrast, the verb *expect*, which we gave a similar semantics to *hope*, is notably degraded with a unmodalized future oriented finite complement.

- (171) a. Alice expects Charlie to win tomorrow.
 b. ?? Alice expects that Charlie wins tomorrow.

One might wonder whether there is plausible explanation for why *hope* can embed a future oriented finite complement (163a), while *expect* cannot (171b). I believe that there might be. A possible answer lies in the fact that *expect* licenses ECM complements (171a) but *hope* does not (172).

- (172) * Alice hopes Charlie to win tomorrow.

With this in mind, we might attempt to account for these facts in terms of *Efficiency*—outlined in Chapter 1—on the assumption that infinitives are structurally simpler than finite clauses. This may be due to infinitives lacking a FIN feature, a CP, or even a TP altogether. The explanation would run as follows. The finite clause with *FUT* embedded under *expect* in (171b) would convey the same meaning as the ECM option (171a). However, since the finite clause is structurally more complex, the infinitival clause is the preferred form and the finite clause is ungrammatical. Now, since an ECM complement for *hope* is unavailable, the only way to express the intended meaning in (172) is with the finite complement in (163a). Because there is no competition with an infinitive which can convey the same meaning, the unmodalized finite clause can be used.

3.10 Conclusion

In this chapter, we extended our account from modal auxiliaries to attitude predicates. We showed how predicates with an ordering semantics were compatible with the contingency presupposition of *FUT*, while those without were not. Finally, we showed that commitment predicates, like performative deontics, are obligatorily future oriented. We attributed this fact to Grano's (2015b) suggestion that these predicates also involve a *To Do List* semantics.

In the next chapter, we will discuss performative deontic modals and commitment predicates again. There we will note a novel observation concerning the distribution of past-in-future readings of perfect *have* under such operators.

Chapter 4

Past-in-Future Readings of Deontic Modals

4.1 Introduction

In the two previous chapters, we proposed that a principle of *Reasonableness* governs obligation imposing and permission granting in order to account for Ninan's (2005) observation that the perfect marker *have* cannot give rise to a true past oriented reading under performative modals and commitment predicates. However, as noted by Portner (2009, p.190, fn.31), the perfect can be embedded under deontic *must* with a past-in-future reading. The (un)availability of this reading is the topic of the present chapter. More specifically, we note that, while deontic *must* can afford a past-in-future reading of a perfect prejacent, deontic *may* is notably degraded with the intended reading.¹

- (173) a. You must have gone to confession before tomorrow. (*deontic*)
b. * You may have gone to the cinema before tomorrow. (*deontic*)

Accounting for the asymmetry in (173) will be the main focus of this chapter. However, in the next few subsections, we will see some additional data showing that the

¹While there is a notable contrast here which has been corroborated by numerous informants, one or two reviewers have expressed that the judgement here is perhaps a double question mark ?? as opposed to a star *. For readability, I will give the judgement as * throughout as opposed to ??/*.

ban extends beyond the case of deontic *may*. In section 4.2.1, a similar asymmetry is observed in root questions with the modal auxiliary *can* which can be used to request permission with a first person subject or can be used to attempt to place the addressee under an obligation with a second person subject. Then in section 4.2.2, we show that parallel facts hold with infinitival complements to *commitment predicates* (Sag and Pollard, 1991; Grano, 2015b, 2017b) which encode the transfer of permission. We will also note some apparent amelioration effects in section 4.2.3.

Following the data, we will provide an account for the observed asymmetry. The account hinges on two premises (i) prior to granting permission to carry out an action, that action was prohibited, (ii) performative speech acts are issued against a background which assumes *Compliance* on the part of the deontic patient. Given these assumptions, we show that the addition of the perfect marker *have* in sentences like (173b) is systematically redundant. That is, the perfect permission is semantically equivalent to, but structurally more complex than, the bare future permission. We suggest that such a state of affairs is ruled out by the grammatical principle of *Efficiency* (Meyer, 2015), discussed in Chapter 1, section 1.6.

4.2 Additional data

4.2.1 Root questions

The core data in (173b) showed that a permission granting use of a deontic modal is unable to embed the perfect marker *have*. In this subsection we will see that such a restriction extends to permission requesting uses of modals too.

When *can* is used in a root question with a first person pronominal subject, it is most naturally understood as a request for permission (174a). However, when the subject is a second person pronoun, the question is understood as an attempt to place the hearer under an obligation (174b). To force the intended readings, the particle *please* has been added.

- (174) a. Please can I eat a cookie before dinner?
b. Please can you tidy your room?

Much like in a permission granting sentence, the perfect marker *have* is notably degraded in a permission requesting sentence (175).

- (175) a. * Please can I have eaten a cookie before dinner?

- b. * Please can I have watched TV by bed time?

However, when a root question with *can* has a second person pronominal subject, and is understood as an attempt to place the hearer under an obligation, these questions are a hospitable environment for perfect *have* with a past-in-future reading.

- (176) a. Please can you have tidied your room before dinner?
 b. Please can you have finished your homework by bed time?

This asymmetry is inline with what we saw for *may* and *must* in the introduction: permission sentences are bad with perfect *have*, while obligation sentences can receive a past-in-future reading. What makes these *can* questions particularly interesting is that the only significant syntactic difference appears to be the person features of the subject. This would immediately call into question any account which attempted to attribute the difference in perfect embedding capabilities of *may* and *must* to a difference in their syntax (e.g., c-selection, or structural height). Rather, the conditioning factor appears to be whether the sentence is a permission sentence or an obligation sentence.

4.2.2 Commitment predicates

As we saw in Chapter 3, there are a number of verbs which encode a transfer of permission between a deontic authority and deontic patient who are not necessarily the hearer and the speaker. These are *commitment predicates* (Sag and Pollard, 1991; Grano, 2015b, 2017b). While these verbs are not performative in the strictest sense, many of them nonetheless describe a speech act of imposing an obligation or granting permission.

- (177) a. *promise, vow* : subject places subject under an obligation.
 b. *tell, order* : subject places object under an obligation.
 c. *allow, permit* : subject grants permission to object.
 d. *ask, request* : subject requests permission from (implicit) object.

Of these verbs, those that encode a transfer of obligation can embed the perfect with a past-in-future reading (178,179).

- (178) a. Alice {promised/vowed} to have done the dishes by dinner time.
 b. Bobby {promised/vowed} to have tidied his room before bedtime.

- (179) a. Alice {told/ordered} Bobby to have done the dishes by dinner time.
b. Alice {told/ordered} Bobby to have tidied his room before bedtime.

In contrast, those verbs which encode a transfer of permission such as *permit* or *allow* cannot embed the perfect when they are used in their active form.

- (180) a. * Alice {allowed/permitted} Bobby to have watched TV by bed time.
b. * Alice {allowed/permitted} Bobby to have eaten a cookie before dinner.

However, when these verbs occur in their adjectival passive form *be allowed* and *be permitted*, they do not describe a transfer of permission but rather they report on a state of being permitted (see Lauer, 2015). Permission modals which have a reportative use are much better with perfect complements (181).

- (181) a. Alice is allowed to have painted her house by the time the new tenants move in.
b. Bobby is permitted to have re-entered the country as often as needed.

However, when they appear with an agentive *by*-phrase, and are thus in their verbal passive forms, these verbs pattern with their active form (Hans van de Koot, pc).²

- (182) a. * Bobby was allowed by Alice to have watched television by bed time.
b. * Bobby was permitted by Alice to have eaten a cookie before dinner.

The minimal pair in (183) provide probably the clearest evidence of a real contrast. Both examples have a second person subject, are in the present tense, and feature the same modal predicate *be allowed* with the same perfect prejacet. The difference between them is that (183a) is preceded with a kind of evidential hedge. The speaker has no direct evidence that the hearer is not allowed to have eaten a cookie before dinner. It therefore cannot be interpreted as a transfer of permission from a speaker in a position of deontic authority to a hearer who is a deontic patient. Conversely,

²The examples in (181) are in the present, while those in (182) are in the past. This was done because the transfer-of-permission reading is not typically available in the present. Forcing the reportative reading for (181). However, even in their past form, they can have the same reading.

- (i) a. Alice was allowed to have painted her house by the time the new tenants move in.
b. Bobby was permitted to have re-entered the country as often as needed.

the sentence in (183b) features the particle *hereby* which forces the performative reading (see Eckardt 2012). This performative sentence (183b) is notably degraded in contrast to (183a).

- (183) a. (As far as I am aware,) you're allowed to have eaten a cookie before dinner.
b. * You're (hereby) allowed to have eaten a cookie before dinner.

Finally, the verbs *ask* and *request*, which describe a request for permission, cannot appear with a perfect complement.

- (184) a. * Bobby {asked/requested} to have watched television by bed time.
b. * Bobby {asked/requested} to have eaten a cookie before dinner.

The case of *ask* is a particularly striking one, since, when it occurs without an explicit object argument, it is interpreted as a request for permission (185a), but when it occurs with an object argument it is interpreted as an attempt by the subject to place the object under an obligation (185b).³

- (185) a. Alice asked to leave early.
b. Bob asked Charlie to tidy up.

When *ask* occurs with an object argument (and thus encodes transfer of obligation) we find that it can embed a perfect complement (186).

- (186) a. Alice asked Bobby to have finished his homework by bed time.
b. Alice asked Bobby to have done the dishes up before dinner.

This falls in line with the generalisation that commitment predicates, like performative permission modals, may embed the perfect with a past-in-future reading only when they describe the imposing of an obligation, and not when they describe the granting or requesting permission. Once again, these facts are inline with what we saw in the case of performative *may* and *must*. What is more, they add further evidence for an affinity in the semantics of performative modals and commitment predicates.

³Many speakers can interpret transitive *ask* as a request by the subject for permission granted by the direct object. In this case it is much like the intransitive *ask*, but with the implicit argument made explicit.

4.2.3 Amelioration effects

Before moving on to our account, it is worth noting that there are some constructions in which the perfect can be embedded under a performative permission modal. Something which these constructions appear to have in common is that they all involve numerical determiners which involve a (potentially implicit) negation.⁴

- (187)
- a. You may have eaten only three cookies before bedtime.
 - b. You may have watched no more than two hours of television by bedtime.
 - c. Alice allowed Bobby to have eaten at most three cookies before bedtime.

While these data are interesting in and of themselves, they are made even more so by the fact that not all types of permission sentences exhibit the same amelioration effects. In particular, it is only permission *granting* sentences which are improved by numerical objects. Permission *requesting* sentences are not.

- (188)
- a. * Please can I have eaten ({only/no more than/at most}) three cookies before bedtime?
 - b. * Bobby asked to have watched ({only/no more than/at most}) two hours of television by bedtime.

In section 4.10, we will propose that the improvement of these permission granting sentences is attributable to a wide scope reading of negation which is not available in the permission requesting sentences. If this proposal is correct, then these sentences are better described as prohibition sentences than permission sentences. As such, we will put these data to the side for now, focusing instead on the core data outlined in the previous subsections.

4.3 The performative presupposition revisited

Our proposal for the asymmetry observed above will rest on the presuppositions of modal elements which encode a transfer of permission. In this section we will

⁴Some speakers have expressed that they find these sentences only marginally better than perfect permission sentences with non-numerical determiners in object position, while others have reported that they find these sentences perfectly acceptable. Despite some variety in judgements, the majority report a notable improvement in acceptability.

revisit the performative presupposition discussed in Chapter 2, section 2.3.3. Although our semantics for performative permission hard-wires the *prior prohibition condition* into the semantics for modal items like *may*, in this section we aim to show that this condition is also empirically motivated.

It is frequently observed in the literature that in performing the speech act of permitting an action, one is making that action permitted when it was not permitted before (i.e., it was previously prohibited) (Kamp, 1973; Lewis, 1979; van Rooy, 2000; Portner, 2010). It is appealed to explicitly by Kamp (1973) in his account of *free choice permission*.⁵

“Thus a permission statement, when it is successful, moves a certain class of actions from the realm of the prohibited into that of the permitted.”

(Kamp, 1973, p.62)

It is worth noting that the prohibition need not be stated explicitly in order to be in effect. It is often the case that the prohibition is implicitly understood by both the deontic authority and the deontic patient.

- (189) SCENARIO: *Alice has made cookies for her son, Bobby. After finishing his vegetables for dinner, Alice decides to let Bobby eat a cookie.*
- a. You may eat a cookie.

In this scenario, Alice need not have explicitly prohibit Bobby from eating a cookie. However, it is nonetheless common ground that Bobby cannot simply eat a cookie whenever he wants. Note that it is possible to challenge this presupposition of prior prohibition with the *Hey wait a minute!* test (von Stechow, 2004).

- (190) A: You may eat a cookie.
B: Hey wait a minute! I didn't know that I wasn't allowed to eat the cookies before.

In this example, Bobby is not challenging Alice's authority, but rather he is challenging the presupposition of prior prohibition.

The most robust method for detecting presuppositions is to check their projection behavior when embedded in entailment cancelling environments such as those

⁵This quote is just one of many which could have been chosen from section 4 of Kamp (1973).

in the *family-of-sentences* paradigm (Chierchia and McConnell-Ginet, 1990; Tonhauser et al., 2013). Unfortunately, this is a slightly problematic exercise for performative *may* and *must* as they are used to perform speech acts and consequently do not embed naturally. Luckily, we can embed the active form of commitment predicates, and, as we would expect, the presupposition of prior prohibition projects.

- (191) a. Alice didn't {allow/permit} Bobby to eat a cookie.
b. Did Alice {allow/permit} Bobby to eat a cookie?
c. If Alice {allowed/permitted} Bobby to eat a cookie, he would have been happy.
d. Alice might have {allowed/permitted} Bobby to eat a cookie.
→ Bob was prohibited from eating a cookie.

Each of the sentences in (191) presupposes that Bobby was prohibited from eating a cookie. The presupposition projects under negation (191a), in a question (191b), in the antecedent of a conditional (191c), and under a modal auxiliary (191d).

A reportative use of a permission modal, such as the adjectival passive *be allowed*, does not require that its prejacent was ruled out at any time. It could simply be that there were never any prohibitions in place which ruled out the deontic patient realizing the prejacent.

- (192) a. Bobby was allowed to eat a cookie.
↯ Bobby was prohibited from eating a cookie.
b. Bobby was allowed to watch TV.
↯ Bobby was prohibited from watching TV.

Of course, the *To Do List* account predicts that performative *must* carries no such presupposition.

- (193) a. You must tidy your room.
↯ You were prohibited from tidying your room.
b. You must do your homework.
↯ You were prohibited from doing your homework.

In fact, just as granting of permission requires that the prejacent was not permitted before, so too does the imposing of an obligation require that the prejacent was not obliged prior the imposition. Once again, this presupposition can be shown to project in the case of obligation encoding commitment predicates.

- (194) a. Alice didn't order Bobby to tidy his room.
 b. Did Alice order Bobby to tidy his room?
 c. If Alice orders Bobby to tidy his room, he will be sad.
 d. Alice might have ordered Bobby to tidy his room.
 → Bobby was not already obliged to tidy his room.

The presupposition of a performative permission sentence requires that none of the best worlds at $t - 1$ is a world in which the prejacent is realized. Whereas, the presupposition of a performative obligation sentence has the weaker requirement that not all of the best worlds at $t - 1$ are worlds in which the prejacent is realized. This will be central to our proposal. We will propose that performative obligation modals but not performative permission modals can embed the perfect on a past-in-future reading precisely because they are compatible with the prejacent being realized prior to t . However, as it stands our semantics needs one or two revisions to capture this.

4.4 Introducing the perfect

The lexical entry we have adopted for the perfect marker *have* is repeated from Chapter 2. It quantifies over times before or equal to the evaluation time.

$$(195) \quad \llbracket \text{have}_{\text{perfect}} \rrbracket = \lambda P_{\langle i, t \rangle} . \lambda t . \exists t' \preceq t : P(t')$$

With prior prohibition motivated both theoretically and empirically, we can now show that the meaning of a sentence of the form *may have φ* systematically collapses to the same meaning of a sentence of the form *may φ* . Before we do so formally, let's take a second to demonstrate the reasoning informally.

First of all, consider performative *must* and the minimal pair in (196).

- (196) SCENARIO: *Alice arrives home and learns that her son, Bobby, has invited his friend, Charlie, around for dinner. Alice has been out all day and is concerned that Bobby's room might be a mess, and Bobby is unlikely to tidy his room when Charlie has arrived. Alice utters "Okay Charlie can come around, but..."*
- a. You must tidy your room before dinner time.
 b. You must have tidied your room before dinner time.

There is a subtle difference in meaning between these two orders. In (196a), the tidying of the room must follow the speech time. This might be used if Alice is aware that Bobby has an untidy room which needs clearing. However, in the scenario given, Alice has just arrived home and is likely ignorant with regard to whether or not Bobby has tidied his room already. In this scenario, (196b) is compatible with the obligation already being fulfilled. If Bobby has not tidied his room recently, then he must do it in the future. But if he has done it already, then the obligation is already satisfied. Suppose that Bobby has tidied his room while Alice was out. If she later issues the bare future oriented obligation, Bobby may dispute this obligation since he has already tidied his room. Conversely, it is much less natural for him to accept the obligation, while informing Alice that it is already done.

- (197) A: You must tidy your room before dinner time.
B: But I've already done it!
B': # That's fine. I did it already.

Compare this to the past-in-future reading of the perfect obligation. In this scenario, it feels unnecessarily confrontational for Bobby to reject the obligation, since he has already fulfilled it. Conversely, it is natural for him to accept the obligation, while following it up by telling Alice that it has been fulfilled.

- (198) A: You must have tidied your room before dinner time.
B: # But I've already done it!
B': That's fine. I did it already.

To help illustrate, consider the following timeline, where t_{utt} is the utterance time and p is the proposition denoted by *you tidy your room*, directed at Bobby. Prior to t_{utt} , Bobby was under no obligation to tidy his room. After being issued a bare future oriented obligation, he is under an obligation to tidy his room after t_{utt} and before dinner time. Finally, when issued a past-in-future obligation, if Bobby has not already tidied his room, then he must do it before dinner time.⁶

⁶These timelines are strictly to facilitate informal understanding of the proposal. They are far from adequate semantic representations, which we will attempt to provide in sections 4.6, and later in 4.9.

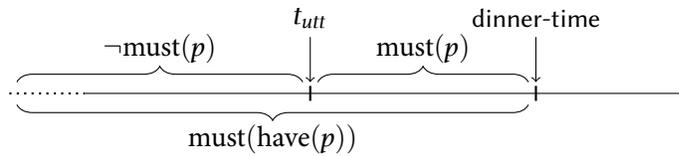


Figure 3: Timeline of obligation imposing

Although the obligation to tidy his room was not in place prior to t_{utt} , Bobby was allowed to tidy his room. So assuming that Bobby is generally a compliant deontic patient, he might have already done it, but he need not have.

Now consider the case of permission granting (199). With the perfect preajcent, the predicted meaning should be that Bobby is permitted to watch TV in the time interval extending backwards from bed time. However, this permission sentence is grammatically deviant.

- (199) SCENARIO: *Alice arrives home and sees that Bobby is sad. She decides to let him watch TV before he goes to bed.*
- a. You may watch TV before bed time.
 - b. * You may have watched TV before bed time. (deontic)

Recall, however, that for permission to be granted in a performative sense, the preajcent must be prohibited prior to the utterance time. This would give us a timeline for permission granting like that in Figure 4, where t_{utt} is the utterance time, and p is *you watch TV*.

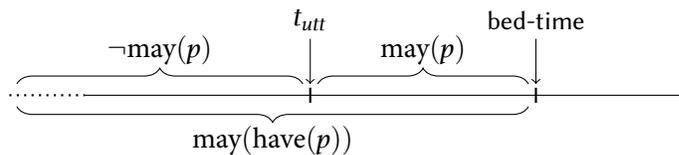


Figure 4: Timeline of permission granting

If the deontic patient, Bobby, has been a compliant deontic patient, then he will not have watched TV prior to t_{utt} . Consequently, upon receiving the perfect permission in (199b), Bobby would be permitted to watch TV at some time prior to bed time, *but not before the utterance time*. That is, assuming that Bobby has complied

with Alice commands up until t_{utt} , the timeline for permission granting would end up more like that in Figure 5.

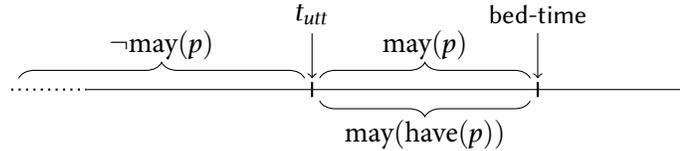


Figure 5: Timeline of permission granting with compliance

Informally, then, the idea is that the permission granted in (199b) is equivalent to the permission granted in (199a). However, as we will see, the option-based, *To Do List* system discussed in the previous two chapters does not quite capture this yet. Firstly, the discussion above frequently makes the assumption that the deontic patient is ‘compliant’. But we might ask what exactly this means, and whether or not it is a justified assumption.

4.5 Compliance

Recall that in Chapter 2, we motivated a principle of *Reasonableness* based on a constitutive rule of Lewis’s (1979) language game. There we considered what consequences Lewis’s rule would have on what the deontic authority could reasonably oblige or permit.

“*The Slave* [deontic patient] *tries to see to it that the actual world is within the sphere of permissibility* [\approx the best worlds] *at all times.*”

(Lewis, 1979, p.22)

The principle *Reasonableness* said that every $t - 1$ best world must have some way to become a t best world. However, note that Lewis’s rule could be argued to have a further consequence. Namely, any new obligations or permissions issued by the deontic authority are done so on the assumption that the deontic patient has complied with his obligations and permissions up to that point. The deontic authority and the deontic patient act as though it is common ground that the deontic patient is compliant with the options made available to him. Another way of saying this is that a deontic patient β is compliant with a deontic authority α iff every world

accessible to α and β , given what is mutually believed at t , shares a past with some $t - 1$ best world.⁷

(200) *Compliance*:

$$\begin{aligned} &\text{For any } \alpha, \beta, w, t : C_{w,t}(\beta, \alpha) \Leftrightarrow \\ &\forall \langle w', t' \rangle \in \text{Acc}_{w,t}^{\alpha, \beta} : \\ &\quad \exists \langle w'', t'' \rangle \in \max_{\text{TDL}_{w,t-1}^{\alpha, \beta}} (\text{Acc}_{w,t-1}^{\alpha, \beta}) : \langle w', t'' \rangle \in \text{Hist}_{w'', t''} \end{aligned}$$

In practice a deontic patient could consistently misbehave, failing to comply with the obligations imposed on him. Certainly, children misbehave and slaves may disobey their masters. However, by issuing an order or granting permission, the deontic authority is behaving as though *Compliance* holds precisely because this is the condition under which these linguistic expression can have the performative force that they do. Consider a deontic authority who did not presuppose that the deontic patient complies with the obligations imposed on him. Could this deontic authority claim to possess any authority at all? The answer in this case is clearly negative. The entire notion of authority is predicated on compliance. If the deontic authority hopes to impose any obligations, she must act as though the deontic patient complies with those obligations. Similarly, in order to grant permission to the deontic patient, the deontic authority must presuppose that the deontic authority has been complying with the prior prohibition imposed on him. If not, she would appear to concede that she has no authority over the patient—a concession which would undermine the act of imposing an obligation or granting permission to begin with.

4.6 Putting it all together

Based on the *To Do List* semantics adopted for deontic modals in Chapters 2 & 3, we can give a semantics for the past-in-future reading of the perfect permission, and the bare permission sentences. The semantics we predict for the perfect permission is given in (201).⁸

$$(201) \quad \llbracket \text{may FUT have you eat a cookie before bedtime} \rrbracket^s(w_0)(t_0)$$

⁷Note that, in order to cash this out, the time and world coordinates have to come apart in the final part of this definition because the time coordinate of the historical alternatives of the best worlds at $t - 1$ will not contain the temporal coordinate of the mutually accessible world-time pairs at t .

⁸The presupposition of *Reasonableness* is omitted here as it is not relevant.

- a. is defined only if
- i. $\forall \langle w_1, t_1 \rangle \in \text{Acc}_{w_0, t_0}^{sp, h} :$

$$\langle w_1, t_1 \rangle \in \text{dom} \left(\left[\left[\begin{array}{c} \text{FUT have you eat a} \\ \text{cookie before bedtime} \end{array} \right] \right]_{\text{Acc}_{w_0, t_0}^{sp, h}} \right)$$
 - ii. $\neg \exists \langle w_2, t_2 \rangle \in \max_{\text{TDL}_{w_0, t_0-1}^{sp, h}} (\text{Acc}_{w_0, t_0-1}^{sp, h}) : \exists t_3 \succ t_2 : \exists t_4 \preceq t_3 :$

$$t_4 \prec \text{bedtime} \wedge \text{eat-cookie}(h)(w_2)(t_4)$$
 - iii. and $\mathcal{C}_{w_0, t_0}(h, sp)$
- b. if defined, = 1 iff $\exists \langle w_3, t_5 \rangle \in \max_{\text{TDL}_{w_0, t_0}^{sp, h}} (\text{Acc}_{w_0, t_0}^{sp, h}) :$
- $$\exists t_6 \succ t_5 : \exists t_7 \preceq t_6 : t_7 \prec \text{bedtime} \wedge \text{eat-cookie}(h)(w_3)(t_7)$$

The first clause (201a-i) requires that the presuppositions of the past-in-future pre-jacent are satisfied throughout the modal base, and going forward we will omit this presupposition for the purposes of space. The second clause (201a-ii) requires that there are no $t_0 - 1$ best worlds (read world-time indices) in which the hearer ate a cookie at any time before bedtime. What is more, the hearer has complied with this prohibition up to t_0 (201a-iii). Consequently, the sentence will only be defined if there are no worlds among the mutually accessible worlds in which the hearer ate a cookie at or prior to t_0 . It will be true only if there is some t_0 best world in which the hearer eats a cookie at any time before bedtime (201b). But crucially, since the accessible worlds do not contain any worlds in which the hearer ate a cookie at or prior to t_0 , all those t_0 best worlds in which the hearer does eat a cookie, he will do so at a time after t_0 . More generally, we can observe that the presuppositions in (201a-ii) and (201a-iii) entail (202), which says that there are no t_0 best worlds in which the hearer ate a cookie at or prior to the speech time.

$$(202) \quad \neg \exists \langle w_1, t_1 \rangle \in \max_{\text{TDL}_{w_0, t_0}^{sp, h}} (\text{Acc}_{w_0, t_0}^{sp, h}) : \exists t_2 \preceq t_1 : \text{eat-cookie}(h)(w_1)(t_2)$$

So at least in the assertive content, the perfect marker *have* will be redundant. However, when we turn to the predicted semantics for our bare future permission (203), we will see that the meaning of the two sentences come apart.

$$(203) \quad \llbracket \text{may FUT you eat a cookie before bedtime} \rrbracket^s(w_0)(t_0)$$

- a. is defined only if
- i. $\neg \exists \langle w_2, t_2 \rangle \in \max_{\text{TDL}_{w_0, t_0-1}^{sp, h}} (\text{Acc}_{w_0, t_0-1}^{sp, h}) : \exists t_3 \succ t_2 :$

$$t_3 \prec \text{bedtime} \wedge \text{eat-cookie}(h)(w_2)(t_3)$$

- ii. and $\mathcal{C}_{w_0, t_0}(h, sp)$
- b. if defined, = 1 iff $\exists \langle w_3, t_4 \rangle \in \max_{\text{TDL}_{w_0, t_0}^{sp, h}} (\text{Acc}_{w_0, t_0}^{sp, h}) :$
 $\exists t_5 \succ t_4 : t_5 \prec \text{bedtime} \wedge \text{eat-cookie}(h)(w_3)(t_5)$

In (203), the truth conditions are similarly met if there is some t_0 best world in which the hearer ate a cookie after t_0 before bedtime (203b). Once again, the presupposition is simply that the prejacents was prohibited at $t_0 - 1$. Which means that (203a-i) ends up being logically weaker than (201a-ii). It only requires that none of the $t_0 - 1$ best worlds are worlds in which the hearer eats a cookie after t . As it stands, these sentences are Strawson equivalent (von Fintel, 1999). That is, when we consider only those worlds for which their denotations are defined, they are equivalent.

4.7 Structural economy and efficiency revisited

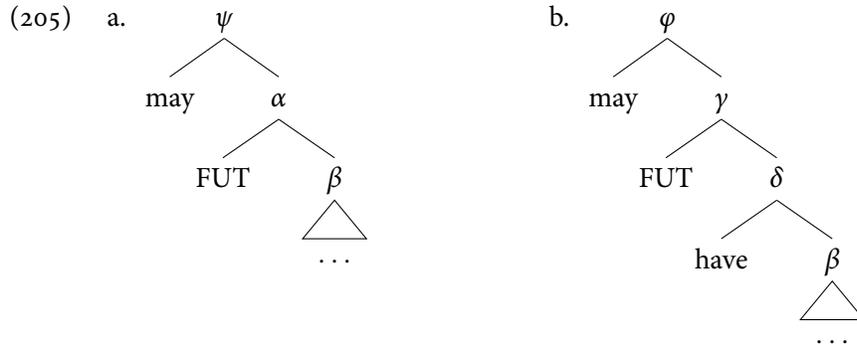
Intuitively, perfect permission is deviant precisely because it requires more structure, yet it adds no information beyond what a bare permission conveys. In Chapter 1, section 1.6 we introduced the principle of *Efficiency* (repeated below) devised by Meyer (2015) as a formalization of the Gricean intuition of brevity.

(204) *Efficiency*

An LF φ is ruled out if there is a distinct competitor ψ such that:

- a. $\psi < \varphi$ where $<$ means ‘strictly simpler’ in the sense of Fox and Katzir (2011)
- b. $\llbracket \psi \rrbracket \equiv \llbracket \varphi \rrbracket$

On fairly standard assumptions, the LFs which we propose to be in competition would be as in (205a) and (205b).



According to the definition of structural simplicity from Fox and Katzir (2011), it should be clear that $\psi \lesssim \varphi$ and $\varphi \not\lesssim \psi$.⁹ Replacing δ with its subconstituent β in (205b) produces ψ in (205a). This is a valid replacement and hence $\psi \lesssim \varphi$. Secondly, $\varphi \not\lesssim \psi$ because there is no valid transformation that the tree in (205b) could undergo to produce (205a). Crucially, φ contains the terminal *have* which ψ does not, and insertion of additional terminal nodes is not a transformation which will produce a simpler structure.

The attentive reader will have observed, however, that, stated this way, *Efficiency* will not give us precisely what we want. Specifically, the denotation of a bare permission and a (past-in-future reading of a) perfect permission are not strictly equivalent, only Strawson equivalent. The presupposition of the past-in-future permission is stronger. As such the clause in (204b), is not satisfied. We can consider two possible fixes to this problem. Firstly, we could redefine *Efficiency* as follows.

(206) *Efficiency (Version 2)*

An LF φ is ruled out if there is a distinct competitor ψ such that:

- a. $\psi < \varphi$
- b. $\llbracket \psi \rrbracket = \llbracket \varphi \rrbracket$ whenever the presuppositions of $\llbracket \psi \rrbracket$ and $\llbracket \varphi \rrbracket$ are satisfied.

⁹Fox and Katzir's definition of structural simplicity is repeated in (i).

- (i) $\psi \lesssim \varphi$ if ψ can be derived from φ by successive replacements of subconstituents of φ with elements from:
 - a. The lexicon
 - b. Subconstituents of φ

However, Paul Marty (pc) notes that this will not work. He provides the following example.

- (207) a. Alice's uncle has brown hair.
 b. Alice's friendly uncle has brown hair.

The definite description in (207b) triggers the presupposition that Alice has a unique friendly uncle. So any context in which the presuppositions of both (207a) and (207b) are satisfied, will be a context in which Alice has only one uncle and he is friendly. In which case, the addition of *friendly* should be redundant, but it isn't. Intuitively, the problem here is that (207b) can be uttered in a context in which Alice has more than one uncle, while (207a) cannot. If we restate *Efficiency* in such a way that it is sensitive only to the presuppositions of the more complex form, then this will rule out our perfect permission sentences, while not ruling out (207b).

(208) *Efficiency (Version 3)*

An LF φ is ruled out if there is a distinct competitor ψ such that:

- a. $\psi < \varphi$
 b. $\llbracket \psi \rrbracket = \llbracket \varphi \rrbracket$ whenever the presuppositions of $\llbracket \varphi \rrbracket$ are satisfied.

Let us consider our examples again. The uniqueness presupposition of (207b) will be satisfied if Alice has exactly one friendly uncle, but she may or may not have additional uncles. In such a context, there will be worlds for which (207b) is true but (207a) is not defined. As a consequence, the addition of *friendly* in (207b) will not be ruled out by our updated version of *Efficiency*. Finally, consider our perfect permission sentences. On our semantics, the bare permission sentences will always be defined when the perfect permission is defined, and whenever the perfect permission is defined, it will be equivalent to the bare permission sentence.

Our first solution, then, was to redefine *Efficiency* in such a way that it is sensitive to the presuppositions of the more complex alternative. This is a solution which I find plausible and appealing. If, however, the reader is uncomfortable with such a suggestion or if it turns out that such a move is empirically inadequate, then a second potential solution is to revise the performative presupposition in such a way that it is equivalent for both the bare permission and the perfect permission sentences. However, it should be noted that this solution is quite *ad hoc*.

4.8 Revising the performative presupposition

In this section, we will revisit the performative presupposition to see whether we can improve our current predictions. Our proposal here will be to strengthen the performative presupposition of a bare permission sentence to that of a perfect permission sentence. Although this might at first seem too strong, we suggest that contextual restriction on the time span quantified over appears to be necessary in the general case, and hopefully that will go some way to placating any qualms on this front. To start with, let us see what our intuitions tell us about obligation sentences to see if they can shed any light on our problem. Consider again the bare obligation sentence (209a) and the perfect obligation sentence (209b).

- (209) a. You must tidy your room.
b. You must have tidied your room before bed time.

Intuitively, what is being obliged in (209a) is not that the hearer tidies his room at just any time in the future. But rather, the hearer is obliged to tidy his room *soon*. Likewise, in (209b) the hearer will not have satisfied his obligation if his room was tidied last week, nor will he satisfy his obligation if he does it next week. Again, the hearer is obliged to either have tidied his room *recently*, or to tidy it *soon*. What these sentences have in common is that the room tidying must happen within some contextually relevant time span. How they differ is that (209a) places the room tidying at some future point within that time span, whereas (209b) allows for the room tidying to have occurred at a past time within that time span.

Now something similar appears to be going on with our permission sentence. Both in terms of its assertion, and its presupposition.

- (210) You may eat a cookie.

While this sentence permits the deontic patient to eat a cookie at some future point within a relevant time span, the presupposition appears to be that, prior to the change in options, the deontic patient was prohibited from eating a cookie at *any* time in that relevant time span. Crucially, this presupposition is stronger than the presupposition we have been assuming so far.

In order to capture this stronger presupposition we include in the presupposition an existential quantifier over all times. The revised presuppositions of perfor-

mative *may* and *must* are as follows, while everything else remains the same.¹⁰

(211) $\llbracket \text{may } \varphi \rrbracket^s(w_0)(t_0)$ is only defined if

$$\neg \exists \langle w_1, t_1 \rangle \in \max_{\text{TDL}_{w_0, t_0-1}^{sp, h}} (\text{Acc}_{w_0, t_0-1}^{sp, h}) : \exists t_2 : \llbracket \varphi \rrbracket^{\text{Acc}_{w_0, t_0-1}^{sp, h}}(w_1)(t_2) = 1$$

(212) $\llbracket \text{must } \varphi \rrbracket^s(w_0)(t_0)$ is only defined if

$$\neg \forall \langle w_1, t_1 \rangle \in \max_{\text{TDL}_{w_0, t_0-1}^{sp, h}} (\text{Acc}_{w_0, t_0-1}^{sp, h}) : \exists t_2 : \llbracket \varphi \rrbracket^{\text{Acc}_{w_0, t_0-1}^{sp, h}}(w_1)(t_2) = 1$$

Now the performative presupposition of a permission sentence requires that there are no $t_0 - 1$ best worlds for which φ is true at any time. At first glance, this is far too strong. However, this is not a problem specific to our presupposition here. As we have just observed, obligations are typically imposed with a relevant time span in mind. (209a) will not be satisfied unless the deontic patient tidies his room *soon*. Likewise, a perfect obligation such as (209b) would not be satisfied if the deontic patient tidied his room several years ago.

This problem arises from treating temporal operators as existential quantifiers (Partee, 1973). The standard solution is to propose that the domain of quantification is contextually restricted to salient intervals. What this means for our present purposes is that the reference time of the deontic option can similarly be restricted to intervals within a contextually supplied time span. Obviously, we would like to say something about which intervals the reference of this time span should be limited to. This is probably pragmatically determined. However, in the case of permission statements specifically, we would not want the time span to extend further backwards than the time at which the prohibition was initially put in place.

¹⁰Throughout, we will use a single existential quantifier over times in our presupposition. This might appear to be non-compositional since it gives the impression we have stripped the preajcent of temporal operators such as *FUT* or the perfect *have*. However, this is just a notational short hand which is made possible by the following equivalences.

- (i) $\exists t : P(t)$
 $\equiv \exists t : \exists t' \succ t : P(t')$
 $\equiv \exists t : \exists t' \succ t : \exists t'' \preceq t' : P(t'')$

4.9 Putting it all together again

Now that we have, at least somewhat, reassured ourselves that introducing an existential quantifier over times in the performative presupposition is no more problematic than treating temporal operators as existential quantifiers generally, we find ourselves in a position where we can take a second pass at a semantics for a perfect permission and a bare performative permission. First, consider the simple permission sentence which just contains *FUT* in the prejacent.

- (213) $\llbracket \text{may FUT you eat a cookie before bedtime} \rrbracket^s(w_0)(t_0)$
- a. is defined only if
 - i. $\neg \exists \langle w_2, t_2 \rangle \in \max_{\text{TDL}_{w_0, t_0-1}^{sp, h}} (\text{Acc}_{w_0, t_0-1}^{sp, h}) : \exists t_3 : t_3 \prec \text{bedtime} \wedge \text{eat-cookie}(h)(w_2)(t_3)$
 - ii. and $C_{w_0, t_0}(h, sp)$
 - b. if defined, = 1 iff $\exists \langle w_3, t_4 \rangle \in \max_{\text{TDL}_{w_0, t_0}^{sp, h}} (\text{Acc}_{w_0, t_0}^{sp, h}) : \exists t_5 \succ t_4 : t_5 \prec \text{bedtime} \wedge \text{eat-cookie}(h)(w_3)(t_5)$

This is defined only if eating a cookie was prohibited prior to the speech time, and the hearer is compliant. It is true only if eating a cookie at some future point is permitted at the speech time. So this sentence will be defined and true in a context in which the hearer has not eaten a cookie at any time, and there are some best worlds at which the hearer eats a cookie at a future time before bedtime. Now consider a perfect permission with a past-in-future reading.

- (214) $\llbracket \text{may FUT have you eat a cookie before bedtime} \rrbracket^s(w_0)(t_0)$
- a. is defined only if
 - i. $\neg \exists \langle w_2, t_2 \rangle \in \max_{\text{TDL}_{w_0, t_0-1}^{sp, h}} (\text{Acc}_{w_0, t_0-1}^{sp, h}) : \exists t_3 : t_3 \prec \text{bedtime} \wedge \text{eat-cookie}(h)(w_2)(t_3)$
 - ii. and $C_{w_0, t_0}(h, sp)$
 - b. if defined, = 1 iff $\exists \langle w_3, t_4 \rangle \in \max_{\text{TDL}_{w_0, t_0}^{sp, h}} (\text{Acc}_{w_0, t_0}^{sp, h}) : \exists t_5 \succ t_4 : \exists t_6 \preceq t_5 : t_6 \prec \text{bedtime} \wedge \text{eat-cookie}(h)(w_3)(t_6)$

The presuppositions of our perfect permission and our bare future permission sentences are now the same. The truth conditions of the simple future permission say that the hearer is permitted at t_0 to eat a cookie at some future time before bedtime,

while the truth conditions of the perfect permission say that the hearer is permitted at t_0 to eat a cookie at any time before bedtime. However, given that the hearer is presupposed to be compliant, the only contexts in which the permission will be defined are ones in which the hearer has not eaten any cookies at any contextually relevant time up to and including t_0 . As such, all the best worlds at t_0 in which the hearer does eat a cookie will be ones in which he does so at a future time. The situations in which the perfect permission is defined and true are all and only those for which the simple future permission sentence is defined and true. This renders the two structural alternatives strictly equivalent, and the perfect maker *have* redundant.

$$(215) \quad \llbracket \text{may FUT } \varphi \rrbracket \equiv \llbracket \text{may FUT have } \varphi \rrbracket$$

As mentioned, above, I find this second solution somewhat unappealing. While it is not unreasonable that the presupposition should be strengthened somehow to reflect that the prior prohibition extends back to the point at which it was put in place, this brute-force means of doing so is not particularly elegant.

4.10 Accounting for amelioration effects

In section 4.2.3, we noted that not all perfect permission sentences are entirely degraded. Specifically, we noted that permission sentences with certain numerical quantifiers in object position appear to be more or less perfectly acceptable environments for the perfect. The following examples are repeated from (187).

- (216)
- a. You may have eaten only three cookies before bedtime.
 - b. You may have watched no more than two hours of television by bedtime.
 - c. Alice allowed Bobby to have eaten at most three cookies before bedtime.

We also noted that construction which involve permission requesting, as opposed to permission granting, did not improve in acceptability of perfect prejacent despite the presence of the same type of numerical quantifiers.

- (217)
- a. * Please can I have eaten ({only/no more than/at most}) three cookies before bedtime?

- b. * Bobby asked to have watched ({only/no more than/at most}) two hours of television by bedtime.

How do these facts fit with the picture we have described above? Here we will attribute these facts to the sentences in (216) being interpreted as prohibition imposing speech acts as opposed to permission granting speech acts. It is on this prohibitive reading that the perfect marker *have* is not redundant, and the sentences are acceptable. In contrast, the permission seeking requests cannot be interpreted as prohibition seeking requests. They therefore lack a reading on which the perfect marker *have* is not redundant.

4.10.1 Wide scope (implicit) negation and prohibition

As mentioned, we attribute the amelioration effects observed above to the sentences in question being disguised prohibitions, as opposed to permission sentences. More specifically, we suggest that the ability to be interpreted as prohibitions is due to the presence of, potentially implicit, negation in the meaning of the numerical determiners in question which can then be interpreted with wide scope over the permission modal. Furthermore, this type of reading is not available with permission requesting, and thus these requests cannot embed the perfect regardless of the object within the prejacent.

With this in mind, let us first see some evidence that wide scope negation in a permission context can indeed be used in prohibition imposing. Consider first (218a), this is readily understood as setting up a prohibition on the hearer, prohibiting him from eating more than three cookies. Compare this to (218b). The first thing to note is that this sentence is notably odd. The only interpretation it can afford is one on which the deontic patient is requesting that he not be obliged to eat more than three cookies before bedtime. He wants permission to eat less cookies than is required of him. Given the appropriate context this reading could be made felicitous. Crucially, however, it cannot afford a reading on which the negation takes scope over *can*. It cannot be used to request that the speaker be prohibited from eating more than three cookies.

- (218) a. You may eat no more than three cookies before bedtime.
 \rightsquigarrow You may not eat more than three cookies before bedtime.
 b. # Please can I eat no more than three cookies before bedtime?

↗ The speaker wants to not be permitted to eat more than three cookies before bedtime.

Turning now to commitment predicates, a similar prohibitive reading can be seen with verbs which describe permission granting events such as *allow* when the complement features a lexical item associated with wide scope negation (219a). This stands in contrast with the verbs which describe permission requesting events such as *ask*.

- (219) a. Alice allowed Bobby to eat at most three cookies before bedtime.
 ↗ Alice prohibited Bobby from eating more than three cookies before bedtime.
- b. # Bobby asked to eat at most three cookies before bedtime.
 ↗ Bobby asked not to be allowed to eat more than three cookies before bedtime.

Once again, the sentence in (219b) is odd except in a context in which Bobby is obliged to eat many cookies against his desires. But, much like with permission requesting root questions, the implicit negation associated with *at most* cannot scope over the existential quantification of the modal component of the verb *ask*.

One might wonder whether there is any evidence that these sentences are indeed prohibitions as opposed to simply permissions with a proviso. I think that there is. Consider first a case in which such a sentence is used out of the blue to grant permission.

- (220) SCENARIO: *Alice has baked some cookies and has told Bobby he is not allowed any cookies until after dinner time. However, when Alice finds out that Bobby has tidied his room without being asked, she tells Bobby (220a,220b)*
- a. Well done. You may eat a cookie.
- b. # Well done. You may eat {only/no more than/at most} three cookies.

In a context in which eating cookies is not an option available to Bobby, (220b) is quite odd. This would be expected if Bobby is not being permitted to eat cookies here, but rather is being prohibited from eating more than three cookies, without being allowed to eat cookies in the first place. Consider also the following sentences.

- (221) SCENARIO: *Bobby finishes tidying his room and asks Alice whether he can eat a cookie. She replies (221a,221b,221c)*

- a. OK, but you may eat {only/no more than/at most} three cookies.
- b. OK, but you must eat {only/no more than/at most} three cookies.
- c. OK, but you must not eat more than three cookies.

In (221a), Alice agrees to allow Bobby to eat some cookies, but prohibits him from eating a number of cookies greater than three. Indeed, the sentence seems to be completely synonymous with a *must* sentence in which negation scopes under the universal modal (221b), or a *must not* sentence (221c). These data indicate that constructions of the sort which show amelioration effects may indeed be prohibition imposing as opposed to permission granting sentences. In the next section, we will show how the account developed so far correctly predicts that, unlike permission sentences, prohibition sentences are suitable environments for past-in-future readings of the perfect.

4.10.2 Prohibition and the perfect

Here we will show that, while the perfect marker *have* is redundant in prejacent of permission modals which have a performative presupposition, the same is not true of the perfect in prohibition sentences. Let us first propose the following semantics for performative prohibition sentences based on our semantics for obligation imposing sentences. The relevant parts are the prior permission presupposition (222a-i), and the update of the TDL with the denotation of the negation of the prejacent (222c).

- (222) $\llbracket \text{NEG may } \varphi \rrbracket^s(w_0)(t_0)$
- a. is defined only if
 - i. $\exists \langle w_2, t_2 \rangle \in \max_{\text{TDL}_{w_0, t_0-1}^{sp, h}} (\text{Acc}_{w_0, t_0-1}^{sp, h}) : \llbracket \varphi \rrbracket^{\text{Acc}_{w_0, t_0-1}^{sp, h}}(w_2)(t_2) = 1$
 - ii. and $\mathcal{C}_{w_0, t_0}(h, sp)$
 - b. if defined, = 1 iff

$$\neg \exists \langle w_3, t_3 \rangle \in \max_{\text{TDL}_{w_0, t_0}^{sp, h}} (\text{Acc}_{w_0, t_0}^{sp, h}) : \llbracket \varphi \rrbracket^{\text{Acc}_{w_0, t_0}^{sp, h}}(w_3)(t_3) = 1$$
 - c. where $\text{TDL}_{w_0, t_0}^{sp, h} = \text{TDL}_{w_0, t_0-1}^{sp, h} \cup \{\lambda w. \lambda t. \llbracket \varphi \rrbracket^{\text{Acc}_{w_0, t_0}^{sp, h}}(w)(t) = 0\}$

If a prohibition is to be defined and true, then at $t_0 - 1$ there must be no proposition which entails the denotation of φ on the deontic patient's list of options. Upon

updating the list with the negation of φ , the new best worlds at t_0 will feature no φ worlds.

Next let us take a look at how this mechanism works when the prejacent contains one or more of the temporal operators we are concerned with. Firstly, let us consider bare future oriented prejacent.¹¹

- (223) $\llbracket \text{NEG may FUT } \varphi \rrbracket^s(w_0)(t_0)$
- a. is defined only if
 - i. $\exists \langle w_2, t_2 \rangle \in \max_{\text{TDL}_{w_0, t_0-1}^{sp, h}} (\text{Acc}_{w_0, t_0-1}^{sp, h}) :$
 $\exists t_3 \succ t_2 : \llbracket \varphi \rrbracket^{\text{Acc}_{w_0, t_0-1}^{sp, h}}(w_2)(t_3) = 1$
 - ii. and $\mathcal{C}_{w_0, t_0}(h, sp)$
 - b. if defined, = 1 iff $\neg \exists \langle w_3, t_4 \rangle \in \max_{\text{TDL}_{w_0, t_0}^{sp, h}} (\text{Acc}_{w_0, t_0}^{sp, h}) :$
 $\exists t_5 \succ t_4 : \llbracket \varphi \rrbracket^{\text{Acc}_{w_0, t_0}^{sp, h}}(w_3)(t_5) = 1$

Importantly, (223) is compatible with it being possible that the deontic patient has realised φ prior to the speech time. Next, consider the case for a past-in-future reading of a perfect prohibition sentence.

- (224) $\llbracket \text{NEG may FUT have } \varphi \rrbracket^s(w_0)(t_0)$
- a. is defined only if
 - i. $\exists \langle w_2, t_2 \rangle \in \max_{\text{TDL}_{w_0, t_0-1}^{sp, h}} (\text{Acc}_{w_0, t_0-1}^{sp, h}) :$
 $\exists t_3 \succ t_2 : \exists t_4 \preceq t_3 : \llbracket \varphi \rrbracket^{\text{Acc}_{w_0, t_0-1}^{sp, h}}(w_2)(t_4) = 1$
 - ii. and $\mathcal{C}_{w_0, t_0}(h, sp)$
 - b. if defined, = 1 iff $\neg \exists \langle w_3, t_5 \rangle \in \max_{\text{TDL}_{w_0, t_0}^{sp, h}} (\text{Acc}_{w_0, t_0}^{sp, h}) :$
 $\exists t_6 \succ t_5 : \exists t_7 \preceq t_6 \llbracket \varphi \rrbracket^{\text{Acc}_{w_0, t_0}^{sp, h}}(w_3)(t_7) = 1$

Crucially, (224a) will be false if it is possible that the deontic patient has already realised φ prior to the speech time. The upshot of all of this is that a past-in-future reading of a perfect prohibition is not (Strawson) equivalent to a bare prohibition. This correctly predicts that the availability of a wide scope interpretation of negation for a permission granting sentences, and the unavailability of a corresponding reading for a permission requesting sentences, should indeed correlate with the respective (un)acceptability of an embedded perfect marker in these sentences.

¹¹Here we do not assume the additional existential quantifier in the presupposition.

Finally, it should be mentioned that we predict that a perfect prohibition should be fully acceptable when the modality is expressed with the combination *may not*. This seems to be corroborated by the facts, however, I do find a *must not* perfect prohibition preferable to a *may not* perfect prohibition.

- (225) a. ? You may not have eaten any cookies before bedtime.
b. You must not have eaten any cookies before bedtime.

The relative acceptability of these sentences may be attributable to the fact that *must+have* is otherwise acceptable with a past-in-future reading, while *may+have* is not. The preference for the former over the latter could thus be a frequency effect. Furthermore, we mentioned above that not all speakers find the amelioration effects to be completely clear cut. Nevertheless, our proposal appears to be getting the facts right.

Chapter 5

Adverbial Clauses

5.1 Introduction

In Chapters 2 & 3, we concerned ourselves primarily with the distribution of *FUT* under various modal operators. However, there are additional types of embedded clauses which receive a future interpretation in the absence of modal operators within the clause itself. These constructions will be the topic of the present chapter and, to some extent, the following chapter. This chapter in particular is concerned with adverbial clauses (ACs).

This chapter will have two primary aims. Firstly, we aim to describe, and subsequently provide an account for, the distribution of future orientation across three classes of ACs. The classes we consider will be: (i) conditional-like ACs, headed by connectives such as those listed in (226a), (ii) causal/concessive ACs (226b), and (iii) temporal ACs (226c).¹

- (226) a. Class I: Conditional ACs: *if, whether (or not), unless*
b. Class II: Causal/concessive ACs: *because, although, even though*
c. Class III: Temporal ACs: *when, before, after, while*

Some example sentences containing ACs of each type are given in (227) below.

- (227) a. {If / whether or not / unless} Alice gets home on time, she will be tired.

¹The list of connectives in (226) is not exhaustive.

- b. {Because / although / even though} Alice bought Bobby new clothes, he is upset.
- c. {When / before / after} Alice gets home, Bobby will be hungry.

Section 5.2 first outlines the distribution of future orientations in the three classes of ACs. In sections 5.3-5.5 we attempt to derive the observed patterns in 5.2 using the proposed semantics for *FUT* in combination with state-of-the-art semantics proposed for these classes of adverbial clauses.

The second goal of this chapter, addressed in section 5.6, is to argue that temporal ACs (Class III) provide evidence in favor of a local licensing account of the future, like that adopted here, as opposed to an account which relies on global licensing or a pragmatic restriction on future reference (e.g., Bohnemeyer, 2009; Kaufmann et al., 2006).

5.2 The distribution of future orientated adverbial clauses

5.2.1 Class I ACs independently license future orientation

First of all, let us consider Class I ACs. These clauses can be future oriented independently of the temporal properties of the main clause. In the following examples, the antecedent can be future oriented when the main clause is in the present (228a), the past (228b), or contains a future oriented modal such as *will* (228c).²

- (228)
- a. If Alice wins tomorrow, then she is better than Bobby.
 - b. If you see Bobby smiling later, his interview went well.
 - c. If the coin comes up heads, then Charlie will be happy.

Crucially, these clauses cannot be future oriented when they occur as root causes.

- (229)
- a. * Alice wins tomorrow.
 - b. * You see Bobby smiling later.
 - c. * The coin comes up heads.

Because conditional clauses license these unmodalized future orientations irrespective of the tense of the main clause, we will say that Class I ACs *independently* license future orientation.

²Example (228b) is based on Crouch's (1993b) example (1), while examples (228c) is based on Kaufmann's (2005) example (30) which we revisit in section 5.6 in the context of Class II ACs.

5.2.2 Class II ACs do not license future orientation

Next consider Class II ACs. These are unable to license a future orientation without a modal operator present in the AC regardless of the tense of the main clause. This can be seen for causal *because* in (230), and the concessive *although* in (231).

- (230) a. * Because Alice wins tomorrow, she is better than Bobby.
 b. * Because you see Bobby smiling later, his interview went well.
 c. * Because the coin comes up heads, Charlie will be happy.
- (231) a. * Although Alice wins tomorrow, she is worse than Bobby.
 b. * Although you see Bobby crying later, his interview went well.
 c. * Although the coin comes up heads, Charlie will be sad.

It should be noted that there is nothing wrong with a future oriented concessive AC provided there is an appropriate modal such as *will* within the AC. Of course, in this case the future operator *FUT* is licensed.³

- (232) a. Although Alice will win tomorrow, she is worse than Bobby.
 b. Although you will see Bobby crying later, his interview went well.
 c. Although the coin will come up heads, Charlie will be sad.

Crucially, Class II ACs cannot be future oriented without an appropriate modal in the AC.

5.2.3 Class III ACs dependently license future orientation

Finally, we turn to Class III ACs (temporal ACs). These ACs can be future oriented, but only when the main clause features a future licensing modal (233c,234c).

- (233) a. * When Alice wins tomorrow, she is better than Bobby.
 b. * When you see Bobby smiling later, his interview went well.
 c. When the coin comes up heads, Charlie will be happy.
- (234) a. * {Before/after} Alice wins tomorrow, she is better than Bobby.
 b. * {Before/after} you see Bobby smiling later, his interview went well.

³The case is not so simple for *because*-clauses as we will see in 5.5.

- c. {Before/after} the coin comes up heads, Charlie will be happy.

We will say that Class III ACs license future orientations *dependently*, since the acceptability of the future orientation is dependent on the temporal properties of the main clause.

The distribution of future oriented readings of unmodalized adverbial clauses is summarized in table 5, where the columns represent the temporal orientation of the main clause.

	Main clause		
	Present	Past	Future
Class I	✓	✓	✓
Class II	*	*	*
Class III	*	*	✓

Table 5: Future oriented readings of unmodalized adverbial clauses

The next three sections are dedicated to showing how the licensing conditions we have proposed for *FUT* can derive the distribution of future orientation in unmodalized ACs as just described. Let us tackle them in order.

5.3 Accounting for Class I ACs

In this subsection, we'll first provide an account for independently licensed future orientations in Class I ACs. First we introduce the *if*-clause-as-restrictor analysis of conditional ACs, showing how this renders conditional ACs acceptable environments for *FUT*. Following that, we discuss temporal shifting in the consequent.

5.3.1 The restrictor analysis and *FUT*

In accounting for the fact that conditional-like clauses (Class I ACs) can license future orientations independently of the main clause, we will show that the *if*-clause-as-restrictor analysis of conditionals (Lewis, 1975; Kratzer, 1981, 1986, 2012) in combination with *FUT* makes the correct predictions.

The *if*-clause-as-restrictor theory proposes that the conditional morpheme *if* has no semantic content in and of itself.

“There is no two place *if...then* connective in the logical forms of natural languages. *If* clauses are devices for restricting the domains of various operators.”

(Kratzer, 1986, 2012)

According to this account, a conditional AC restricts the domain of a (possibly covert) modal operator. Consider the example (235) from Heim (1982).

(235) If Alice enters the room, she might trip the switch.

On a traditional account of conditionals, (235) would be true iff all the worlds in which Alice enters the rooms are such that she might trip the switch. On the *if*-clause-as-restrictor account, the antecedent of the conditional serves to restrict the domain of the modal *might*. It predicts that (235) is true iff there exists some accessible world in which Alice enters the room and Alice trips the switch. An important point to make is that if the domain of quantification which is restricted by the antecedent is also restricted by an ordering source, then the restriction imposed by the conditional AC is imposed prior to the restriction imposed by the ordering source. Essentially, the purpose of a conditional AC *if* φ is to add φ to the set of propositions which determine the modal base. By way of illustration, consider the following example where the modal *should* is to be construed epistemically with an ordering source of likelihood.

(236) SCENARIO: *Bobby is part of his school's chess club. He shows a lot of promise, but he is extremely lazy and never studies any opening theory. The chess teacher enrolls him in a tournament for the upcoming summer, saying to Bobby's mother, Alice, (236a).*

a. If Bobby practices his openings, then he should win.

First, consider what the truth conditions would be if the antecedent were to restrict the domain of quantification after the ordering source. The sentence would be true iff every alternative which is maximally likely and in which Bobby practices his openings, Bobby wins the tournament. However, in this context Bobby is lazy and is unlikely to study opening theory. So there will not be any alternatives that are maximally likely in which Bobby practices his openings.⁴ Conversely, if the ordering source applies to a modal base which has first been updated with the antecedent,

⁴The sentence would therefore be either trivially true, or a presupposition failure (if conditional sentences presuppose that some world satisfies the antecedent).

then the truth conditions will be met if we consider only the epistemic alternatives in which Bobby practices his openings, and all of the most likely of those alternatives are ones in which he wins the tournament. It is clear that out of these two possibilities, it is the second which corresponds with our intuitions about the conditions under which (236a) would be true.

In cases where there does not appear to be any modal operator in the matrix clause, it is assumed that the conditional clause restricts a covert epistemic necessity modal \emptyset_{\square} (e.g., Kratzer, 1986, 2012; Kaufmann, 2005; Meyer, 2015, a.m.o), which, given the domain semantics adopted here, is a universal quantifier over worlds in the modal context s .

$$(237) \quad \llbracket \emptyset_{\square} \rrbracket^s(w_0)(t_0)(\llbracket \varphi \rrbracket^s) = 1 \text{ iff } \forall \langle w_1, t_1 \rangle \in s : \llbracket \varphi \rrbracket^s(w_1)(t_1) = 1$$

For concreteness, we assume that the conditional clause acts as an additional argument to the modal operator. When no overt conditional is present, the reference of the first argument can be contextually resolved.⁵

$$(238) \quad \llbracket \emptyset_{\square} \rrbracket^s(w_0)(t_0)(\llbracket \text{if } \varphi \rrbracket^s)(\llbracket \psi \rrbracket^s) = 1 \text{ iff} \\ \forall \langle w_1, t_1 \rangle \in s \cap \llbracket \varphi \rrbracket^s : \llbracket \psi \rrbracket^s(w_1)(t_1) = 1$$

This semantics for conditional clauses is compatible with the modal context including both φ and $\neg\varphi$ worlds. In fact, for an indicative conditional to be felicitous, typically both the antecedent and the consequent must be possible but not certain (Veltman, 1986). This ensures that the antecedent of a conditional will be hospitable environment for a future operator without the need for a modal operator.

Note that, although this semantics (correctly) predicts that the antecedent can contain *FUT* independently of the content of the consequent, it also predicts that the consequent should be able to independently license *FUT*. However, unlicensed future orientations are degraded in the consequent of a conditional.⁶

(239) If Alice is at the party, Bobby {will be/ *is} upset when he finds out.

⁵This semantics satisfies import-export, which (Mandelkern, 2020b) shows makes inaccurate predictions combined with a classical semantics for *and*. This is a matter of ongoing research, and I will not be able to address these issues here.

⁶Richard Stockwell (pc) notes that conditionals of this nature are attested in contexts of sporting punditry.

- (i) If Deulofeu is fit, then Watford wins tomorrow.

We propose, then, that in the case of a conditional, intersecting the modal base with the antecedent φ creates not just a new modal base, but also a new modal context against which the consequent is evaluated.

$$(240) \quad \forall \langle w_1, t_1 \rangle \in s \cap \llbracket \varphi \rrbracket^s : \llbracket \psi \rrbracket^{s \cap \llbracket \varphi \rrbracket^s} (w_1)(t_1) = 1$$

This is essentially Yalcin’s (2007) approach to indicative conditionals, and it is certainly reasonable given our assumptions about modal bases and modal contexts.⁷

As for the other ACs in this class, Rawlins (2008) proposes an analysis for so-called “unconditional” *whether or not*-clauses which treats them as set denoting conditional antecedents which restrict the domain of modal quantifiers in a point wise fashion. Similarly, *unless* clauses have been analysed by von Stechow (1991) as conditional like in nature. The present account extends to these constructions rather straightforwardly predicting them to independently license future orientations in the AC.⁸

5.3.2 Temporal shift in the main clause

Besides temporal shifting in the antecedent, Crouch (1993a,b) observes that there are also instances in which the temporal anchor of the main clause can be shifted. Take for instance the following two examples uttered in the context given.

- (241) SCENARIO: *Alice calls Bobby to tell him that the electricity has been shut off and she doesn’t know whether it will be back on by the time Bobby gets home. She tells him:*

He also notes that these constructions convey a certain over-confidence which sounds unreasonable outside of such contexts. To the extent I find these sentences acceptable, it feels as though the speaker is treating the consequent as scheduled in some sense, hence the feeling of over-confidence (after all, Watford winning is unlikely in most contexts).

⁷The possibility that modal domain restriction bears on the modal context allows for the possibility that the apparent weakness of epistemic *must*, discussed in Chapter 2 section 2.2.3, could be due to the presence of an implicit conditional antecedent. Instances of apparently weak readings of *must* are not due to the presence of an ordering source, but rather an implicit conditional antecedent. This suggestion is similar in spirit to that of Mandelkern (2016).

⁸Kyle Rawlins (pc) points out that so-called “biscuit” conditionals also license future interpretations of an unmodalized AC.

- (i) If you are hungry later, there is some pizza in the fridge.

If the present account is correct, this may be evidence in favor of a restrictor-type analysis of biscuit conditionals.

- a. If the light turns on when you come home later, then the electricity is back on.
- b. If the light turns on when you come home later, then the electricity has been turned back on.

In these examples, it is not just the antecedent which refers to a future time. The temporal anchor of the consequent can also be interpreted in the future. The present tense stative predicate in (241a) is interpreted as temporally overlapping the coming home event. Similarly, the present perfect in (241b) places the turning on of the electricity prior to the coming home, but after the time of Alice's utterance. In both cases, the context entails that Alice believes that the electricity is not on at the time of her utterance, meaning the only sensible interpretation in the context is one in which the consequent describes a future event.

More striking than this, however, is the following sentence which is based on Crouch's (1993a) example (5).

(242) If Alice smiles when she gets out, then the interview went well.

The surprising thing about this sentence is that the past tense of the consequent is not anchored to the speech time, but rather picks out a past time relative to the time at which Alice smiles. Both events can therefore be situated in the future despite the main clause being in the past tense (!). Crouch (1993a,b) thus distinguishes two forms of temporal shifting in conditionals. The following classifications are adapted from Crouch (1993b, p.5).⁹

- (243)
- a. *Antecedent deictic shifting*
 - i. Only affects antecedent tenses.
 - ii. Only gives present tenses future time reference.
 - b. *Consequent deictic shifting*
 - i. Affects consequent tenses, provided antecedent is shifted.
 - ii. Gives both past and present tenses future time reference.

So far, we have managed to account for antecedent deictic shifting by appealing to the covert future operator *FUT*. We also provided an explanation for why a consequent was unable to shift independently of the antecedent without an appropriate

⁹Crouch (1993b,a) calls antecedent deictic shifting "secondary deictic shifting", and he calls consequent shifting "primary deictic shifting". These names are confusing for our present purposes. Not least because primary shifting is dependent on secondary shifting and not vice versa.

modal, because it was required to be true in all of the worlds in the updated modal context. However, we currently have no account for the possibility of consequent shifting when the antecedent has shifted. And while antecedent shifting seems to be attributable to the presence of *FUT*, there are a number of good reasons to believe that consequent shifting cannot receive a similar treatment. Here, we will review some solid evidence that the temporal anchor of the main clause is in fact being bound somehow by the reference time in the future shifted antecedent. There are at least four reasons to think that this is correct. Firstly, as Crouch (1993b,a) observes, the consequent can only be shifted if the antecedent is shifted.

(244) * If Alice ordered pizza (earlier), Bobby eats it (later).

If *FUT* were licensed in the consequent, then why would it depend on the antecedent being shifted? Conversely, if the temporal anchor, or the NOW of the main clause was bound by the future time introduced in the antecedent, then this would follow straightforwardly.

Secondly, the event described in the consequent cannot follow the event of the antecedent even when the antecedent is shifted.¹⁰

(245) * If Alice goes to the party, she is happy the next day.

This data is compatible with the temporal anchor of the main clause being bound. However, if *FUT* were licensed in the consequent, then this sentence should be fine. In order for the reference time of the consequent to follow that of the antecedent, the consequent must contain an appropriate modal which can license *FUT*.

(246) If Alice goes to the party, she will be happy the next day.

Thirdly, a present tense consequent with an episodic eventive predicate is degraded. The following is based on Crouch (1993b) example (15).

(247) * If Alice goes to the party, she drinks too much.

¹⁰Crouch (1993a) provides instances of, what he calls, habitual conditionals in which every event described by the antecedent precedes an accompanying event described the consequent.

- (i) a. If the the temperature rises, then bimetallic strip bends.
- b. If Alice goes to a party, she drinks too much.

These habitual/generic conditionals almost certainly deserve their own treatment, and are outside the scope of the present discussion. Importantly, the specific reading of (245) is forced by the definite *the party*, standing in contrast to Crouch's habitual conditional (ib) which features the indefinite *a party*.

If the main clause were to feature its own *FUT*, this sentence should be straightforwardly acceptable.

Fourthly and finally, a past tense consequent can have future reference. This was exemplified by Crouch's (1993a) example, repeated below.

(248) If Alice smiles when she gets out, then the interview went well.

Now recall that Crouch observed that the antecedent cannot contain a future shifted past tense. It can only feature a future shifted present tense. The following can only receive a past interpretation, and is degraded when the temporal adverb *later* is added in the antecedent.

(249) If Alice smiled when she got out (*later), then the interview went well.

These two facts follow if we propose that *FUT* cannot occur in a deictic past tense clause. This would mean that past tense antecedents cannot embed *FUT*, and thus cannot be future shifted, and past tense consequent clauses can only receive a future interpretation when the temporal anchor of the clause is bound by the reference time of the antecedent clause.

Summarizing these data, we have seen that (i) the consequent can only be shifted if the antecedent is shifted, (ii) the consequent event cannot follow the antecedent event, (iii) present tense eventive consequent clauses are degraded, and (iv) past tense consequent clauses, but not past tense antecedent clauses, can be situated in the future. These data suggest that antecedent shifting is amenable to a treatment which posits a covert *FUT* in the antecedent. However, consequent shifting appears to be a different phenomenon entirely. It appears that the temporal anchor of the main clause (i.e., the consequent) is bound by the reference time in the antecedent, almost as if the main clause were in fact an embedded clause.

We know that English has such a relative past tense. The following data, again from Crouch (1993a), show that the anchor time of embedded clauses can be bound by a superordinate *FUT*.

- (250) a. By 1998, everybody will know someone who died of Aids.
b. Next week, you must show me a problem that you solved on your own.

These sentence can be given the following simplified LFs. Notice that in both cases the anchor of the *PAST* t_1 is a temporal variable which is bound by a superordinate *FUT* as opposed to the speech time t_0 .

- (251) a. By 1998, everybody will FUT λt_1 know someone who [PAST t_1] died of Aids.
 b. Next week, you must FUT λt_1 show me a problem that you [PAST t_1] solved on your own.

Could it be that precisely the same thing is occurring in consequent shifting? A potential issue with this suggestion is that the relative *PAST* in (251) is within the scope of *FUT*, whereas in the case of conditionals, *FUT* does not c-command the tense in the main clause. How could this past tense be relative? How could the main clause behave as though it is the embedded clause? The temporal anchor of the main clause, which is usually identified with the speech time, appears as though it can be bound by the reference time of the antecedent clause despite being outside of its c-command domain. Since we are primarily concerned in this dissertation with the distribution of *FUT*, and since we have concluded that consequent shifting is not attributable to *FUT*, we will not provide a complete account of consequent deictic shifting here. However, we will note that it is reminiscent of another non-canonical binding relation. Namely, that of donkey anaphora.

- (252) a. If [a farmer]_{*i*} owns [a donkey]_{*j*}, he_{*i*} loves it_{*j*}.
 b. If Alice FUT λt_1 smiles when she gets out, then the interview [PAST t_1] went well.

Notice also that consequent shifting is order sensitive (253b), as is the case for donkey anaphora (Chierchia, 1995).

- (253) a. * He_{*i*} loves it_{*j*}, if [a farmer]_{*i*} owns [a donkey]_{*j*}.
 b. * The interview [PAST t_1] went well, if Alice FUT λt_1 smiles when she gets out.

Unfortunately, we cannot work out a theory of temporal donkey anaphora here. However, in the next Chapter we will see further evidence that such an approach is potentially correct. Specifically, we will note that several other constructions which allow for this non-canonical binding configuration, such as binding out of the restrictor argument of a universal quantifier phrase and binding out of a disjunct, can also give rise to this type of temporal donkey anaphora provided the clause which contains the antecedent time is otherwise able to license *FUT*. These facts will further support our suggestion that consequent deictic shifting is best treated as the

result of temporal donkey binding, and is not due to the presence of a *FUT* in the consequent.

5.3.3 Previous accounts of future orientation in conditionals

Much of the data on the temporal properties of conditionals is based on data from the dissertation of Crouch (1993a). However, it is hard to compare the present proposal with that of Crouch. In particular, Crouch's (1993a; 1993b) analysis is framed in an intuitionistic logic which treats assertion and verification as semantic primitives which operate on information states. Moreover, Crouch (1993b,b) does not seem to be concerned with deriving the future orientation of conditionals *per se*. Since the present proposal is explicitly compositional and simply aims to derive the futurity of conditional antecedents, the two proposals might well be compatible, arguably being concerned with different levels of representation.

Both Kaufmann (2005) and Schulz (2008) provide an analysis for the future orientation in conditional antecedents, as well the consequent shifting observed by Crouch (1993a). Their accounts share many similarities to one another, and both attribute consequent shifting to a special type of modal base. Schulz (2008) calls this special modal base an “*ontic*” modal base. It is similar to a historical modal base, however she proposes that the time coordinate of the world-time pairs in the modal base are not just candidates for the evaluation time, but may be future times. A similar tact is adopted by Kaufmann (2005) who proposes that the modal base involved for conditionals allows future shifting.

In Chapter 6, we see some similar examples which involve a relative past in a main clause. Again, we find examples where a *FUT* is licensed and binds the temporal anchor of the main clause despite not being in a *c*-command relation with the anchor. These sentences do not involve a conditional syntax. As such, it is not clear whether Kaufmann (2005) or Schulz (2008) can accommodate these data. Conversely, a *FUT* account in combination with a relative past tense which is non-canonically bound in a donkey binding configuration would extend straightforwardly to those data.

5.4 Accounting for Class II ACs

Recall that Class II ACs do not license a future orientation in the absence of an appropriate modal within the AC. They are nonetheless of interest as we need to show that the semantics for *FUT* proposed above not only generates future orientations where attested, but also fails to generate future orientations where they are unattested. In this section, we will attempt to show how the contingency presupposition of *FUT* makes it unsuitable for embedding within the vast majority of Class II ACs. We attribute this to the fact that concessive clauses and fronted *because*-clauses are not at-issue. Given an appropriate notion of presupposition, we show that such ACs can never be defined when they contain *FUT*. Interestingly, we will also see a genuine counter example to this generalisation. Specifically, sentence final *because*-clauses can often be at-issue and can occur within the scope of modal operators in the main clause. In such a situation, and given an appropriate context, we will see that such ACs may be able to dependently license a future orientation.

5.4.1 Concessive clauses

First, consider concessive ACs such as those headed with *although* and *even though*.

(254) The ice didn't melt although the temperature rose.

Many traditional accounts of concessive constructions hinge on the fact that they are associated with the following inferences (e.g., König and Siemund, 2000, a.m.o).

- (255) a. The ice didn't melt although the temperature rose.
 b. \Rightarrow (i) The ice didn't melt.
 (ii) The temperature rose.
 (iii) Normally, if the temperature rises, the ice melts.

Of these inferences, (i) is clearly asserted, while (ii) and (iii) appear to be presuppositions. The important point for our purposes is that the content of the AC in concessive constructions is always backgrounded.

- (256) a. Bobby isn't happy {although/even though} Alice was here.
 b. If Bobby is happy {although/even though} Alice was here, then maybe he likes her.
 c. Bobby might be happy {although/even though} Alice was here.

- d. Was Bobby happy {although/even though} Alice was here?
 → Alice was here.

Putting these inference together, with a Kratzerian semantics for a generic conditional, we arrive at something like the following.

- (257) $\llbracket \text{although } \varphi, \psi \rrbracket^s(w_0)(t_0)$
- a. is defined only if
 - i. $\llbracket \varphi \rrbracket^s(w_0)(t_0) = 1 \wedge$
 - ii. $\forall \langle w_1, t_1 \rangle \in \text{max}_{\text{NORMAL}_{w_0, t_0}}(\llbracket \varphi \rrbracket^s) : \llbracket \psi \rrbracket^{\llbracket \varphi \rrbracket^s}(w_1)(t_1) = 0$
 - b. if defined, = 1 iff $\llbracket \psi \rrbracket^s(w_0)(t_0) = 1$

This presupposes that φ (the AC) is true and that the most normal φ worlds are worlds in which ψ (the main clause) is false. However, the sentence is true only when the main clause, ψ , is true. What is communicated, then, is that the actual world is not among the most normal.¹¹ For example, the sentence (254) conveys that it is somewhat surprising or unusual that the ice did not melt.

On the Stalnakerian approach to presupposition (Stalnaker, 1978), a concessive construction will be defined only if the content of the AC is entailed by the *context set* (i.e., the worlds compatible with the *common ground*). Intuitively, we would like this to be the source of the ungrammaticality when attempting to embed *FUT* in the AC without the presence of an appropriate modal. When an AC φ is presupposed, φ must be true at all world time pairs in the context set, *cs*. As such, any presuppositions ψ of φ must also be true at all world time pairs in *cs*. Finally, the modal context against which φ is interpreted is set to *cs*. In which case, a more accurate and more explicit way of writing (257) would be something like (258).

- (258) $\llbracket \text{although } \varphi, \psi \rrbracket^s(w_0)(t_0)$
- a. is defined only if $\forall \langle w_1, t_1 \rangle \in cs : \llbracket \varphi \rrbracket^{cs}(w_1)(t_1) = 1 \wedge$
 $\forall \langle w_3, t_3 \rangle \in \text{max}_{\text{NORMAL}_{w_0, t_0}}(\llbracket \varphi \rrbracket^{cs}) : \llbracket \psi \rrbracket^{\llbracket \varphi \rrbracket^{cs}}(w_3)(t_3) = 0$
 - b. if defined, = 1 iff $\llbracket \psi \rrbracket^s(w_0)(t_0) = 1$

Recall that, unlike most definedness conditions, the contingency presupposition of *FUT* does not make direct reference to the evaluation world, but rather it places a condition on the worlds in the modal context.

¹¹This is essentially the same as Toosarvandani's (2014) semantics for concessive *but*.

- (259) $\llbracket \text{FUT } \varphi \rrbracket^s(w_0)(t_0)$
- a. is defined only if $\exists \langle w_1, t_1 \rangle \in s : \exists t_2 \succ t_1 : \llbracket \varphi \rrbracket^s(w_1)(t_2) = 1$
 $\wedge \exists \langle w_2, t_3 \rangle \in s : \neg \exists t_4 \succ t_3 : \llbracket \varphi \rrbracket^s(w_2)(t_4) = 1$
 - b. if defined, = 1 iff $\exists t_5 \succ t_0 : \llbracket \varphi \rrbracket^s(w_0)(t_5) = 1$

Because of how *FUT* is defined, any presupposed clause of the form *FUT*(φ) will involve the following definedness conditions: (i) every world-time pair in *cs* must feature a subsequent time at which φ holds, and (ii) some world-time pair in *cs* must feature no subsequent time at which φ holds. There is no *cs* which can satisfy these definedness conditions, and consequently *FUT* cannot be embedded within a concessive AC, or indeed any presupposed clause.

5.4.2 *Because*-clauses

Consider next causal ACs headed by *because*. The first thing to note is that fronted *because*-clauses appear to be presupposed (260), or at the very least, outside the scope of modal operators in the main clause.¹² In which case, they could receive a similar treatment to concessive clauses.

- (260) a. Because Alice is here, Bobby isn't happy.
 b. Because Alice is here, Bobby might be happy.
 c. Because Alice was here, was Bobby happy?
 \rightarrow Alice was here.

However, unlike concessives, sentence final *because*-clauses can be at-issue.

- (261) a. Bobby isn't happy because Alice was here.
 b. If Bobby is happy because Alice was here, then maybe he likes her.
 c. Bobby might be happy because Alice was here.
 d. Was Bobby happy because Alice was here?
 \nrightarrow Alice was here.

¹²Conditional antecedents typically resist fronting operations (Haegeman, 2010) and so are not possible testing grounds for the projection properties of sentence initial *because*-clauses.

(i) * If because Alice is here Bobby is happy, then maybe he likes her.

Sæbø (1991, 2011) considers two analyses for *because* clauses. The first treats *because* as encoding a conjunction of the main clause ψ and the AC φ as well as what essentially amounts to a conditional in which φ acts as the antecedent restricting a generic quantifier with ψ as its scope.

- (262) a. The ice melted because the temperature rose.
 b. \Rightarrow (i) The ice melted.
 (ii) The temperature rose.
 (iii) If the temperature rises, ice melts.

Another analysis, based on Lewis's (1973) account of causation and defended in Sæbø (1980, 1991, 2011), proposes that ψ *because* φ asserts both φ and ψ as well as the counterfactual conditional *if* $\neg\varphi$, *then* $\neg\psi$.

- (263) a. The ice melted because the temperature rose.
 b. \Rightarrow (i) The ice melted.
 (ii) The temperature rose.
 (iii) If the temperature did not rise, the ice would not have melted.

This will give us a semantics as follows (where $\text{Sim}_{w,t}(p)$ picks out those p world-time pairs which are maximally similar to w at t Heim 1992).

- (264) $\llbracket\psi$ because $\varphi\rrbracket^s(w_0)(t_0) = 1$ iff
 a. $\llbracket\varphi\rrbracket^s(w_0)(t_0) = 1 \wedge \llbracket\psi\rrbracket^s(w_0)(t_0) = 1 \wedge$
 b. $\forall \langle w_1, t_1 \rangle \in \text{Sim}_{w_0, t_0}(\neg\llbracket\varphi\rrbracket^s) : \llbracket\psi\rrbracket^{\neg\llbracket\varphi\rrbracket^s}(w_1)(t_1) = 0$

Sæbø (1980, 1991, 2011) provides a number of reasons to prefer this counterfactual semantics over a generic conditional semantics. Among these, Sæbø (1980) shows how (264) rules out cases in which the event of the *because*-clause follows the main clause. The following sentence is example (37) from Sæbø (2011).¹³

¹³Notice that this is not true of so-called 'evidential' uses of *because* like that in (i).

- (i) The temperature rose, because the ice melted.
 \rightsquigarrow The temperature rose, and I know this because the ice melted.

In this example, the time of the ice melting is obviously after the time of the temperature rising. It is unclear what our predictions should be about these evidential uses, and discussion of them will have to wait until another time.

- (265) # The settlements perished around 1400 because the supply ships stopped coming around 1420.

With this sentence, it is asserted that the effect (the settlements perished) happened, and the cause (the ships stopped coming) happened, and the most similar worlds to the actual world in which the cause did not happen are ones in which the effect did not happen. But notice that if the cause follows the effect, the most similar worlds to the actual world in which the cause happened (i.e., the ships stopped coming in 1420) will still be worlds in which the effect has *already* happened (i.e., the settlements perished in 1400). So at best we cannot establish a sensible notion of similarity, and at worst we derive a contradiction (see Sæbø 1980 for details).

Whether we adopt a generic conditional semantics or a counterfactual semantics for *because*-clauses, neither will rule out embedding *FUT* in the *because*-clause when it is sentence final and within the scope of a future licensing modal operator, provided the effect follows the cause. Indeed, as it stands, we make the prediction that Class II ACs can license *FUT* in the AC under these specific conditions; (i) the AC is a sentence final *because*-clause, (ii) the AC occurs in the scope of a *FUT* licensing modal, (iii) the content of the AC (the cause) occurs before the content of the main clause (the effect). Let us test this prediction.

- (266) ?? Alice might be happy (tomorrow) because she wins (tonight).

Here the main clause features a future licensing modal, and the *because* clause is within the scope of the modal, finally the effect, described by the main clause, does not precede the cause, described by the AC. However, this sentence appears to be dubious at best. We might wonder, however, whether it is possible to create a context in which the intended reading is made more salient.¹⁴

- (267) SCENARIO: *Charlie is competing in a chess tournament. Charlie is doing well and is likely to win. Alice knows the results so far but Bobby does not.*

A: See if you can guess why Charlie is going to be happy later.

B: Well, he could be happy because he wins the chess tournament.

B': Well, it's possible that he's happy because he wins the chess tournament.

In the provided context, this kind of sentence is much improved, suggesting that the oddity of (266) could be extra-grammatical. Perhaps it is hard to imagine an

¹⁴Note that in (267B'), both clauses of the *because*-construction are embedded under a possibility modal, with no modal in either of the clauses of the *because*-construction.

appropriate context out of the blue. Whatever the source of this strangeness, the prediction that Class II ACs can license *FUT* under very specific conditions does appear to be borne out.

5.5 Accounting for Class III ACs

In the following two subsections, we will provide a brief review of the literature on temporal adverbial clauses. In doing so, we will show that von Stechow and Grønn's (2013) account of tense in adverbial relative clauses fits with the proposed semantics we have developed for *FUT*. Following the literature, *when*-clauses are analysed as temporal relative clauses (Arregui and Kusumoto, 1998; Caponigro, 2004; Haegeman, 2009; von Stechow and Grønn, 2013), and dependently licensed future orientations are treated as an instance of temporal binding of the AC reference time by a higher future operator (Ogihara, 1996; von Stechow and Grønn, 2013, a.m.o).

Next, we evaluate quantificational and prepositional accounts of the temporal connectives *before* and *after*. Like von Stechow and Grønn (2013), we adopt a prepositional analysis in combination with the special modal operator EARLIEST proposed by Beaver and Condoravdi (2003) and Condoravdi (2010). Due to the semantics of *before*, von Stechow and Grønn (2013) note that we need to insert a *FUT* operator in *before*-clauses. We show that the modal semantics of EARLIEST introduces a suitable licensing environment for this *FUT*. Finally, we deviate from von Stechow and Grønn (2013), and explore some data in support of Sharvit's (2014) dual derivations for long distance and short distance *before* and *after*-clauses. The take home message from this section will be that the account of *FUT* developed so far fits comfortably with the distribution of dependently licensed future orientations in Class III ACs.

5.5.1 *When*-clauses

Like concessive ACs, *when*-clauses are not at-issue; they are presupposed (Johnston, 1994; Sawada and Larson, 2004; Sæbø, 2011, a.m.o). This is demonstrated by the examples in (268), all of which presuppose that Alice was here yesterday.

- (268) a. Bobby wasn't happy when Alice was here yesterday.
b. If Bobby was happy when Alice was here yesterday, then he likes her.

- c. Bobby might have been happy when Alice was here yesterday.
- d. Was Bobby happy when Alice was here yesterday?
→ Alice was here yesterday.

Given our analysis of concessive ACs, *when*-clauses will be inhospitable environments for embedding *FUT*. This means dependent future orientations in *when*-clauses must be derived by another mechanism available to the grammar. Here we will follow von Stechow and Grønn (2013) in proposing that these dependent future orientations are due to the reference time of the future oriented AC being bound by an appropriately licensed future operator in the main clause. Before showing how this works, let us first go through the derivation of past tense *when*-clauses to illustrate how the composition and interpretation of these clauses comes about in the base case.

von Stechow and Grønn (2013), essentially following Arregui and Kusumoto (1998), develop a theory of tense in temporal adjuncts wherein the tense in a past-under-past *when*-clause (269a) is interpreted deictically (269b).

- (269) a. Bobby was happy when Alice was here.
- b. λt_0 [PAST t_0] λt_1 Bobby be happy [when [PAST t_0] λt_2 Alice be here]

The *when*-clause itself is a modifier which denotes a predicate of times. This is derived by *wh*-movement in a manner similar to relative clauses. Evidence for this was first observed by Geis (1970) who observed that bi-clausal *when*-clauses can be ambiguous between a high reading and a low reading (see also Larson, 1990; Arregui and Kusumoto, 1998; Takahashi, 2008; Haegeman, 2009). The following example from Larson (1990) has both a high reading, on which I saw Alice when she made a claim, and a low reading, on which I saw Alice at the time such that she claimed she would arrive at that time.

- (270) I saw Alice in New York when she claimed she would arrive.

The ambiguity arises due to the availability of two relativization sites. A base position in the embedding clause within the AC gives rise to the high reading (271a), while a base position in the embedded clause gives rise to an low reading (271b).

- (271) I saw Alice in New York when she claimed she would arrive.
- a. I saw Alice in New York [when₁ she claimed [she would arrive] AT t_1]
- b. I saw Alice in New York [when₁ she claimed [she would arrive AT t_1]]

The temporal pronoun *when* originates in the AC as an argument of a temporal preposition AT which is covert in English (Arregui and Kusumoto, 1998; Caponigro, 2004; von Stechow and Grønn, 2013, a.m.o).¹⁵

$$(272) \quad \llbracket AT \rrbracket = \lambda t. \lambda t'. t' = t$$

After combining with *when*, the temporal PP denotes a predicate of times, which is merged into the AC directly below Tense via type-general predicate modification.

$$(273) \quad \llbracket \text{she be in New York } AT \text{ when} \rrbracket = \\ \lambda t. \llbracket \text{she be in New York} \rrbracket(t) = 1 \wedge \llbracket AT \text{ when} \rrbracket(t) = 1$$

The rest of the clause will be composed as a normal TP. Eventually, *wh*-movement will abstract over the argument of AT forming a predicate of times which are coextensive with the reference time of the clause.¹⁶

$$(274) \quad \llbracket \text{when}_2 [\text{PAST } t_0] \text{ she was in New York } AT t_2 \rrbracket = \\ \lambda t_2. \exists t_1 \prec t_0 : \llbracket \text{she be in New York} \rrbracket(t_1) = 1 \wedge t_1 = t_2$$

This temporal predicate will then combine with the main clause under Tense via predicate modification. Since the final conjunct of the expression within the body of the lambda function identifies the reference time of the AC (t_1) with the variable abstracted over (t_2), it will have the effect of equating the reference time of the main clause with that of the AC.

This conventional analysis makes a number of accurate predictions when describing the temporal relations between eventualities in the AC and the main clause. To see this, suppose the following Davidsonian event semantics for eventive (275a) and stative (275b) predicates.¹⁷ Here, τ is the temporal trace function which, given an event, returns the interval containing all and only the moments at which the eventuality holds.

$$(275) \quad \text{a. } \llbracket \text{Alice hug Bobby} \rrbracket(t) = 1 \text{ iff } \exists e[\text{a-hug-b}(e) \wedge \tau(e) \subseteq t] \\ \text{b. } \llbracket \text{Alice be in New York} \rrbracket(t) = 1 \text{ iff } \exists e[\text{a-in-NY}(e) \wedge t \subseteq \tau(e)]$$

¹⁵We'll ignore world variables and the modal context here as they are not relevant.

¹⁶We treat *wh*-elements as variables, with *wh*-movement resulting in λ -abstraction (Heim and Kratzer, 1998).

¹⁷It is common to attribute these semantics to (im)perfective aspect (e.g., Kratzer, 1998, a.m.o.). Since the role of outer aspect is often difficult to determine in English, we will just consider clearly perfective eventive predicates with an episodic interpretation and stative predicates, assuming they encode the temporal relations expressed in (275).

According to this semantics, an eventive predicate encodes that the event time is contained within the reference time, while a stative predicate encodes that the event time contains the reference time.

Given these denotations for eventive and stative predicates, we correctly predict that a stative main clause with an eventive AC expresses the same temporal relation as an eventive main clause with a stative AC (Sæbø, 2011). For instance the following sentences describe the same temporal relation between Alice's being in New York, and her hugging of Bobby, with any difference in meaning between them being a matter of what information is treated as background.

- (276) a. Alice hugged Bobby when she was in New York.
b. Alice was in New York when she hugged Bobby.

In both cases, the reference time is contained in the time that Alice was in New York, and it contains the time at which she hugged Bobby. In other words, the time at which Alice hugged Bobby was contained in the time she was in New York.¹⁸

When both clauses contain a stative predicate, the reference time will be contained in the run time of both eventualities. The two eventualities must have a time in common.

- (277) Alice was happy when she was in New York.

This too seems to be correct, since all we can infer from (277) is that the run times of these eventualities overlap. Besides this, we do not know which eventuality started first or which ended first.

Finally, when both clauses are eventive, the shared reference time of the main clause and the AC should contain both eventualities, although we do not make any further predictions about their ordering. This too appears to be borne out. Hinrichs (1986) provides examples in which the event time of the *when*-clause co-occurs with

¹⁸Certain sentences with stative predicates may appear to order the the stative predicate before or after the eventive predicate. Take our sentence (i) as an example, the most salient reading of which is that Alice's being happy will follow the result of the coin flip.

- (i) Alice will be happy when the coin comes up heads.

This can be attributed to the availability of inchoative coercion in English, giving (i) a reading roughly equivalent to (ii).

- (ii) Alice will become happy when the coin comes up heads.

that of the main clause (278a), precedes it (278b), and follows it (278c). The following are based on Hinrichs's (30-32).¹⁹

- (278) a. Alice broke her arm when she wrecked her car.
b. When Alice moved in, she threw a party.
c. When Alice threw the party, she invited her neighbours.

Now, when the main clause involves a future licensing modal, the tense in the *when*-clause cannot be interpreted deictically because we would arrive at a denotation which would place the reference time of the AC at a present time, and that of the main clause at a future time. An AC like this would not be a suitable modifier for the reference time of the main clause as the reference time would be placed within two disjoint intervals. Instead, von Stechow and Grønn (2013) propose that the reference time in the AC is interpreted as a variable which is bound by a lambda abstractor in the main clause.

- (279) a. Bobby will be happy when Alice is here.
b. PRES+*woll* FUT λt_2 Bobby be happy [when PRES t_2 Alice be here]

The resulting interpretation is that the reference time of the embedded clause is identified with the reference time of the main clause.²⁰ Accordingly, dependent future orientation in *when*-clauses can be attributed to binding of the AC reference time by an appropriately licensed *FUT* in the main clause, and not due to the presence of an unlicensed *FUT* within the AC itself. Later in section 5.6, we will argue that the fact that *when*-clauses can be future oriented in this way despite being presupposed is directly relevant to teasing apart different theories of future licensing in favor of an account such as the one adopted here.

¹⁹For some reason, von Stechow and Grønn (2013) seem to think that their account doesn't capture data such as these without further amendment, likely because they omit an event semantics for inner/outer aspect within their paper. They resort to inserting covert temporal shifting operators within the AC (p.323). Thankfully, adopting a fairly conventional event semantics like that in (275) obviates the need for additional covert temporal shifting operators.

²⁰There is a long standing question of why English *when*-clauses cannot contain a deictic present with a future licensing modal (Stump, 1985).

- (i) ?? Bobby will be happy when Alice will be here.

I do not have anything to add on this topic here.

5.5.2 *Before* and *after*-clauses

Clauses which are headed by the temporal connectives *before* and *after* have been the focus of a great deal of research. At the forefront of this persistent interest are a number of asymmetries between *before* and *after*-clauses which at first might appear to be totally unrelated. The first of these is the veridicality of the AC (Heinämäki, 1972, 1974; Ogihara, 1995; Beaver and Condoravdi, 2003). Past tense *after*-clauses entail the content of the AC (i.e., they are veridical). Conversely, *before*-clauses do not (i.e., they are non-veridical). The sentence in (280a), can be true if Alice never met her grandchildren, indeed that is the only sensible reading of the sentence. Compare this to (280b) which can only be true if Alice did meet her grandchildren.

- (280) a. Alice died before she met her grandchildren.
 b. Alice died after she met her grandchildren.

The second contrast arises when the main predicate of the temporal AC is non-eventive. In particular, a sentence containing a stative *before*-clause is true iff the eventuality described by the main clause temporally precedes the whole of the eventuality described in the AC, while for a sentence featuring a non-eventive *after*-clause, it suffices that the eventuality of the main clause only follows part of the eventuality described by the AC (Anscombe, 1964). To see this, consider the following sentences based on similar examples in Anscombe (1964) and Ogihara (1995).

- (281) SCENARIO: *The Arch of Titus was constructed in approximately 81 AD and still stands in Rome today. The Septizodium was constructed later than the Arch of Titus, in 203 AD, but has since been destroyed.*
- a. The Septizodium was in Rome after the Arch of Titus was in Rome.
 b. The Arch of Titus was in Rome after the The Septizodium was in Rome.

Firstly, note that both sentences in (281) are true. The Septizodium only needs to have been in Rome after *some* time at which the Arch of Titus was in Rome, and the Arch of Titus only needs to have been in Rome after *some* time at which the Septizodium was in Rome. Compare this to the same sentences with *before*.

- (282) SCENARIO: *Same as (281).*
- a. # The Septizodium was in Rome before the Arch of Titus was in Rome.

- b. The Arch of Titus was in Rome before the The Septizodium was in Rome.

If it were sufficient that the Septizodium had been in Rome before some time at which the Arch of Titus was in Rome, then the sentence in (282a) would be true. After all, the Septizodium was in Rome before now, and the Arch of Titus is in Rome now. However, this sentence is false. Rather, [Anscombe \(1964\)](#) notes that for a sentence such as (282a) to be true, the Septizodium would have to be in Rome before *all* of the times at which the Arch of Titus was in Rome.

Finally, *before*-clauses can license negative polarity items (NPIs), such as *anyone*, while *after*-clauses cannot. The following examples are based on [Condoravdi \(2010\)](#).

- (283) a. Alice left before there was anyone in the room.
 b. * Alice left after there was anyone was in the room.

In the following subsection we review two approaches to handling these data. The first approach gives each of the temporal connectives a distinct quantificational semantics ([Anscombe, 1964](#); [Heinämäki, 1974](#); [Ogihara, 1995](#); [Krifka, 2010](#)), while the second proposes a minimal semantics for the connectives themselves, designating all the heavy lifting to a covert operator, EARLIEST ([Beaver and Condoravdi, 2003](#)).

5.5.2.1 Quantificational vs. prepositional accounts

Both the quantificational account and the more recent prepositional account propose that the AC denotes a predicate of times at some point in the derivation. In the quantificational approach, the AC undergoes tense deletion and the connective combines directly with the temporal clause which is interpreted as a predicate of reference times ([Ogihara, 1995](#)).

- (284) a. $\llbracket \text{before}_{Quant} \rrbracket = \lambda P_{\langle i,t \rangle} . \lambda t . \forall t' [P(t') \rightarrow t \prec t']$
 $= \lambda P_{\langle i,t \rangle} . \lambda t . \neg \exists t' [P(t') \wedge t \succeq t']$
 b. $\llbracket \text{after}_{Quant} \rrbracket = \lambda P_{\langle i,t \rangle} . \lambda t . \exists t' [P(t') \wedge t \succ t']$

Very roughly, this will give the sentences in (280) the truth conditions in (285).

- (285) a. $\exists t_1 \prec t_0 : \text{a-die}(t_1) \wedge \forall t_2 [\text{a-meet-grandchildren}(t_2) \rightarrow t_1 \prec t_2]$

$$b. \exists t_1 \prec t_0 : a\text{-die}(t_1) \wedge \exists t_2 [a\text{-meet-grandchildren}(t_2) \wedge t_1 \succ t_2]$$

Straight off the bat, this account explains a number of the asymmetries between *after* and *before*. Firstly, it accounts for the fact that both of the sentences in our Rome scenario in (281) can be judged true, while only (282b) is true and (282a) is not. Recall that for an *after* sentence to be true the main clause reference time only needs to follow some time described by the content of the AC, while for a *before* sentence to be true the main clause reference time must precede all times described by the content of the AC.

Secondly, since the *before*-clause is a downward monotonic environment, this account correctly predicts that NPIs should be licensed in the AC (Ladusaw, 1979). In addition, it correctly predicts that the content of the *before*-clause is not entailed. This is easier to see if we rewrite the truth conditions with a (logically equivalent) negated existential quantifier over times which are before or equal to the main clause time (Ogihara, 1995; Krifka, 2010). This says that there were no times at which Alice met her grandchildren which were before or at the time she died.

$$(286) \quad \exists t_1 \prec t_0 : a\text{-die}(t_1) \wedge \neg \exists t_2 [a\text{-meet-grandchildren}(t_2) \wedge t_1 \succeq t_2]$$

We can see then, that the quantificational approach to *before* and *after*-clauses is already quite successful. However, there are a few reasons to think that we can do better.

One objection to this account, put forward by Beaver and Condoravdi (2003), is that a sentence like (287a) (based on their 32-33) is predicted to be true on the quantificational account.²¹

(287) SCENARIO: *Alice ate four burgers. She was in terrible physical condition and had never competed in any athletic competitions.*

- a. # Alice ate four burgers before she won all the Olympic track and field gold medals.

Secondly, they note that the quantificational account would appear to make incorrect predictions for sentences with non-monotonic measure phrases like that in (288). With a quantificational semantics, (288) would be true only if the interval at

²¹It's hard to say that the quantificational account is at odds with this data point. For instance, Krifka (2010) suggests that *before* triggers an implicature that the eventuality in the AC is likely to be true at some point. Provided this implicature cannot easily be cancelled, this could explain the infelicity of (287a) in the context given.

which Alice left occurred exactly five seconds before every interval at which Bobby sang. In a context in which Bobby sang for an extended period of time, such a state of affairs would be impossible.

(288) Alice left exactly five seconds before Bobby sang.

Finally, consider the following prepositional uses with time denoting nominal complements.

- (289) a. Alice will arrive before next week.
 b. Bobby went to bed after midnight.

Assuming that these nominal expressions denote a temporal interval of type i , it would look like we want a semantics for *before* and *after* which simply denotes a relation between two intervals.²²

- (290) a. $\llbracket \text{before}_{prep.} \rrbracket = \lambda t. \lambda t'. t' \prec t$
 b. $\llbracket \text{after}_{prep.} \rrbracket = \lambda t. \lambda t'. t' \succ t$

This minimal semantics for *before* and *after* are taken as the starting point for the prepositional account to *before* and *after*-clauses. On this account, the clausal complement to the preposition will need to undergo type shifting to denote a temporal interval. Suppose we adopt a typical type-shifting operator which would return a unique maximal interval from the predicate of times denoted by the AC. We could adopt a definite temporal operator ι_{MAX} based on von Stechow et al.'s (2014) notion of definiteness as maximal informativeness (291). This operator, applied to a property of times φ in w , picks out the unique φ time t such that for any t' at which φ holds, we will know that φ holds at t' because we know that φ holds at t .

- (291) $\llbracket \iota_{MAX} \rrbracket^s(\llbracket \varphi \rrbracket^s)(w_0)$
 a. is defined only if $\exists! t_1 : t_1$ is maximally informative w.r.t. $\llbracket \varphi \rrbracket^s$ in w_0
 b. if defined, $= \iota t_2 [t_2$ is maximally informative w.r.t. $\llbracket \varphi \rrbracket^s$ in $w_0]$
 c. where t_2 is maximally informative w.r.t. $\llbracket \varphi \rrbracket^s$ in w_0 iff
 i. $\llbracket \varphi \rrbracket^s(w_0)(t_2) = 1 \wedge$

²²It should be said that this objection is not a knockdown argument against the quantificational account either. Temporal phrases like *next week* could denote a set containing only the single interval corresponding to the entirety of next week. In which case, the quantificational account will correctly place *before/after next week* before or after the entirety of that interval respectively.

$$\text{ii. } \forall t_3 \left[\begin{array}{c} \llbracket \varphi \rrbracket^s(w_0)(t_3) = 1 \rightarrow \\ \{w_1 \mid \llbracket \varphi \rrbracket^s(w_1)(t_2) = 1\} \subseteq \{w_2 \mid \llbracket \varphi \rrbracket^s(w_2)(t_3) = 1\} \end{array} \right]$$

Given the semantics for eventive and stative predicates above, it is easy enough to convince ourselves that the maximally informative reference time at which either a stative or eventive predicate holds is in fact equal to $\tau(e)$. The semantics for stative and eventive predicates in (275) is repeated in (292) with the addition of world variables.

- (292) a. $\llbracket \text{Alice hug Bobby} \rrbracket(w)(t) = 1$ iff $\exists e[\text{a-hug-b}(e)(w_0) \wedge \tau(e) \subseteq t_1]$
 b. $\llbracket \text{Alice be in New York} \rrbracket(w)(t) = 1$ iff $\exists e[\text{a-in-NY}(e)(w) \wedge t \subseteq \tau(e)]$

Consider first an eventive predicate (292a), the maximally informative interval which contains $\tau(e)$ will be the smallest such interval. Any larger interval can be guaranteed to also contains $\tau(e)$, and any smaller interval obviously cannot contain $\tau(e)$. Since every interval contains itself, the maximally informative interval will be equal to $\tau(e)$. Next consider a stative predicate (292b). In this case, the maximally informative interval which is contained by $\tau(e)$ will be the largest interval which is contained by $\tau(e)$. For any smaller interval, we can guarantee that this too will be contained by $\tau(e)$ and any larger interval cannot be contained by $\tau(e)$. Again, the maximally informative interval will be equal to $\tau(e)$ since $\tau(e)$ is the largest interval contained in $\tau(e)$.

Notice that deriving a temporal interval from a property of times using this type-shifting operator makes incorrect predictions when combined with the prepositional *after* given above. Specifically, we fail to derive the observation that the reference time of the main clause need only follow the initial, or earliest, part of the eventuality in an *after*-clause. Instead we predict that it should follow the whole AC eventuality. Consequently, Beaver and Condoravdi (2003) propose that the type-shifting involved is that of an EARLIEST operator. The operator EARLIEST is a modal operator which, given a property of times, returns the earliest time for which the property holds in some likely historical alternative. Notice that, since this operator has a modal component, the modal context against which the content of the AC is interpreted is also shifted.²³

²³Since we have been treating modal contexts as sets of world-time pairs, we need to vacuously quantify over the time coordinate of the historical alternatives t_4 (which will just be identified with the temporal anchor of the modal base t_1).

- (293) $\llbracket \text{EARLIEST} \rrbracket^s(w_0)(t_1)(\llbracket \varphi \rrbracket^s)$
- a. is defined only if
 - $\exists! t_2 : t_2$ is the earliest possible time w.r.t. $\llbracket \varphi \rrbracket^s$ at t_1 in w_0
 - b. if defined, $= \iota t_3 [t_3$ is the earliest possible time w.r.t. $\llbracket \varphi \rrbracket^s$ at t_1 in $w_0]$
 - c. where t_3 is the earliest possible time w.r.t. $\llbracket \varphi \rrbracket^s$ at t_1 in w_0 iff
 - i. $\exists \langle w_1, t_4 \rangle \in \text{MAX}_{\text{LIKELY}}_{w_0, t_1}(\text{Hist}_{w_0, t_1}) : \llbracket \varphi \rrbracket^{\text{Hist}_{w_0, t_1}}(w_1)(t_3) = 1 \wedge$
 - ii. $\forall \langle w_2, t_4 \rangle, t_5 \left[\begin{array}{l} \langle w_2, t_4 \rangle \in \text{MAX}_{\text{LIKELY}}_{w_0, t_1}(\text{Hist}_{w_0, t_1}) \wedge \\ \llbracket \varphi \rrbracket^{\text{Hist}_{w_0, t_1}}(w_2)(t_5) = 1 \rightarrow t_3 \preceq t_5 \end{array} \right]$

By design, this semantics derives the observation that the reference time of the main clause need only follow the initial, or earliest, part of the eventuality in an *after*-clause. Likewise, in (288) the main clause eventuality occurs exactly five seconds before the earliest time Bobby was singing. Secondly, Beaver and Condoravdi's semantics for EARLIEST can derive the contrast in veridicality between *before* and *after*-clauses. Recall that the historical alternatives of a world w at t are those worlds which are identical with w at times up to and including t , but may differ from w after t . Since the worlds quantified over are historical alternatives of the evaluation world at the reference time, eventualities occurring at some following time, like those described in *before*-clauses, need not occur in the evaluation world. *After*-clauses on the other hand describe eventualities which occur prior to the reference time of the main clause. The historical alternatives of the evaluation world w at that time will be identical to w , and any eventuality which occurs in one of these historical alternatives must also have occurred in w . Thirdly, this operator accounts for the oddity of the Olympics example above (287a). In that context Alice ate burgers and never exercised, so it is not likely that there would ever be a time at which she won all the Olympic track and field medals. However, this semantics says that at least one likely historical alternative features such a state of affairs. Consequently (287a) would not be defined. Finally, Condoravdi (2010) shows how *before*-clauses containing EARLIEST are (Strawson) downward entailing, and are thereby a suitable licensing environment for NPIs (von Stechow, 1999).

In the next subsection, we will see that *before* and *after*-clauses also display Geis ambiguities, giving rise to both high and low readings. We will review some data from Sharvit (2014) which suggest that high and low readings of *before* and *after*-clauses have different structures. Sharvit (2014) proposes that long distant *before*-

clauses have a free relative like structure involving a maximality type-shifting operator, while short distant *before*-clauses involve an EARLIEST operator. We put forward some additional evidence to support Sharvit’s suggestion before providing derivations of the proposed LFs and their interpretations.

5.5.2.2 High and low derivations

Much like with *when*-clauses, *before* and *after*-clauses can give rise to both a high reading and a low reading. For instance, the following sentence is ambiguous between a high reading on which Alice left before/after saying something, and a low reading on which Alice left before/after a certain time such that she said she would leave at that time.

(294) Alice left {before/after} she said she would.

For this reason, von Stechow and Grønn (2013) give *before/after*-clauses a relative structure derived by movement of a covert *wh*-item. These authors, again following Arregui and Kusumoto (1998), propose that a past tense in *before* and *after*-clauses is deictic. The property of times which is denoted by the relative clause after abstracting over the world variable is the complement of the EARLIEST operator, returning a definite description of an interval.

(295) a. Alice left before Bobby arrived.
 b. [PAST t_0] Alice leave [before [EARLIEST ~~when~~ λt_1 [PAST t_0] Bobby arrive AT t_1]]

Since the past tense of each clause is deictic, two reference times with different indices are introduced, and the temporal ordering of these reference times is determined by the temporal connective.

(296) $\exists t_1 \prec t_0 : \llbracket \text{Alice leave} \rrbracket^s(w_0)(t_1) \wedge$
 $t_1 \prec (\llbracket \text{EARLIEST} \rrbracket^s(w_0)(t_1)$
 $(\lambda w_1. \lambda t_2. \exists t_3 \prec t_0 : \llbracket \text{Alice leave} \rrbracket^{\text{Hist}_{w_0, t_1}}(w_1)(t_3) \wedge t_3 = t_2))$

When the tense in the AC is present, von Stechow and Grønn (2013) propose that the reference time is once again interpreted as a bound variable. However, in such an LF the reference time of the main clause and the reference time of the AC will be co-indexed, while the temporal connective, for instance *before*, will place the

reference time of the main clause before the reference time of the AC. To avoid this, von Stechow and Grønn (2013) propose inserting a covert *FUT*.

- (297) a. Alice might leave before Bobby arrives.
 b. PRES+might FUT λ_1 Alice leave [before [EARLIEST when λ_2 PRES t_1 FUT λ_3 Bobby arrive AT t_2]]

What is crucial to note here is that due to the semantics of EARLIEST, this *FUT* can be appropriately licensed here. This is because the modal context against which the AC is interpreted is the historical alternatives of the evaluation world at the reference time of the main clause. The modal semantics of EARLIEST features existential quantification over the likeliest historical alternatives and will not conflict with the contingency presupposition of *FUT*.

- (298) $\exists \langle w_1, t_1 \rangle \in s : \exists t_2 \succ t_1 : \llbracket \text{Alice leave} \rrbracket^s(w_1)(t_2) = 1$
 $\wedge t_2 \prec (\llbracket \text{EARLIEST} \rrbracket^s(w_1)(t_2)$
 $(\lambda w_2. \lambda t_3. \exists t_4 \succ t_2 : \llbracket \text{Alice leave} \rrbracket^{\text{Hist}_{w_1, t_2}}(w_2)(t_2) \wedge t_4 = t_3))$

Given this proposal we can, and indeed must, insert a *FUT* within a future oriented *before*-clause in order to avoid a contradiction within our truth conditions.²⁴ Notice that we make an additional prediction here. Specifically, since a *FUT* must be inserted to avoid the contradiction which arises as a result of the reference times being co-indexed, we predict that a low construal of a *before*-clause requires an overt future licensing modal in the embedded clause in the AC in order to license this *FUT*. As we can see from (299a), we cannot make the low reading acceptable by simply inserting a *FUT* under *say*. This is because the embedding verb creates a new modal context, effectively intervening between EARLIEST and *FUT*.

- (299) a. Alice will leave before Bobby says Charlie is dancing. (*high*, **low*)
 b. Alice will FUT leave [before Bobby says [Charlie (*FUT) is dancing]]

To make the low reading available, an appropriate modal such as *will* needs to be inserted below *say* (300a) so that *FUT* can be inserted and the contradiction avoided.

²⁴ von Stechow and Grønn (2013) note that we also need to insert a covert perfect, or past shifting operator, within *after*-clauses for essentially the same reason. I find this unattractive. Of course, the same could arguably be said about inserting *FUT* into *before*-clauses. However, it suffices for our purposes to show that the present account of *FUT* is compatible with contemporary accounts of tense in future oriented temporal ACs.

- (300) a. Alice will leave before Bobby says Charlie will be dancing. (*high, low*)
 b. Alice will FUT leave [before Bobby says [Charlie will FUT be dancing]]

Interestingly, however, Sharvit (2014) notes several differences exist between high and low readings of *before*-clauses which suggest that long distance derivations might not involve an EARLIEST operator at all. Firstly, she notes that the presence of an NPI in either clause within the AC blocks a low reading. To verify this observation, we can construct a context in which the high reading is false but the low reading is true. If Sharvit (2014) is right, then the sentence in question should be infelicitous when an NPI is present. Consider then the sentence in (301a). This is true in the given context, but only on the low reading. It is true because Alice arrived at 8, and Bobby said that Charlie would leave at 10. Crucially the sentence is false on the high reading because it was at 7 that Bobby mentioned Charlie's leaving.

- (301) SCENARIO: *At 7, Bobby said that Charlie would leave the party at 10. Alice arrived at the party at 8. Then, Charlie, who was the first person to leave the party, left at 9.*
 a. Alice arrived before Bobby said Charlie would leave.

Now consider (302a, 302b), these too are false on the high reading since Alice arrived after the time at which Bobby was talking, but they would be true on the low reading, if it were available, because Alice arrived before the time Bobby was talking about.

- (302) SCENARIO: *Same as (301).*
 a. # Alice arrived before Bobby said anybody would leave.
 b. # Alice arrived before anybody said Charlie would leave.

The obvious falsity of these sentences confirm Sharvit's observation: the presence of an NPI in either clause within the AC blocks a low reading.

Sharvit further notes that low readings of *before*-clauses are always veridical, while, as we have seen, high readings are non-veridical. On the high reading, the following sentence is true even if Bobby does not say anything. Indeed, in a context in which Alice was the last person at the party, there would be nobody for Bobby to speak to after Alice had left. This reading is best paraphrased as in (303a). Note however, that this sentence does not have a reading like that in (303b).

- (303) Alice went home before Bobby said the party would finish.

- a. \rightsquigarrow Alice went home before Bobby could say the party would finish
- b. $\not\rightarrow$ Alice went home before the time such that Bobby could say the party would finish at that time

This sentence cannot describe a situation in which Alice went home at 8, and Bobby could have said at 7 that the party would finish at 10 but he didn't. That is, the long distance reading requires that there be a speaking event in the actual world.

These two properties of low distance readings of *before* lead Sharvit to propose that long distance construals of *before* are instances of prepositional *before* in combination with a temporal free relative derived by a maximality operator. Interestingly, although Sharvit (2014) does not discuss *after*-clauses in any detail, there is evidence that low readings of *after* also have a different derivation to that of the high readings. As we have seen already, high readings of a non-eventive *after*-clause give rise to an "earliest" interpretation.

- (304) SCENARIO: *Bobby and Charlie were at the party. Bobby was dancing between 8 and 10. Charlie left at 9.*
- a. Charlie left after Bobby was dancing.

However, it is far less clear that such an interpretation is available with a low reading.

- (305) SCENARIO: *Alice, Bobby, and Charlie were at a party. Charlie left at 9. At 11, Alice said Bobby had been dancing between 8 and 10.*
- a. # Charlie left after Alice said Bobby was dancing.

This sentence is false on both possible interpretations. Certainly, Charlie left before Alice said anything, so the high reading is predictably false. But notice, that if an earliest interpretation were available here this sentence should be true on the low reading. If, however, only a maximal reading is available, then the sentence's falsity is predicted because Charlie did not leave after the whole of the dancing event as described by Alice. This evidence, then, would seem to add further support to Sharvit's claim that low readings are not associated with an EARLIEST operator.

The key differences between high and low readings of *before* and *after*-clauses is summarized in the following table.

These data are captured by an analysis of *before* and *after*-clauses in which the low construal is derived via the combination of a prepositional *before* and *after* combined with a temporal free relative involving a maximality operator like that defined in (291).

	High	Low
Non-veridical (<i>before</i>)	✓	*
NPIs (<i>before</i>)	✓	*
Earliest (<i>after</i>)	✓	*

Table 6: High and low derivations of *before* and *after*-clauses

(306) Alice left [before/after [t_{MAX} [~~when~~ $\lambda t \dots$ AT t]]]

The veridicality of long distance *before*-clauses can be attributed to the fact that t_{MAX} triggers the presupposition that there is some time at which eventuality described by the AC was realized. The ungrammaticality of NPIs in long distance *before*-clauses also support Sharvit’s proposal since, as she observes (p. 294-5), an overt definite description *the time at which* also blocks NPIs (307).

(307) Alice left before the time at which Bobby hugged {someone/*anyone}.

Finally, our observation that long distance *after*-clauses lack an “earliest” reading follows because the t_{MAX} -operator returns the whole run time of the stative eventuality described by the AC not the initial part of that run time.

To conclude, we have seen how our *FUT* operator, in combination with contemporary accounts of tense in temporal adverbial clauses, can capture the distribution of dependently licensed future orientations. Only in the case of *before*-clauses does this require inserting a future operator within the AC itself. However, we have seen that the modal semantics associated with EARLIEST renders these clauses suitable environments for *FUT*. We also saw that dependent future orientations in *when*-clauses do not necessitate a *FUT* within the AC itself, but rather arise as a result of binding of the AC reference time by the appropriately licensed *FUT* in the main clause. That this mechanism is available for *when*-clauses is of crucial importance, since they are presupposed and therefore cannot host *FUT*. This final point is the discussion of 5.6.

5.6 Local vs. global licensing of the future

As, we saw in Chapter 1, the presupposition we have attributed to *FUT*, has precedence in the literature on future reference. Specifically, several authors have suggested that assertion or presupposition of an unmodalized future oriented propo-

sition is generally infelicitous or ungrammatical. However, accounts of this sort typically take the form of a global constraint on future licensing or a pragmatic principle which restricts assertion or presupposition to only those propositions which are taken to be *settled*. For instance, [Bohnemeyer \(2009\)](#) proposes a *Modal Commitment Constraint* (MCC) for the Yucatec Maya language which is stated as follows.

“The realization of events in the (relative or absolute) future cannot be asserted, denied, questioned, or presupposed as fact. Assertions, questions, and presuppositions regarding the future realization of events, or the failure thereof, require specification of a modal attitude on the part of the speaker.”

([Bohnemeyer, 2009](#))

Admittedly, the MCC is language-specific. However, we might wonder whether it could be extended to other languages, like English. After all, it would appear to cover a significant portion of the data we have considered throughout this dissertation. As we will see, however, this straw man falls down.

[Kaufmann et al. \(2006\)](#) propose a similar type of constraint, although it is less clear whether or not it should be construed as a constraint on the grammar or some sort of pragmatic constraint.

“Speakers cannot have full confidence about the truth values of sentences whose truth they also believe is not yet objectively settled. Having such beliefs would imply that the speaker (believes that she) can ‘look ahead’ in history, an attitude which we will assume (perhaps somewhat optimistically) is not attested.”

([Kaufmann et al., 2006](#))

These two proposals are both constraints on future reference, and both have a similar flavor to the present proposal. Note, however, that both are stated at a global, or even post-grammatical, level. Interestingly, it appears that Class III ACs (temporal adverbials clauses) provide a unique testing ground for teasing apart the present proposal from accounts of the above type. The account developed here, proposes that a dedicated future operator *FUT* is licensed locally in an appropriate modal context. Whereas, the two global licensing accounts imply that future oriented propositions should never be presupposed. With this in mind, consider the following example from [Kaufmann \(2005\)](#).

(308) * The coin (eventually) comes up heads.

The sentence in (308) is used by Kaufmann (2005) to show that future oriented propositions about contingent states of affairs cannot be asserted without an appropriate modal (e.g., *will*). Even in a context in which we plan to toss the coin a great number of times (assume a fair coin throughout). Note, however, that it is possible to form a sentence which carries a presupposition identical to the proposition denoted by (308).²⁵ In a context in which Alice plans to toss the coin only twice, (309a) and (309b) are infelicitous since the common ground does not entail that the coin will come up heads within those two tosses. However, in a context in which Alice plans to toss the coin a thousand times, it is reasonable to utter a sentence which presupposes that there is some time at which the coin eventually comes up heads. The example in (309b) is particularly relevant as it is clear that what is presupposed is not that the coin *might* come up heads, but that, at some later point, it *does* come up heads; the presupposition projects.

- (309) a. Alice will be happy when the coin (eventually) comes up heads.
 b. Bobby might even faint when the coin (eventually) comes up heads.

These data are both striking and suggestive. Specifically, they show that the realization of a non-scheduled future event can in fact be presupposed provided the temporal clause is within the scope of *FUT*. Crucially, however, the presupposition itself is not modalized. Global accounts of the sort discussed above will be hard-pressed to reconcile the facts in (308) and (309). A global licensing rule which implies that a non-scheduled future eventuality cannot be settled according to some set of worlds, would predict that presupposed temporal clauses should not license future orientations (much like the Class II ACs which are presupposed). The predictions of the present account are slightly more subtle. For the most part, we make similar predictions to a global principle. While we do indeed predict that *FUT* cannot be embedded in a *when*-clause, we nonetheless allow for the possibility that the temporal AC may itself be predicated of an otherwise licensed future time. That is, we allow for future orientations to be *dependently* licensed in these *when*-clauses—a future orientation in a *when*-clause can be parasitic on a future oriented main clause.

²⁵While Kaufmann (2005) does not discuss whether a sentence like (308) can be presupposed, the most natural reading of his account would suggest that (308) should not be a possible presupposition of a sentence.

A globally stated licensing account would have to be modified to allow for this possibility, and it is not clear how this modification could be formulated naturally.

Chapter 6

Discussion

6.1 Discussion

In this section, we will briefly look at some data which provide further avenues of investigation or did not fit neatly into the preceding chapters.

6.1.1 Sentential Adverbials

Serge Minor (pc) points out that sentential adverbials such as *maybe* and *perhaps* are used to express uncertainty. But, at least at first glance, they do not appear to license *FUT*.

(310) ?? {Maybe/perhaps} Alice wins tomorrow.

This is an interesting observation, and I certainly find (310) degraded. However, I find that the same sentences are ameliorated significantly by prefacing them with an admission of ignorance.

- (311) a. (?) Who knows! Perhaps Alice wins tomorrow.
b. (?) I don't know what's going to happen. Maybe Alice wins tomorrow.

Beyond this, constructions in which two future *maybe* clauses are contrasted appear to be perfectly fine.

(312) Maybe Alice wins tomorrow, maybe she doesn't.

With that being said, I agree that our semantics for *FUT* would predict (310) to be better than it is, and it is not entirely clear to me why it is marked.

6.1.2 Disjunctions

It has often been noted that disjunction expresses epistemic uncertainty with respect to each of the disjuncts (see especially Zimmermann, 2000).

- (313) Either Alice is at home, or she is at the cinema.
 \rightsquigarrow Alice might be at home.
 \rightsquigarrow Alice might be at the cinema.

Given this, we might expect that disjunction licenses *FUT* in both disjuncts. Indeed, this is precisely what we find.

- (314) a. Either you win tomorrow, or you don't.
 b. Either Alice shows up soon, or we're screwed!

Unsurprisingly, this stands in stark contrast to cases of conjunction.

- (315) a. * You win tomorrow, and I lose.
 b. * Alice shows up soon, and we're screwed!

These data are hardly surprising, and should be easy enough to incorporate into the present account. In both cases, we can say that a covert epistemic necessity modal takes scope over the entire sentence.

- (316) a. $[\emptyset_{\square} [\varphi \text{ and } \psi]]$
 b. $[\emptyset_{\square} [\varphi \text{ or } \psi]]$

In the case of conjunction, each conjunct needs to be true throughout the epistemic alternatives in order for the sentence to be true. In the case of disjunction, neither disjunct has to be true throughout the epistemic alternatives. This straightforwardly accounts for the acceptability of *FUT* in the case of disjunction, and the unacceptability of *FUT* in the case of conjunction.

As mentioned in the previous chapter these disjunctions allow for a relative past in the second disjunct. The temporal anchor of this disjunct can be bound by *FUT* in the first disjunct despite not being c-commanded by it.

- (317) a. If he comes out smiling, the interview went well.

- b. Either Bob comes out smiling (later), or he didn't do well.

Again, this is reminiscent of non-canonical donkey binding found across disjunction (Evans, 1977).¹

(318) Either the farmer doesn't own [a donkey]_i, or he keeps it_i very quiet.

6.1.3 Quantifier phrases

Finally, *FUT* is licensed in the restrictor argument of a universal quantifier phrase (QP), but not an existential.²

- (319) a. Every student who comes out smiling (later) did well.
 b. * Some student who comes out smiling (later) did well.

Whether these facts are compatible with our present theory depends on a number of (possibly related) issues. Firstly, how does the presupposition of *FUT* project out of the restrictor argument of QPs? Secondly, does (319a) presuppose *some student comes out smiling* (i.e., existential import)?

Concerning the second question, it seems that this inference is defeasible. In the following examples, it is acceptable for the speaker to follow up (320a) by saying that he or she hopes that a student passed, which is only felicitous if he or she is uncertain whether a student passed. Crucially, such a continuation is not possible in (320b).

- (320) a. Every student who passed that course will be given a strong letter of recommendation. I hope at least one of them managed to.
 b. # Some student who passed that course will be given a strong letter of recommendation. I hope at least one of them managed to.

The sentence (320a) can be uttered by a speaker who believes that it is possible that none of the students passed the course.³ In which case, there maybe some epistemically accessible worlds in which a student passed, but others in which no student

¹See also the famous bathroom example attributed to Barbara Partee (Roberts, 1989).

(i) Either there's no bathroom in this house, or it's in a funny place.

²The temporal adverbial *later* has been added here. Without it, the existential sentence can have a grammatical generic reading.

³Emphasis on *possible* here. This sentence would be infelicitous if the speaker were certain that no student passed the course.

passed. This is not the case for (320b) which entails that at least one student passed. What we see then is that *FUT* can be embedded in the restrictor argument of a QP which is compatible with the possibility that some individual satisfies the restrictor argument as well as the possibility that no individual satisfies it. But *FUT* cannot be embedded in the restrictor of a QP which entails that some individual satisfies the restrictor. This pattern is reminiscent of the facts observed in the previous chapters.

Finally, notice that (319a), once again, exhibits the binding pattern **Crouch** observed in conditionals. The main clause features a relative past tense whose temporal anchor is bound by the *FUT* in the relative clause. This type of non-canonical binding is well-established with donkey anaphora which can be bound by an indefinite antecedent within the restrictor of a universal QP.

(321) Every farmer who own [a donkey]_i loves it_i.

Unfortunately, time and space preclude a full discussion of these facts. But certainly there is more to be said. The **Crouch** pattern which shows up in conditionals, disjunction, and universal QPs would no doubt benefit from a dynamic treatment. However, this lies well outside the scope of the present dissertation.

6.2 Conclusion

This dissertation has attempted to answer a number of questions surrounding the future licensing properties of modal operators and adverbial clauses. Not every question was answered in a satisfactory way, and ultimately many new questions have arisen as a result. It is my hope that this dissertation has provided some empirical and theoretical insights as well as some indication as to how these questions may be answered.

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