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„Temporal and Epistemic Readings of English W*ill* and German W*erden*"

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Chapter 1

Intro

1.1 The phenomenon

In many languages, items that induce a future-oriented reading are also used in epistemic statements which make no obvious reference to the future. That is, putting it in most common terminology, *future tense morphemes* often have uses where they express *epistemic modality*. This is illustrated for English *will* and German *werden* in (1) and (2).[1]

(1) **Future tense**
(Do you know what Lia is doing tomorrow?)

a. Yes, Lia **will** hand in her application to the circus tomorrow. (English)

b. Ja, morgen **wird** die Lia ihre Zirkusbewerbung einreichen. (German)
yes, tomorrow will the Lia her circus.application hand.in

(2) **Epistemic modality**
(Where is Ava?)

a. Ava **will** be in the stable feeding the pigs now.

b. Ava **wird** gerade im Stall sein die Schweine füttern.
Ava will right.now in.the stable be the pigs feed

The most prominent reading of (1) is one for which (3) is a decent enough paraphrase. The most prominent reading of (2) is one that can be paraphrased with (4) with comparable adequacy.

(3) There is a time t following the time of utterance (and within tomorrow) such that Lia is handing in her application at t.

[1] In English and German, both readings are compatible with the PERFECT.

(i) (Why can't we call the vet tomorrow?)

a. Tomorrow, the horse will have foaled already.

b. Morgen wird das Pferd bereits gefohlt
tomorrow will the horse already foaled
haben.
have

(ii) (How did Rapid play yesterday?)

a. They will have won.

b. Die werden gewonnen haben.
they will won have

(4) For all I know, it is the case that Ava is in the stable feeding the pigs.

I will refer to the most prominent reading of (1) as the *temporal reading* of *will* and I will refer to the most prominent reading of (2) as the *epistemic reading* of *will*. I will often use '$will_{ep}$' and '$will_{temp}$' as short term labels for '*will* on an epistemic reading' and '*will* on a temporal reading' respectively. Morphemes that give rise to those meanings I will call *alternating futures* or *alternating future expressions* (AFs). That epistemic and temporal interpretations are indeed two distinct readings of the alternating future in English and German receives initial confirmation from the fact that their paraphrases are not interchangeable.[2]

(5) a. The most prominent reading of (1) is not adequately paraphrased by (4).
b. The most prominent reading of (2) is not adequately paraphrased by (3).

Given the cross linguistic prevalence of this pattern, my work will base on the assumption that a unified analysis of the future in (4) and (5) is needed.[3]

Previous work on the future that is not ignorant to the epistemic-temporal alternation exhibited by future markers exists in two varieties: such approaches that assume a purely temporal semantics (Kissine 2008, 2014 and Salkie 2010) and such that treat the alternating future as a modal, which is clearly the route that is followed most frequently in the literature (e.g. Cariani and Santorio 2018; Cariani 2021; Condoravdi 2002, 2003; Copley 2002; Giannakidou and Mari 2018; Ippolito and Farkas 2021; Mari 2010; Mihoc et al. 2019; Werner 2006). Most of the modal accounts treat alternating future expressions as *necessity* modals, thereby suggesting (implicitly or explicitly) semantic similarity between *will* and *must*. Following Cariani and Santorio (2018) and Ippolito and Farkas (2021), I will argue that the alternating future (in English and German) is a *non-quantificational* modal. Following Condoravdi (2002, 2003) (among many others), I assume that alternating futures use epistemic and metaphysical modal bases and that the two main readings of alternating futures result from a shift between those two kinds of modal bases.

Another property of existing analyses that is important to this thesis concerns the *modal strength* attributed to alternating future expressions. Assuming that a modal operator $\mathscr{O}$ takes as its semantic argument a property of worlds p, $\mathscr{O}$ is said to be modally *strong* iff the truth of $\mathscr{O}\ p$ in w (at t) logically entails the truth of p in w (at some t'), as in (6).[4]

(6) **Strength of an operator**
A modal operator $\mathscr{O}$ is strong iff:
$[\![\mathscr{O}\ p]\!]^w = 1 \rightarrow [\![p]\!]^w = 1$.

[2]Not all existing analyses share this assumption: it has been claimed (Giannakidou and Mari 2018) that the temporal reading expresses a meaning that can be paraphrased by (4) indeed.

[3]Within the Indo-European family, those languages include Dutch (Broekhuis and Verkuyl 2014) English (Condoravdi 2002, 2003), French (Mari 2010, 2016), German (Dieling 1982), Greek and Italian (Giannakidou and Mari 2018), Hindi (Kush, 2015), Spanish and Catalan (Winans 2016). Other languages that have been studied with respect to the temporal-epistemic alternation include, Medumba (Mucha 2016) and Turkish (Yavaş 1982). Furthermore, I have (quite randomly, really) come across passages in the descriptive literature on Basque (Oyharçabal 2003, p.252) and Quechua (Cole 1982, p. 145) suggesting the existence of alternating future expressions in those languages.

[4]Note that, construed in that way, modal strength and modal force are two distinct properties. Cf. *weak necessity modals*.

It is *weak* otherwise.

Hence, a speaker who makes the assertion that $\mathscr{O}p$ in w commits herself to the truth of p in w. Among existing approaches, strong treatments of alternating futures are rare. To my knowledge, only Kissine (2008), Cariani and Santorio (2018) and Cariani (2021) have suggested strong analyses of alternating futures, while existing necessity-treatments are, as a matter of fact, unanimously *weak* analyses of alternating futures. In this thesis I, too, will adopt the position that *will* and *werden* are *strong* modals.

The analysis proposed in this thesis is thus characterized by the three parameters listed in (7).

(7) **Main properties of my analysis**
In English and German, the alternating future:
a. is a modal (using epistemic and metaphysical modal backgrounds)
b. is non-quantificational
c. asserts its prejacent, it is modally *strong*

In the following subsection, I illustrate some of the data that is most important to this thesis.

will and *must* are not identical

The readings that temporal *will* gives rise to are what I will call 'neutral future-oriented claims'. In those readings, *will* simply seems to be a (or *the*) standard device used to express future reference, much like past tense or perfect morphology is required for past-orientation in languages like English and German. In that sense, *will* and *werden* can be seen as the standard devices in English and German to express that the eventuality described by a sentence is shifted to some time following the time of utterance. Accordingly, purely temporal paraphrases such as (3) are quite accurate descriptions of the meaning of temporal *will*. Such readings are absent for *must*.

Temporal *will* does not express uncertainty

The modal strength of *will* is most apparent with its temporal readings. Nevertheless, the fact that we do not have full certainty about many things that will happen in the future has led authors to suggest that *will* signals uncertainty in *both* the epistemic and the temporal reading. But it can be easily demonstrated that temporal *will* is well compatible with full knowledge of the prejacent proposition. This can be shown with any past in the future expressions that embeds a proposition that is *known* to be true at the point of utterance, where *will* is entirely felicitous.[5]

(8) A: It is 1pm. The evil butcher comes again at 8pm. If Ida has not foaled by 8pm, he will take her.
B: Ida will$_{\text{tem}}$ have foaled by 8pm. [Pulls aside the curtain behind which Ida started foaling.] She is saved! (temporal)

(9) In ten hours, 600 minutes will have passed. (temporal)

[5] I thank Ryan Bochnak and Valerie Wurm for help with those examples.

Temporal *will* does not express epistemic indirectness

According to some analyses (Mari 2010, 2016, building on von Fintel and Gillies's (2010) analysis of epistemic *must*), temporal and epistemic interpretations of alternating futures share a restriction demanding that the evidence for the prejacent proposition must be only *indirect*. (10) shows that such a requirement is plausible for epistemic readings of *must* and *will*: the statement $must_{ep}$/$will_{ep}$ *p* is incompatible with *direct evidence of p*, which includes information gained through direct perception or through trustworthy sources as in (10).

(10) Lia {$must_{ep}$/$will_{ep}$} be feeding the pigs.
Not OK if:
   a. The speaker has direct evidence (e.g. *sees*) that Lia is feeding the pigs.
   b. The speaker has been informed about what Lia is doing by a trustworthy source.

The idea is that temporal uses of alternating future expressions signal such indirectness too, because properties of future times cannot be experienced directly. However, this kind of indirectness requirement can not straightforwardly be adopted for *temporal* uses of *will* since it is acceptable to use *will* if its prejacent proposition expresses information gained through trustworthy sources.

(11) a. Ava to Lia: Tomorrow, I will apply to circus.
   b. Lia to Rio: Ava will apply to circus tomorrow.

It seems that the commonality between epistemic and temporal *will* is simply not a requirement of indirect *evidence*. Instead, I will propose that temporal *will* (and *werden*) is subject to a form of 'metaphysical indirectness'.

Obligatory speaker commitment to the prejacent proposition

The following examples cast further doubt that the future is *weak* as not only temporal but also epistemic *will* seems to assert their prejacent proposition. This is illustrated for epistemic *will* in the examples (12)–(13) (based on examples by von Fintel and Gillies (2010)) which indicate that a speaker asserting (unembedded) *will p* is obligatorily committed to *p*. Hence, even though the epistemic future signals speaker uncertainty, the assertion of the prejacent proposition seems to be preserved.

(12) A: It $will_{ep}$ be raining by now. (based on von Fintel and Gillies 2010, p. 366)
   B: [checks] No, it is not raining. You were wrong!
   A: #No, I was not wrong. Look, I didn't say it *was* raining, I only said that it *will* be.

(13) a. #Although I am not certain, that (noise) $will_{ep}$ be John rearranging his furniture.
   b. #Ich bin mir zwar nicht sicher, aber das (Geräusch) $wird_{ep}$ John sein, der die
   I am REFL admittedly not certain, but the (noise) will John be, who the
   Möbel umstellt. (based on von Fintel and Gillies (2021), p.100)
   furniture rearranges.

Temporal *will*, of course, exhibits this behavior too. Note that in (14), there is not even an obvious stronger expression that *will* can be contrasted with (as indicated by '… [?]…').

(14) A: The barn will$_{\text{temp}}$ collapse tomorrow.
B: [checking 2 days later] No, the barn did not collapse. You were wrong!
A: #No, I was not wrong. Look, I didn't say … I only said that it *will* collapse.

(15) #Although I am not certain, the barn will collapse tomorrow.

As I will show in Section 3.1, possibility modals and even weak necessity modals or modals expressing likelihood behave in a different way. By those diagnostics, *will* is in both of its readings (if a modal) a *strong* one. It entails its prejacent.

Epistemic *will* signals epistemic uncertainty (even though it is strong)

Epistemic *must*-claims are reported to make a stronger claim than their epistemic future counterpart. Contexts that give rise to certainty-readings of *must* fail to induce such a reading for *will*.

(16) Chris has lost her ball, but she knows with full certainty that it is either in Box A or B or C. She says: The ball is in A or in B or in C. It is not in A… It is not in B …
a. So, it ✓must / #will be in C.
b. Also ✓muss / #wird er in C sein. (based on von Fintel & Gillies 2010, p.362)

This observation is consistent with the fact that *must* cannot occur with probability/likelihood adverbials, while *will* can.

(17) Where are my Toni Erdmann teeth?
a. They will (probably/maybe) be in the stable.
b. They must (#probably/#maybe) be in the stable.

Trivial scope

Unlike *must* and *can*, the future does not lead to scope ambiguities with negation. The sentence in (18-a) has one reading on which it is equivalent to (18-b) (if 'be in danger' is interpreted as the negation of 'be save') and one reading on which it is not. Arguably this is because the two readings correspond to two logical forms that differ in relative scope between *must* and *nobody*.

(18) a. Nobody must have been safe.
(i) It is necessary that there is no human x such that x has been safe.
(ii) There is no human x, such that is necessary for x that x has been safe.
b. Everybody must have been in danger.

In contrast, (19-a) where *must* is replaced with *will*, has *only* a reading on which it is equivalent to (19-b).

(19) a. Nobody will have been safe.

b. Everybody will have been in danger.

That is, *will* behaves like a neg-raising predicate (NRP). It has been argued that predicates behaving as NRPs deserve a *non-quantificational* analysis (for NRPs in general see Križ 2015, for discussion of non-quantificational behavior of alternating futures see Cariani and Santorio 2018, Cariani 2021 and Ippolito and Farkas 2021).

1.2 Scope, goal and outlook

In a nutshell, the goal of this thesis is to show that *will* and *werden* are –if they are modals at all– *strong* modals as has also been implicit in the work by Cariani and Santorio (2018) and Cariani (2021)) and that their readings (temporal and epistemic) can be derived on a purely modal strategy. Most existing modal analyses (i) treat *will* as a semantically weak necessity modal (Section 2.2) and (ii) assume some purely temporal ingredient in the lexical entry of *will* in order to account for future-orientation in temporal readings (Section 2.4). After a brief outline of the rudimentary empirical data in Chapter 3, I will show in Chapters 4 and 5 that *will* and *werden* are *strong* modals and that their semantics is not adequately by analyses that treat them as necessity modals. Chapters 4 and 5 are structured as follows:

- The meaning of *will* is **stronger** than assumed by most analyses. (Chapter 4)
  - The assertion of $will_{temp}$ p is compatible with metaphysical (and epistemic) settledness with respect to p (i.e. compatible with $\mathrm{MB}_{\mathrm{met}} \subseteq \mathrm{p}$). Hence uncertainty with respect to p is not a lexical requirement of *will*. (Section 4.1)
  - A speaker asserting *will p* commits herself to the truth of p. This is, I argue, because assertion of *will p* also results in the assertion of p. The reason why *will p* asserts p is that *will* is a strong modal. (Section 4.2)

- The claim *will p* is **not a necessity claim:** (Chapter 5)
  - Unlike *must*, *will* does not lead to scope-effects with negation. (Sections 5.1)
  - Unlike predicted by necessity-analyses of *will*, metaphysical uses of *must* are not equivalent to temporal *will* and epistemic uses of *must* are not equivalent to epistemic *will*. The assertion of *will p* (on any reading) is compatible with MB being non-settled with respect to p (i.e. compatible with MB $\not\subseteq$ p): the assertion of $will_{\mathrm{temp}}$ p is compatible with metaphysical (and hence epistemic) non-settledness of p. The assertion of $will_{\mathrm{ep}}$ p is compatible with epistemic non-settledness of p. (Sections 5.2 and 5.3)

Some of those points are also implicit in the work by Cariani and Santorio (2018) (and Cariani (2021)). As I discuss in section 2.3.2, their account does not explain the epistemic readings of *will*. Furthermore it suffers from the disadvantage that it relies on the assumption of purely temporal semantics in addition to modal semantics to derive forward-oriented readings.

My proposal in Chapter 6 improves on both of those issues. Adopting Cariani and Santorio's choice function treatment of *will*, I propose that the asserted content of *will* and *werden* is quasi-vacuous. To derive epistemic and temporal readings of *will* (and *werden*), I adopt the idea proposed by von Fintel and Gillies (2010) that modal bases are derived from 'kernels', which correspond to some privileged part of the modal base. Epistemic readings of *will* share with *must* the requirement of *indirectness*, which is modeled as a condition on the kernel of the epistemic modal base: what is known *directly* must not settle directly the prejacent proposition. This definedness condition is what distinguishes *will p* from bare assertion of *p*; the contrast to *must p* follows from the fact that their asserted content is different: *must p* quantifies universally over epistemically accessible worlds, *will p* does not.
The derivation of temporal readings of *will* proceeds in a completely parallel manner. Obligatory forward-orientation of temporal readings of *will* is derived by a condition requiring that the kernel of a metaphysical modal base must not directly settle the prejacent proposition. Since a metaphysical kernel $K_{met}(w)(t)$ is the set of propositions whose big intersection characterizes the set of epistemic alternatives of w at t, it follows that *will p* is only defined if the temporal argument of the prejacent p is some time following t.

I stress that the goal of this thesis is not to balance between modal and non-modal strategies of accounting for the behavior of alternating future. Instead, I seek to answer how a unified analysis of *will/werden* is possible *within* the modal strategy.

1.3 Terminology

The pattern exhibited by (1) – (2) I will refer to as the 'epistemic-temporal-alternation'. Morphemes giving rise to that pattern I will refer to as 'alternating futures' or 'alternating future morphemes'. When I speak of the 'epistemic future' or 'temporal future' I will always refer to different *readings* a given alternating future morpheme gives rise to. I use the terms 'epistemic' and 'temporal' in a purely descriptive manner and not in a way that anticipates the semantic analysis of their meanings. I will use *will*$_{\text{ep}}$ or '*will*$_{\text{temp}}$ as short-term labels for '*will* (or some other alternating future morpheme) construed on the epistemic reading' or *will* construed on the temporal reading' respectively. Other terminology corresponding to those descriptions that can be found in the literature are given in below.

(20) Terminology found in the literature

a. **Epistemic reading**: *conjectural, evidential, modal, non-predictive, present*.
b. **Temporal reading**: *predictive, forward shifting/extending/oriented.*

When I use 'forward-shifting' or 'forward-extending', I refer to the specific semantic operations associated with those terms. I use 'forward-orientation' or 'future-orientation' as cover terms for both of them. The other terms in (20) I will not use in that way.

Chapter 2

Existing analyses of the future

2.1 Chapter Intro

Not all research on the semantics of the future has been conducted in the awareness that the future behaves like a modal in many cases. In this chapter, I will restrict my roundup of previous research to work concerned with or at least acknowledging the existence of modal-like interpretations of the future. With the exception of the work by Kissine (2008, 2014), which I discuss in section 2.5, those accounts unanimously propose that the future involves *modal* semantics –at least to my knowledge.

In the remainder of the intro to this chapter, I present a fairly brief introduction to temporal and modal semantics in Sections 2.1.1 – 2.1.2. In the main body of this chapter, I present the details of existing analyses of epistemic futures. I will do so by separating modal from temporal ingredients of those accounts. First, in Section 2.2, I give an overview of analyses that treat *will* as a *necessity modal*. Other types of modal analyses (Cariani and Santorio 2018; Cariani 2021; Ippolito and Farkas 2021) are presented in Section 2.3. Next, in Section 2.4, I will look at the different ways the future-orientation of temporal readings has been accounted for in the literature. In section 2.5 I present the analysis by Kissine (2008), who suggests a purely temporal account of (both readings of) *will*.

To facilitate reading, I offer figure 2.1, which depicts a structured overview on the accounts that are featured in this chapter. The accounts listed here unanimously aim at an analysis that is to some extent a *unified* analysis of the temporal future (with the exception of Ippolito and Farkas 2021, who only look at the epistemic future but invoke the possibility of a historical explanation of alternating futures).[1]

2.1.1 Brief intro to temporal semantics

On a quantificational treatment of tense, temporal operators existentially quantify over times (i.e. intervals or points in time).[2] If restricted to a time before the time of utterance, existential quantification over times derives past tense. Restriction to a time following the time of utterance derives the future tense.

[1] See Table 2.4 for the main properties of the work by Mihoc et al. (2019), whose discussion of alternating futures is restricted to epistemic uses too.

[2] The quantificational approach goes back to the treatment of tense in logic (i.e. to the work by Arthur Prior, e.g. 1967 where tenses were given the semantics of a sentential operator.)

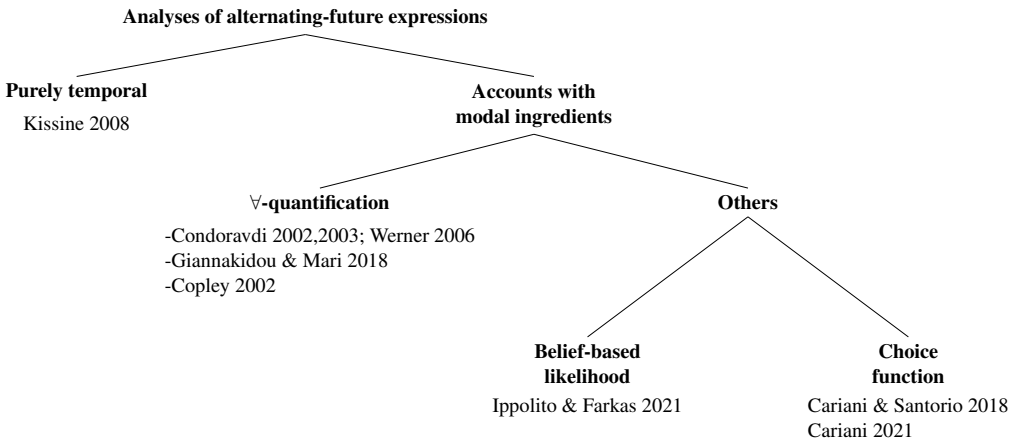

Figure 2.1: Future-research overview.

Temporal morphemes can then be defined as functions that take as their argument a proposition and shift their time of evaluation to a time introduced by the temporal morpheme. On that analysis, the tenses PAST and FUTURE have the denotations in (21). (The most simple analysis of the so-called *present tense* treats it as being semantically vacuous, which is why it is left out here. See e.g. Sauerland et al. 2002.)

(21) a. $[\![\textit{PAST-tense}]\!]^{w,t} = \lambda$p. $\exists t' < t.p(t')(w) = 1$.

b. $[\![\textit{FUTURE-tense}]\!]^{w,t} = \lambda$p. $\exists t' > t.p(t')(w) = 1$.
(where $t' < t$ is a relation between two times t and t' which holds iff t' temporally precedes t and $t'' > t$ holds between iff t" temporally follows t.)

Going back to early work by Dorit Abusch (1997; 1998), *will* and *would* are standardly assumed to be the surface forms of an underlying morpheme *woll*. *Would* is supposed to be the conditioned allomorph of *will* in the scope of PAST tense and in subjunctive contexts; *will* is the form arising elsewhere (or under PRESENT).

As an alternative to the quantificational theory, it has been suggested that tenses are *referential* and that they carry an index that is assigned a time by the assignment function g. On that account, a tense can be implemented as a functor taking a proposition as its argument as in (22), or, analogous to the semantics of pronouns, as the temporal argument of a proposition as in (23).

(22) a. $[\![\textit{PAST}_i]\!]^{w,t,g} = \lambda p_{\langle z,\langle s,t\rangle\rangle} : g(i)_z$ s.t. $g(i) < t_i.p(w)(g(i)) = 1$.

b. $[\![\textit{FUTURE}_i]\!]^{w,t,g} = \lambda p_{\langle z,\langle s,t\rangle\rangle} : g(i)_z$ s.t. $g(i) > t_i.p(w)(g(i)) = 1$.

(from von Fintel and Heim 2021, p. 119; slightly adapted)

(23) a. $[\![\textit{PAST}_i]\!]^{w,t,g} = g(i)$ if $g(i)$ is a time and $g(i) < t$, undefined otherwise

b. $[\![\textit{FUTURE}_i]\!]^{w,t,g} = g(i)$ if $g(i)$ is a time and $g(i) > t$, undefined otherwise

(from Büring 2019, slightly adapted)

While those two approaches are not equivalent, either strategy from (21) through (23) makes the future

tense the mirror image of the past. Evidence distorting that picture comes from contexts where a temporal operator appears in the scope of another temporal operator (so-called *sequence of tense* contexts). As an example, consider PAST under PAST and FUTURE under FUTURE respectively. For a past tense embedded under an attitude verb like *think* in the past tense, there are two readings available: one where the time of evaluation of the attitude verb is simultaneous (or overlapping) with the evaluation time of the embedded verb and one reading where the evaluation time of the embedded verb precedes the time of evaluation of the attutude verb. Enç (1996) calls those readings the 'simultaneous reading' and the 'shifted reading' respectively.

(24) Lia believed that Roy cried.

$[_{XP}\ \textit{Lia}_k\ [_{TP}\ \text{PAST}\ [\ \ldots\ [_{VP}\ t_k\ \textit{believe}\ [_{CP}\ \textit{that}\ [_{TP}\ [_{XP}\ \textit{Roy}_j\ ]\ \text{PAST}\ [\ \ldots\ [_{VP}\ t_j\ \textit{cry}\ ]]]]]]]]$

a. Available: τ(Roy cries) $<$ τ(Lia believes) $<$ t_0 (shifted reading)

b. Available: τ(Roy cries) $\circ$ τ(Lia believes) $<$ t_0 (simultaneous reading)

Crucially, the simultaneous reading is missing for sentences that embed one future under another.

(25) Lia will believe that Roy will cry.

$[_{XP}\ \textit{Lia}_k\ [_{TP}\ \text{WILL}\ [\ \ldots\ [_{VP}\ t_k\ \textit{believe}\ [_{CP}\ \textit{that}\ [_{TP}\ [_{XP}\ \textit{Roy}_j\ ]\ \text{WILL}\ [\ \ldots\ [_{VP}\ t_j\ \textit{cry}\ ]]]]]]]]$

a. Available: $t_0 >$ τ(Lia believes) $>$ τ(Roy cries) (shifted reading)

b. Not available: $t_0 >$ τ(Lia believes) $\circ$ τ(Roy cries) (simultaneous reading)

There exist other puzzling sequence of tense phenomena (see Abusch 1997 and Enç 1996), but their details are not important for the current purpose. The bottom line of those observations is that if both PAST and FUTURE are tenses, then either (i) they do not merely express the inverted temporal relation of each other or (ii) additional rules have to be stipulated to apply selectively to only one of the two tenses (see e.g. the *sequence of tense*-rule suggested by Enç (1987)). A possible reaction to this observation is to claim that the future belongs to a different semantic category altogether. Such a response is given by Enç (1996), who claims that the asymmetry found between PAST and FUTURE can be explained if *will* is a modal, not a tense.

The asymmetry between PAST and FUTURE is of course not the only reason to treat *will* as a modal. Due to the existence of non-temporal readings (i.e. especially epistemic readings) of future morphemes, the idea that the future might express modal semantics is around at least since the work on the English temporal system by Carlota Smith (1978). Another very early advocate in favor of this view is Feryal Yavas (1982), who worked on the Turkish future marker *-ecek*. Nevertheless, purely temporal (i.e. non-modal) approaches of non-temporal readings of the future do exist. The earliest version of such an explanation is by Bennett and Partee (1978) who paraphrase the contribution made by epistemic readings with (26-a). Another 'check and see' explanation for epistemic readings of the future can be found in Sweetser 1990.

(26) **Check and see accounts of epistemic readings**

a. John will have eaten the fish by now
$\approx$ *it will be known that John has eaten the fish now* (Bennett & Partee 1972/78, p.100)

b. He will be home by now
≈ *If we check, we will find out that he is home.* (Sweetser 1990, p. 55)

Another purely temporal account of (both readings of) *will* is offered by Kissine (2008, 2014). His account (which is actually not based on a *go and see*-type of explanation) is presented in section 2.5 as the only non-temporal account featured in this thesis (it is also, to my knowledge, the only elaborated non-modal account of *will* not ignorant to the existence of epistemic readings of *will*. A historical explanation is suggested by Salkie (2010).) Approaches related to the *check and see*-idea (even though they are treating the future as a modal) can be found in the work by Mari (2010, 2016) and MacFarlane (2003) who assume that what temporal and epistemic readings of the future have in common is that their truth conditions are calculated relative to a future 'time of assessment'. [3] In this thesis, I do not either of those types of accounts. In Section 2.5, I discuss the account by Kissine, which will turn out to be problematic. To keep things transparent, I will not make use of indices consisting of world-time pairs in this thesis, instead I will write them as separate parameters. Times t are elements of the domain D_z[4]; possible worlds w are elements of the domain D_s. I take propositions to denote properties of world-time-pairs. Such propositions are of the type $\langle z,\langle s,t\rangle\rangle$. Although I will ignore the temporal parameter whenever it can be done safely, in which case propositions are modeled as sets of possible worlds (i.e. of type $\langle s,t\rangle$).

2.1.2 Brief intro to basics of Kratzerian modal semantics

Here, I will give a brief introduction into those parts of the basics of modal semantics that are most relevant to the current thesis. The specific variant of modal semantics that I will assume here and throughout the thesis follows the style that is today most commonly assumed in formal semantics, i.e. the modal semantics based on the work by Angelika Kratzer (Kratzer 2012a). The analyses discussed in the next section deploy different notational conventions which I will translate into a consistent notation as far as possible.
To start out, consider each of the modals in (27) and note that the interpretation of even one and the same modal is not uniform.

(27) a. Ava **must** have been drinking.
b. It **may** be raining, but it **can't** be snowing.
c. Lui **must** be in bed at 8pm.
d. My pig Lia **can/may** be up at 10pm.
e. Pia **can** play the synth very well.

In (27), there is constancy with respect to the *force* of the modal: in the widest sense, *must* always seems to express some sort of necessity while *can* and *may* express compatibility. But we find inconstancy on a different level. The sentences in (a-b) are typically interpreted as making a claim about the speakers informational state, those in (c-d) make a claim about the obligations and permissions of the subject and (e) is a statement about the subject's abilities or the circumstances it finds itself in. That is, they vary in

[3] The idea of assessment-sensitivity has been adopted for epistemic modals in general by MacFarlane (2011).
[4] For German 'Zeit', based on 2019 lecture notes by Daniel Büring.

their *modal flavor*.

Instead of assuming as many lexical entries for modals as we might find modal flavors, Kratzer (1977, 2012a) implements this form of context dependence as a standard component of modals in general: modal force is a constant component of the meaning of a modal.[5] and is modeled as quantification over possible worlds: necessity corresponds to universal quantification, possibility corresponds to existential quantification. The quantificational domain of a modal is restricted by the conversational background. Which set of worlds this domain corresponds to is not (fully) lexically specified by a modal, but is fixed by context. Those empty slots specifying how the quantificational domain of a modal is restricted are called *conversational backgrounds*. A conversational background is modeled as a function from a world to a set of propositions. For example, with epistemic conversational backgrounds, this function takes a world w (e.g. the world of utterance) and yields the set of propositions known in that world w. Propositions are taken to denote sets of possible worlds (whenever the temporal parameter can be ignored, see Section 2.1.1 above). Accordingly, a conversational background is a function from a possible world to a set of sets of possible worlds, i.e. to a set of propositions (a power set of worlds).

(28) **Conversational backgrounds (CB)** (based on Portner 2009, p.51)

Given a context of utterance c, a conversational background is modeled as a function f from possible worlds to propositions.

a. if f is an epistemic modal background :
$f(\mathrm{w}) = \{\mathrm{p} : \text{the speaker of } c \text{ knows } p \text{ in } w\}$

b. if f is a deontic modal background :
$f(\mathrm{w}) = \{\mathrm{p} : \mathrm{p} \text{ is a rule in } c \text{ in } w\}$

According to (28), f yields for any possible world w, the set of propositions known by the speaker of c in w if the conversational background is epistemic; it yields the set of propositions p such that p consitutes a rule in c in w, if the conversational background is deontic. The quantificational domain of a modal is then the intersection of all propositions in f. A necessity modal yields truth, iff the embedded proposition of the modal (also called the *prejacent* of the modal) is true in *every* possible world in the logical space specified by the conversational background. A possibility modal yields truth, iff the prejacent is true in *some* possible world(s) of the conversational background. The entries for *must* and *can* can thus be represented as in (29), where the interpretation function is defined relative to a world of evaluation w, a context c and a conversational background f.[6]

(29) **Lexical entries for modals** (based on Portner 2009, p.52)

For any world w,w', context c and conversational backgrounds f, if N is a necessity modal, P is a possibility modal and ϕ an arbitrary proposition:

a. $[\![\mathrm{N}\phi]\!]^{w,c,f} = 1$ iff $\forall w'[w' \in \bigcap f(w) \rightarrow [\![\phi]\!]^{w',c,f} = 1.]$

b. $[\![\mathrm{P}\phi]\!]^{w,c,f} = 1$ iff $\exists w'[w' \in \bigcap f(w) \& [\![\phi]\!]^{w',c,f} = 1.]$

In a last step, we will now introduce the possibility for the set of worlds specified by $\bigcap f$ to be structured:

[5] There may be modals with variable force. See Kratzer 2012a, Ch. 2.

[6] In the remainder of the thesis I will often omit the contextual parameter c and the assignment function g.

in order to solve certain problems often pointed out in the modal literature, necessity modals have to be amended: Kratzer (1977/2012a, Ch.1) suggests that in some cases, the domain of quantification is not the whole set of worlds specified by $\bigcap f$, but only a subset thereof. The need for such an amendment has among other things been illustrated with versions of the *Good Samaritan Paradox* (which originally goes back to Arthur Prior as well). For our purposes, a very rudimentary version of it, taken from von Fintel and Heim 2021, is sufficient (see Portner 2009 for a more detailed discussion.) The paradox introduces some body of regulatory statements that contains (30-a) as a rule.

(30) **Good Samaritan Paradox** (adapted from von Fintel and Heim 2021, p.60)

a. John ought to help the person who was robbed.

b. → It ought to be the case that someone was robbed. (by (29-a))

If *ought* is taken to be a necessity modal, the entry in (29-a) predicts that (30-a) is true iff *John helps the person who was robbed* in every world of the deontic modal background. However, if that is the case, (30-b) follows from (30-a). This is completely contradictory to intuitions.

This problem is solved if modals are defined relative not to one, but two conversational backgrounds: (i) a set *MB(w)* of propositions containing e.g. known propositions or rules in *w* (now called the *modal base*) and (ii) a different set *j(w)* functioning as the basis for the structure induced on *MB(w)*, called the *ordering source*. For example, if *j*(*w*) consists of, as is typically assumed, propositions stating what the normal course of events is like in *w*, *j*(w) is called a *stereotypical* or *normality* ordering source. As an example, I give the rather broad definition of a stereotypical ordering source by Mihoc et al. (2019) in (31).

(31) **Stereotypical ordering source** (from Mihoc et al. 2019, p.7)

j(w) ={*p : p* is a belief / stereotypical fact / reasonable assumption in *w*}

The way one set can function as an ordering for another is given defined in (32).

(32) **Definition of the Ordering $\leq$ on possible worlds**[7] (adapted from Portner 2009, p.64)

For any set of propositions X and any worlds $w, w' : w \leq_X w'$ iff

for all $p \in X$, if *w'* $\in p$, then $w \in p$

(32) defines $\leq$ as a relation between two worlds such that the world to the left of $\leq$ satisfies at least as many propositions in X as the world to the left of $\leq$. The quantificational domain of a modal can then be restricted to the subset of the modal base that satisfies most of the propositions in the ordering source. The function *Best* as defined in (33) has such a set as its output.

(33) **Function *Best*** (based on Portner 2009, p. 67)

for any modal base $\bigcap MB$(w) and ordering source *j*(w):

$Best(\bigcap MB(w), j(w)) = \{w' : w' \in \bigcap MB(w) \ \& \ \neg\exists w''.[w'' \in MB(w) \& w'' \leq_{j(w)} w']\}$

A necessity modal construed on such a *doubly relative* strategy then has the entry as in (34).

[7] I believe there is a typo in (Portner, 2009, p.64): in the original, '$p \in X$' in (32) is replaced by *'$p \in S$'*.

(34) **Doubly relative necessity modal**

$[\![ought\ \phi]\!]^{w,c,MB,j} = 1$ iff $\forall w'.\ [w' \in Best(\bigcap MB(w), j(w)) \rightarrow [\![\phi]\!]^{w',c,MB,j} = 1.]$

It is a question of ongoing research, whether it is all or only certain modals whose semantics is doubly relative in the sense of (34).

2.2 ∀-quantificational accounts

In this section, I illustrate accounts suggesting that alternating futures can be analyzed as necessity modals, and hence in a way that parallels the standard treatment of *must*. Note that in this subsection I focus only on the modal ingredients of the analyses; any temporal components are illustrated separately in Section 2.4. The analyses presented here differ, among other things, with respect to the set of worlds that forms the domain of quantification. In some analyses, the modal base is assumed to change dynamically in order to give rise to different readings, as already seen with other modals in 2.1.2. In others, only one modal flavor is supposed to give rise to all different interpretations. The examples to be discussed here include metaphysical, epistemic and bouletic modality. For all I know, this captures the totality of modal bases assumed in the literature on the future.

2.2.1 Metaphysical and epistemic modality: Condoravdi 2002 and Werner 2006

An early unified analysis of the future is found in Condoravdi (2002) and Condoravdi (2003). The major issue addressed in this work concerns the way how the temporal orientation of a modal interacts with the time of instantiation of the prejacent and with the flavor of the modal base. One modal that features prominently in her discussion is *will*. The work by Werner (2006) focuses on *will* specifically but else has a similar scope. What both accounts have in common are the specific flavors of the modal base assumed to be available for *will*, which both assume is a necessity modal.[8]

Werner and Condoravdi assume that the modal base of *will* shifts between an epistemic and a *metaphysical* modal base. What is a *metaphysical* modal base in the sense of the above analyses? Which are the worlds that are metaphysically accessible from a world? One available metaphysical model of the future is the deterministic one: everything that will happen in the future of any given point in time t in a world w is already predetermined by the totality of past and present properties of w. That is, on the deterministic view, there are no metaphysical future alternatives for a possible world. This is *not* the kind of metaphysical model the metaphysical modal base by Condoravdi and Werner is based on. The metaphysical modal base used in their work is a 'branching future' structure. For any pair of a possible world and a time ⟨w,t⟩, there is a set of possible worlds *w'* such that *w'* is identical to w at least up to t. That is, the worlds in that set are exact matches of each other up to t and may begin to develop in different directions after t. The set of worlds which are identical to w up to t is called the set of *historical alternatives* of w up to t (cf. Condoravdi 2002; Werner 2006; Giannakidou and Mari 2018). Table 2.1 depicts an illustration of such a branching-future metaphysical model.

The diagram in (34) illustrates a scenario where all worlds from w_1 to w_8 share the same history up to

[8]The account by Mihoc et al. (2019) is silent on the semantics of temporal readings but else is well compatible with the approaches presented here. See Table 2.4 for a schematic overview that includes the account by Mihoc et al.

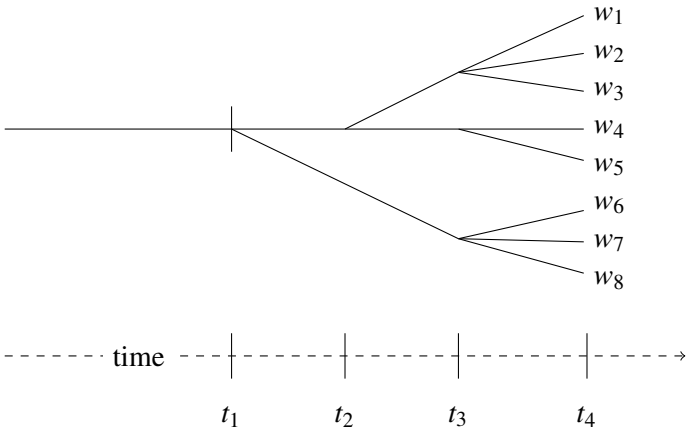

Table 2.1: Branching-future model

time t_1. At time t_2 the historical equivalence classes are the worlds w_1 to w_5 and w_6 to w_8 respectively. The sets of historical equivalent worlds at t_3 correspond to worlds w_1 to w_3, worlds w_4 to w_5 and worlds w_6 to w_7 respectively. None of those worlds are historically equivalent to each other at time t_4. In the remainder of the thesis, I will use the terms *metaphysical* and *forward-branching* as synonyms. The property of two worlds sharing the same past up to a certain time is referred to as *historical equivalence*, which is modeled as the relation between two worlds in (35).

(35) **Historical equivalence** (based on Condoravdi (2002, 2003))
Historical equivalence ($\simeq$) is a relation on $\mathrm{T}\times\mathrm{W}\times\mathrm{W}$
(T the domain of times and W the domain of possible worlds) such that:
for all $t \in$ T, $\simeq_t$ is an equivalence relation on $\mathrm{W}\times\mathrm{W}$ such that:
for any *w,w'* $\in$ W and *t,t'* $\in$ T, if $w \simeq_t w'$, and $t' \prec t$, then $w \simeq_{t'} w'$

The metaphysical modal base assumed by Condoravdi and Werner then consists of the set of worlds that are historically equivalent to the anchor world w up to the time of evaluation t ('$\mathrm{MB}_{\mathrm{met(aphysical)}}$(w)(t)'). This modal base is modeled as the set in (36).[9]

(36) **Metaphysical modal base**
For any world w and time t,
$\mathrm{MB}_{\mathrm{met}}(\mathrm{w})(\mathrm{t}) = \{\mathrm{w'} \mid \mathrm{w} \simeq_{\mathrm{t}} \mathrm{w'}\}$

On their accounts, the metaphysical modal base is responsible for the temporal reading of *will*: on its temporal reading, *will* is assumed to quantify universally over the set of worlds that are historically equivalent to the world of evaluation of the modal up to the time of evaluation of the modal. Ignoring other lexical components of their analyses (such as temporal forward extension (Condoravdi), diversity

[9] One can conceive of metaphysical modality as a form of circumstantial modality. The way I think of it, is that metaphysical modality is just circumstantial modality with a very large anchor situation. That is, I stick to the view that the modal base in question is based on a branching future and is projected from a world as in (36). There are however arguments against the view that metaphysical/circumstantial modal bases are based on a branching future (Abusch 2012, see also Kratzer 2012b). Noting the similarity between *alethic, metaphysical* and 'extremely objective' forms of epistemic modality, Portner (2009, see esp. Chapters 3.3.3 and 4.1.1) suggests 'factual modality' as a cover term. For the purpose of my thesis, the definition of metaphysical modality as in (36) is sufficient.

requirements at the truth conditional level (Werner)) the lexical entry for *will* on the temporal reading is sketched in (37).

(37) **Condoravdi/Werner: modal part of temporal *will***
$[\![will]\!]^{w,t,MB,j} = \lambda p.\forall w'.[w' \in BEST(MB_{\text{met}}(w)(t), j(w)) \rightarrow p(w') = 1.]$

So far, nothing in (38) precludes the time of instantiation of the prejacent to be at a non-future time. The authors suggest different strategies to derive the future-orientation of the 'temporal' reading, as will be discussed in section 2.4. Based on the entry in (38-a) would be roughly equivalent to the paraphrase in (38-b) according to Condoravdi's and Werner's account. Again, I ignore temporal information.

(38) a. White will_{tem} win this game.
b. $\approx$ *In all most normal worlds that are historically equivalent to the world of utterance up to the utterance time, white wins/is winning the game.*

For epistemic readings of *will*, the authors assume universal quantification over an epistemic modal base. The shift between metaphysical and epistemic readings of *will* is attributed to a shift between epistemic and metaphysical modal bases. As far as the quantificational part of the modal component of *will* is concerned, the analyses by Condoravdi and Werner converge on the lexical entry in (39), where the subscript to the modal base labels the flavors the modal base may alternate between. Since *will* is a necessity modal on that account, equivalence between *must* and *will* is predicted. As I will discuss in Chapter 5, such equivalence is not supported by the data.

(39) $[\![will]\!]^{w,t,MB,j} = \lambda p.\forall w'.[w' \in BEST(MB_{\text{met/ep}}(w)(t), j(w)) \rightarrow p(w') = 1.]$
Where: $MB_{\text{met}}(w)(t) = \{w' \mid w \simeq w'\}$
and $MB_{\text{ep}}(w)(t) = \{w' \mid$ is compatible with what's known in $w\}$

Werner explicitly assumes that the domain of quantification is ordered by a stereotypical ordering source while in Condoravdi's work, an ordering seems to be assumed only implicitly, otherwise *diversity* of the modal base cannot be satisfied by any necessity modal: Condoravdi and Werner assume the restriction in (40), which functions as a definedness condition of a modal and which requires that a modal base be non-homogeneous with respect to the prejacent proposition. In Condoravdi's analysis this requirement has the status of a presupposition. Werner implements it as a proper part of the at-issue semantics of the lexical item. Here, I will illustrate the strategy pursued by Condoravdi, because her work is more explicit with regards to modal base selection. See my Section 2.4.3 for Werner's implementation.

(40) **Condoravdi's diversity condition**
The semantics of a modal expression MODAL(p), where p is the prejacent, is defined iff the modal base is compatible with both p and $\neg p$.

The second requirement determines when some proposition is presupposed to be metaphysically *settled*. Informally, a proposition p satisfies metaphysical settledness in a world w whenever the historical alternatives of w are homogeneously p or $\neg p$ worlds. The definition of the settledness-presupposition in (41) is defined relative to a common ground, which Condoravdi takes to be the union of the historical

equivalents of those worlds that are compatible with shared knowledge and reasonable, agreed upon assumptions.

(41) **Presupposing Settledness** (based on Condoravdi 2002,2003.)
A common ground *cg* settles a property *P* iff
for any *w* ∈ *cg* and any *w'* such that $w \simeq_{t_0} w'$:
AT((t_0,∞),*w*,*P*) iff AT((t_0,∞),*w'*,*P*)

If a common ground *settles* a proposition *p*, it is *presupposed* that the world of utterance has as its historical equivalents only *p* or only ¬*p*-worlds respectively. Given the definition of historical equivalence in (35) and (41), it follows that a property of times that is instantiated before or at the time of utterance is *always* presupposed to be settled. Put differently, even if a speaker in *w* does not know whether a non-future time *t* satisfies a certain property *p*, she presupposes that if *t* satisfies *p* in *w*, then *t* satisfies *p* in any historically equivalent world *w'* too; and if *t* in *w* does not satisfy *p*, then *t* does not satisfy *p* in w' either. Thereby, the definition in (41) states that, for any non-future temporal property *p*, the past and present is presupposed to be, in terms of what is metaphysically possible, either a homogeneous *p*-space or a homogeneous ¬*p*- space.
This brings us back to modal base selection: by (40), a modal is only defined if it can be assigned a modal base that satisfies diversity with respect to the prejacent proposition, i.e. if it is a non-homogeneous logical space with respect to the prejacent. (41), in turn, states that speakers presuppose that the historical alternatives of (whatever turns out to be) the actual world are metaphysically homogeneous with respect to past and present properties of times but not with respect to future properties of times. Clearly, presupposing both (i) that the modal base satisfies diversity with respect to the prejacent and (ii) that the past and present is metaphysically settled must result in a contradiction if the prejacent of a metaphysical modal denoted a property that is metaphysically settled. In that way Condoravdi arrives at a mechanism for modal base selection that can be summarized as (42).

(42) If a property *p* is settled by a common ground *cg*, a modal with prejacent *p* cannot be assigned a metaphysical modal base by *cg*.

Since past and present oriented propositions are presupposed to be settled, it is expected that *will* is only compatible with a metaphysical modal base if the prejacent is future-oriented. Also, this condition is used to derive the fact that there are no metaphysical readings of *might* under the scope of the perfect (see Abusch 2012 and Thomas 2014 for discussion and revision).

In sum, the work presented in this subsection assumes that the (quantificational part of the) lexical entry of *will* is as in (39): *will* is a universal quantifier whose domain of quantification consists of worlds that are epistemically or metaphysically accessible. Quantification over epistemic modal bases derive epistemic readings, quantification over metaphysical (i.e. future-branching) modal bases derives temporal readings. The relation between the of evaluation of the prejacent and modal flavour is mediated by conversational adherence to the diversity principle and by the presupposition of settledness of a proposition. Ultimately, I will argue that both Condoravdi's and Werner's account of *will* is to *weak* to explain the fact that the alternating future in German and English *asserts* its prejacent.

My account follows their analyses in the assumption that metaphysical and epistemic modal bases derive temporal and epistemic readings respectively. Furthermore, I account for the future-orientation of temporal readings of *will* (and *werden*) in a way which is very similar to the proposal by Werner, but which is not based on (run of the mill) metaphysical non-settledness. Instead, I will argue based on von Fintel and Gillies (2010), who argue for a more structured view of epistemic modal bases, that there exists a privileged part of metaphysical modal bases too. I will then suggest that the non-settledness requirement (of both epistemic and metaphysical readings of *will*) has to target only this privileged part of the modal base.

2.2.2 Purely doxastic and speaker-anchored MB: Giannakidou and Mari 2018

Giannakidou and Mari (2018) too assume that the alternating future (in Greek, Italian and English) is a universal quantifier. They argue that not only epistemic readings but also temporal readings of the alternating future are derived from epistemic modal bases. This view is substantially based on their stance towards the truth-conditions of future-oriented assertions (and epistemic claims in general). On their view, a speaker who claims that AF *p* or *must p* can not be said to have made a false statement as long as she *believes p*. Comparing *must* and *will* to cases of *faultless disagreement*, they offer examples like (43) and (44).[10]

(43) **Scenario:** *Lia is enjoying her holidays on a lonely island. Pia does not know that. Misinterpreting certain clues, she says:*

a. Lia must be at home right now.

b. Lia must have been at home this morning. (based on Giannakidou and Mari 2018)

In the scenario of (43), both (43-a) and (43-b) are judged true by the authors: even though the prejacent is false in the world of utterance (Lia is not home in the scenario), Pia did -according to their judgment- not make a false statement, since the proposition that *Lia is home* is the prejacent of epistemic *must* in the assertion by Pia. (44) makes the same case for temporal *will*.

(44) **Scenario:** *On Monday, Lia and Susan set up a meeting for Friday. However, Susan died in a car accident on Wednesday. On Thursday, Lia, not knowing that Susan had died on Wednesday, says:*

I will meet Susan tomorrow. (based on Giannakidou and Mari 2018, p.105)

In a scenario like (44), from the moment when Susan dies in world *w*, there is not a single historical alternative of the world of utterance where Lia and Susan ever meet again. Nevertheless, Giannakidou and Mari claim that Susan did not make a false claim. Even more, they claim that (44) *fails* to receive an interpretation on which it is false in this context. Personally, I wish to disagree even with the weaker claim: according to my own judgments, there is not a single interpretation of (44) on which it is true (in

[10] In the original argument by Giannakidou and Mari, the examples contain the phrase 'for all I know'. However, they do not discuss the contribution of that phrase and their discussion of relative truth of modal statements does not seem to rely on such a phrase being present. Therefore, I assume that their claims equally apply to examples like the one in (i).

English and its German equivalent, that is; note that their original examples are in Italian and Greek, but they extend their claims to English).

In any case, since (44) fails to be false on their judgments, even though there can not be a single historical alternative in the branching structure where Susan and Lia meet, they conclude that the modal base of the future cannot be metaphysical. Assuring that (43) and (44) come out true can for example be achieved by restricting modal quantification to only the 'best' of epistemically accessible worlds or by making the modal base doxastic, i.e. identifying the domain of quantification with the set of worlds compatible with what is believed (instead of what is *known*).[11] Giannakidou and Mari take both. Furthermore, they assume a 'Nonveridicality Axiom of modals' in (45). It is basically identical to Condoravdi's diversity condition discussed in the previous subsection, with the difference that the Nonveridicality Axiom is taken to be a general condition on the use of *any* modal.

(45) **Nonveridicality Axiom of modals** (≈ Condoravdi's diversity principle)
MODAL (M) (p) can be defined only if the modal base M is nonveridical, i.e. only if M contains p and non-p worlds. (Giannakidou and Mari 2018, p. 100)

(46) illustrates the suggested lexical entries for *will* and *must*. They quantify over the most normal/stereotypical subset of the set of worlds that are compatible with what the speaker *believes*. The modal base is hence suggested to be always calculated relative to a speaker (identified with the index *i* in (46)).[12]

(46) Lexical entry by Giannakidou and Mari (2018) (notation adapted)
$[\![\text{AF}]\!]^{\text{w,t,MB,j}} = \lambda \text{p}.\ \forall w'.[w' \in BEST(MB_{\text{ep}}(i)(w)(t), j(w)) \rightarrow p(w') = 1.]$
(where MB_{ep}(i)(w)(t) = $\{w' \mid w'$ is compatible with what *i* believes in $w\}$)

In that way, they arrive at a meaning for the alternating future (in both readings) that is completely identical to the meaning they assume for epistemic *must*. Their system is hence a *purely* doxastic analysis of the future: statements about the future are epistemic claims just as much as genuine epistemic readings of *will*. Different readings of *will* are therefore only a consequence of the temporal orientation of the prejacent.

Thereby, the system suggests a very direct correlation between embedded tense and resulting interpretation of the future where for each tense co-occurring with the future, there is exactly one reading of the future. On their account, the syntactic locus of the future (and *must*) -regardless of their reading- has scope over the TP.

(47) $[_{\text{AFP}}\ \text{AF}\ [_{\text{TP}}\ \text{T}\ [_{\text{AspP}}\ \text{Asp}\ [_{\text{VP}}\ \text{V}\ ]]]]$

They assume three tenses PAST, PRESENT and NON-PAST. Tense and resulting reading are assumed to map to each other as in (48).[13]

[11] Note that they sometimes refer to the this type of modality as *epistemic* and sometimes as *doxastic*. They are also not consistent with respect to their use of *knowledge* vs. *belief*.

[12] A speaker relative notion of epistemic modality for the future is also assumed in Mari 2010.

[13] Note that (48) is only an abstraction from the Greek and Italian data as the labels do not describe the argument of the future in full detail: the difference between 'NON-PAST' and 'PRESENT' in (48) is dependent on Aktionsart in Italian and aspect in Greek. (i) and (ii) thus contain more accurate labels than (48). However the authors assume that, where relevant for the interpretation of the future, they both boil down to (47). See the original paper for more details.

(48) a. AF(NON-PAST) ≈ temporal
b. AF(PRESENT) ≈ epistemic
c. AF(PAST) ≈ epistemic

I will argue against this analysis by showing that *will* (and *werden*) do not behave as would be expected of *weak* modals: First, metaphysical *will* is compatible with full knowledge of the prejacent proposition. This is well compatible with the fact that both epistemic and temporal readings of *will p* commit the speaker to the truth of *p*. Furthermore, *will* is very often not replaceable by *must*. None of this fits the suggested analysis by Giannakidou and Mari.

2.2.3 Bouletic analysis: Copley 2002, 2008

Copley (2002) and Mari (2010) suggest a bouletic analysis of alternating futures. I will confine this section to the work by Bridget Copley, whose work addresses *will* and *be going to* as well as the semantics of *futurates*, i.e. future-oriented expressions with present indicative morphology. Here, I will only discuss her assessment of *will*.

Like the work presented in section 2.2.1, Copley (2002) assumes a forward branching metaphysical modal base as the modal base of *will*, which is a necessity modal on her account too. But the way Copley models the ordering of modal bases is quite different from what we have seen in other analyses. On this account, *will* presupposes that there is some entity (for example a person) which *directs* the prejacent proposition. Roughly, an entity directs a proposition *p* if it has full control over the truth-value of *p*. Her definition of directing a proposition is in (49).

(49) **Copley's definition of *Direction***
An entity d *directs* a proposition p in w at t iff:
∀w' metaphysically accessible from w at t and maximally consistent with d's commitments in w at t:
[∀w" metaphysically accessible from w at t:
[∃t' > t: [p(w')(t')] ↔ [∃t": [p(w")(t")]]]]

(from Copley 2002, p.34)

(49) states that *d directs* a proposition *p* iff *p* happens if and only if *d* wants *p* to happen. That is, if *d* directs *p*, then *d* has full control over *p*.
She assumes that the quantificational-domain of *will* is restricted by a metaphysical modal base and a

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(i) **Greek: correlation TP-semantics and interpretation of future**
a. AF(NON-PAST(PERF)) ≈ temporal
b. AF(NON-PAST(IMPERF)) ≈ epistemic
c. AF(PAST) ≈ epistemic

(ii) **Italian: correlation TP-semantics and interpretation of future**
a. AF(NON-PAST(eventive Aktionsart)) ≈ temporal
b. AF(NON-PAST(stative/progr. Aktionsart)) ≈ epistemic
c. AF(PAST) ≈ epistemic

bouletic ordering source. (50) is an example of a bouletic ordering source, which is defined relative to a world w and an index i representing the attitude holder. According to the lexical entry in (50), the assertion of *will p* then is true iff p is true in all worlds that are metaphysically accessible from w and maximally consistent with the director's commitment in w (cf. Copley 2002, p.35).

(50) $j_{boul(etic)}(w)(t)(i) = \{w' \mid w' \text{ is consistent with the desires of } i \text{ in } w \text{ at } t\}$

(51) $[\![will]\!]^{w,t,MB,j,d} = \lambda p.\forall w'.[w' \in BEST(MB_{\text{met}}(w)(t), j_{\text{boul}}(w)(t)(d)) \rightarrow p(w')(t) = 1]$.
Presupposition: d directs p in w at t.

In principle the identity of the director is supplied contextually, but very often the director corresponds to the subject of the sentence, if the subject is animate. In certain cases, typically when the subject of a *will*-sentence is not animate, the director is interpreted to be inanimate. In such a case, the ordering is not (really) a bouletic ordering source but an inertial ordering source. Roughly, an inertial ordering source is a set of worlds *w'* such that all events that are already happening in the anchor world continue normally (it is hence a kind of normality-ordering. See also Portner (1998), p.761). Instead of assuming that bouletic ordering sources switch to inertial ordering sources with inanimate directors, Copley suggests that (i) inanimate directors can be equated with 'the universe', (ii) the universe is able to *want* or *desire* things too and that (iii) the 'wishes' and 'desires' by the universe are subject to the restriction in (52).

(52) **Inertia Principle for futures**
The universe "wants" and can direct only the completion or continuation of eventualities that are already underway, or for which a compelling cause has already occurred. (Copley 2002, p.63)

At bottom, this is a way of equating a bouletic modal space to an inertial one. Presumably, the intention behind those assumptions is to stick to the *director*-idea even if there is no entity which can plausibly fulfill such a role.
Ultimately, the account by Copley can be restated as follows: *will* universally quantifies over a subset of the historical alternatives of the world of utterance. If the context provides an animate director (typically the subject, if animate), this subset corresponds to the subset of historical alternatives of w_0 that is most consistent with what the animate director *wants*, i.e. a metaphysical modal base restricted by a *bouletic* ordering source. If context does not provide an animate director, *will* quantifies over a metaphysical modal base ordered by an inertial (i.e. normality) ordering source. In both cases, the actualization of the event described by the prejacent is presupposed by means of a *direction*-presupposition.
The argument in favor of bouletic and stereotypical orderings is based on Copley's judgments of *will* claims, which are very similar to the judgments by Giannakidou and Mari discussed in the previous section. Bouletic orderings on historical alternatives are supported, according to Copley, by examples like (53).

(53) **Context:** *You have a friend who does not always show up when she says she will. You are supposed to meet her at 5, but you are expressing doubt that she will show up. Another friend might say, to comfort you [...]:*
Don't worry, she'll be there at 5. (adapted from Copley 2002, p.63)

Copley does not explicitly discuss the truth conditions for this example. At any rate, she uses the example to justify a bouletic semantics of *will*, which makes any *will* claim true if context provides an animate director such that the prejacent holds true in all of the director's best desire-worlds. As for cases for which Copley suggests a normality ordering on historical alternatives, she imagines the dialogue in (54).

(54) a. A: The ball will roll all the way down the hill!
b. B: Oh yeah? Even if I run up and stop it?

(Copley 2002, p.60)

Copley judges (54-a) to be true in the scenario even though B actually *could* prevent the ball from rolling all the way down. If the prejacent in (54-a) *could* be prevented from being instantiated, the prejacent is not metaphysically necessary. She concludes that universal quantification must be restricted to a subset of metaphysically accessible worlds. The restriction she suggests is a normality ordering source. Note however, that such an ordering allows not only that the prejacent *could* be prevented from happening, but it also allows that the prejacent proposition is actually not instantiated at all (e.g. if it is prevented) in the world of utterance. This consequence seems to be intended by the author.

I disagree with this judgment. On my own proposal, which I will present in Chapter 6, *will p* is compatible with the metaphysical possibility of $\neg p$. It is, however, not compatible with $w_0 \in \neg p$. As I will argue in Chapter 4, future-oriented claims entail the assertion of the bare prejacent. Claims like (53-a) or (54-a) are hence not *true* if the predicted eventuality is prevented from happening. It is just that, as relatively little is known about which propositions will hold at a future time, the threshold of acceptability is relatively low for future-oriented assertions. But this is, I take it, just a matter of how assertions with different levels of credence are treated pragmatically and not a matter of *will* or other futures being weaker than bare assertion of the prejacent.

2.2.4 Conclusion: Existing ∀-analyses are *weak*

The analyses presented in Sections 2.2.1, 2.2.2 and 2.2.3 all assume that *will* is a modal with universal quantificational force. All of those accounts assume that this quantifier is restricted to a certain non-realistic subset of the modal base (by a stereotypical or bouletic ordering source). This is a consequence of the requirement that the modal base has to be diverse with respect to the prejacent proposition, which in turn is based on the assumption by some authors that alternating futures can be true even if the prejacent proposition is false. If the modal base is required to be diverse with respect to the prejacent, then unrestricted quantification results in a contradiction unless there is a non-empty ordering source.[14] Existing necessity-accounts are therefore *weak* treatments of the alternating future. In section 4, I will argue that those treatments, due to their weakness, cannot account for the fact that the assertion of *will p* entails the assertion of *p*.

[14]Mihoc et al. (2019) state this requirement as a lexical presupposition of the (English and Bulgarian) alternating future. See Section 5.3.

2.3 Other modal analyses

2.3.1 Ippolito and Farkas 2021: The future as a comparative subjective modal

Ippolito and Farkas (2021) are concerned with the semantics of epistemic readings of the future in Italian. The essence of their proposal can be captured as in (55).

(55) The Italian presumptive future expresses that the prejacent proposition is subjectively more likely than any other salient alternative (of a question under discussion).

Very roughly, the salient alternatives in a discourse are the most salient possible answers to the *question under discussion* (QUD). QUDs have been argued to constitute fundamental components of linguistic discourse and have been used as a means to define when a given contribution to a discourse satisfies *relevance* (e.g. Roberts 1996; **?**). Roughly, a contribution (or *move*) is relevant iff it addresses the QUD.[15] A QUD is not (necessarily) explicitly asked, but is implicit in the topic of the discourse. It is modeled as the set of propositions that are possible answers to the question. In Roothian theories of focus, the focus semantic value of a constituent containing a focus-marked element is taken to be the set of elements of the same type that differ only in the value of the focus-marked element. An assertion is acceptable (i.e. congruent to the QUD and hence *relevant*) only if its focus alternatives are a subset of (or equal to) the QUD. The salient alternatives of the prejacent's semantic value are thus a subset of the focal alternatives of the prejacent (see (56-a-b)). Given that the prejacent is assumed to be a proposition, the set of salient alternatives is a set of propositions.

According to the informal definition above in (55), the Italian epistemic future asserts that the prejacent proposition is the subjectively most likely alternative among the salient alternatives. The relation of subjective likelihood ($>$) is modeled relative to a doxastic state D and to the attitude holder of the doxastic state i (very much like in the proposal by Giannakidou and Mari above). The value of the attitude holder i is provided by context and defaults to the speaker. In order for the at-issue content of the epistemic future to be defined, the presupposition in (56) has to be satisfied. Informally, it states that there is a proposition that is (doxastically for i) the most likely salient alternative. The semantic content in (57) states that FUT_{ep}(p) asserts that p is that proposition.

(56) **Definedness condition**

$[\![FUT(p)_{\text{F}}]\!]^{\text{g,w,t,c}}$ is defined iff

$[\![p_{\text{F}}]\!]^{\text{g,w,t,c}} \in \text{C}$ and there is a $q \in \text{C}$ s.t.

$\forall$ r: r $\in$ C and r $\neq$ q, q $>_{\text{i,t,D}_\text{i},\text{w}}$ r.

where:

a. $[\![p_{\text{F}}]\!]^f$ is the focus semantic value of the prejacent

b. $\text{C} \subseteq [\![p_{\text{F}}]\!]^f$

c. D_i is the set of worlds *w'* such that for every propositions *p*' such that *i* believes at *t* in *w* that w $\in$ *p'*, *w'* $\in$ *p'*.

[15] Ippolito and Farkas do not commit to a specific view of when something counts as *addressing* (or *answering*) the QUD. In view of their proposal, the loose definition found in **?** seems to be suitable: 'A is an answer to Q if A shifts the probabilistic weights among the propositions denoted by Q.' (p. 517).

d. *i* is a contextually bound variable; in default cases its value is the speaker in declaratives and the addressee in interrogatives;

e. for any propositions p, q $\in \mathscr{P}$(W): p $>_{i,t,D_i,w}$ q iff *i*'s credence in *p* is greater than *i*'s credence in *q* in *w* at *t* relative to D_i.

(from Ippolito and Farkas 2021, p. 11-12; slightly adapted)

(57) **Semantic content**

$[\![FUT(p)_F]\!]^{g,w,t,c}$ = 1 iff $[\![p_F]\!]^{g,w,t,c}$ = the q s.t. [∀r: r ∈ C and r ≠ q, q $>_{i,t,D_i,w}$ r].

(Ippolito and Farkas, 2021, p.12)

The authors assume that this entry gives rise to a mandatory implicature of non-veridicality: the doxastic state of *i* is compatible with both *p* and ¬*p* (see the diversity condition above). The implicature is a result of the competition with the assertion of the bare prejacent, which is more informative and involves less phonology than FUT(p).

It seems that the main purpose of the proposition in (56), which can be simplified to (58), is to account for the fact that the epistemic future does not lead to scope ambiguities with negation.

(58) There is a unique proposition in D_i that *i* considers most likely.

Since there is a presupposition of uniqueness of a most likely alternative in *i*'s doxastic space, the expressions ¬(FUT(p)) and FUT(¬(p)), the authors argue, come out as equivalent. This is shown in an example involving German *werden* (the equivalent English sentences sound odd without clefting). Given a QUD *What is missing from the cookie plate?* and the salient propositional alternatives *(the...) Vanillekipferl, Rumkugel, Butterbrot (...is missing)*, the meaning of the vague LF in (59-b), where *werden* is in the scope of negation, is strengthened by the presupposition in (56) (and (58)) to a meaning that is equivalent to (59-a).

(59) Das Vanillekipferl wird nicht fehlen.
the vanillekipferl will not be.missing
'The vanillekipferl won't be missing.'

a. [$_{willP}$ *will* [$_{negP}$ ¬ [$_{XP}$ *the vanillekipferl is missing*]]]
At-issue meaning: That *the vanillekipferl is not missing* is the subjectively$_i$ most likely alternative.

b. [$_{negP}$ ¬ [$_{willP}$ *will* [$_{XP}$ *the vanillekipferl is missing*]]]
At-issue meaning: That *the vanillekipferl is missing* is not the subjectively$_i$ most likely alternative.
Implicature: That *the vanillekipferl is not missing* is the subjectively$_i$ most likely alternative.

This analysis posits a *weak* semantics for the Italian epistemic future. The ingredients responsible for its weakness are (i) the use of a non-realistic set of alternatives (doxastic alternatives) and (ii) the relation of comparative, subjective likelihood. I will argue that this meaning is still too weak to account for the data in German and English in Section 4.

2.3.2 Cariani & Santorio 2018: A strong and non-quantificational treatment of *will*

Cariani and Santorio's (2018) treatment of the *will* does not involve quantification over possible worlds. Instead they assume that *will* denotes a choice function with the properties illustrated below. The main reason for this choice is the fact that *will* (just like alternating futures in German and Italian) is not involved in any scope related phenomena. Their main focus are temporal readings of *will*, though they briefly note that their analysis might be applicable to epistemic interpretations as well. In my own proposal, I too will argue against a quantificational analysis of *will* and *werden*, but I remain agnostic as to whether this should be achieved with a choice function semantics or some other strategy (see especially Section 7.3.4).

The details of their analysis work as follows. They assume that *will* denotes a choice function which takes as its semantic argument a world and (according to an updated version of the proposal in Cariani 2021) a modal base and returns a world that replaces the world of evaluation of the prejacent by a certain world in the modal base by following the restrictions in (60).

(60) A function s: $\mathscr{W} \times (\mathscr{W} \rightarrow \mathscr{P}(\mathscr{W})) \rightarrow \mathscr{W}$ is a selection function iff:

a. if $MB(w)$ is non-empty, then $s(w,MB(w)) \in \mathrm{MB}(w)$, and

b. if $w \in MB(w)$, then $s(w,MB(w)) = w$

(adapted from Cariani and Santorio 2018; Cariani 2021)

The function s takes as its arguments a world w and a modal base $MB(w)$ and, by (60-a), returns a world *w'* that is an element of $MB(w)$. By (60-b), if w is in $MB(w)$, the selected world *w'* is identical to *w.* The default modal base of *will* is assumed to consist of the set of metaphysically accessible worlds.[16] The proposed entry for *will* then yields truth for *will p* iff p is true in the world selected by $s(w, MB_{met}(w))$, as in (61).[17]

(61) $[\![will\ p]\!]^{w,s,g} = 1$ iff $p(s(w, MB_{met}(w))) = 1$

The analysis (as updated in Cariani 2021) indeed predicts that there are no non-trivial scope phenomena if *will* occurs with negation. In the case where negation takes scope over *will*, as in (62), the assertion *not will p* is true iff the world w selected by the choice function (from a metaphysical modal base) does not satisfy p. If *will* scopes over negation, as in (63), *will not p* is true iff the world w selected by the choice function is such that w satisfies $\neg p$. Since w satisfies $\neg p$ if and only if w does not satisfy p, (62) and (63) come out as equivalent, as indicated in (64).[18]

(62) $[\![not(will\, p)]\!] = 1$ iff $p(s(w, MB(w))) = 0.$
$\equiv 1$ iff $\neg p(s(w, MB(w))) = 1.$

[16] Presumably, epistemic interpretations would be derived from an epistemic modal base.

[17] Taken together, (60-a) and (60-b) might form a promising answer to the question why alternating futures always seem to alternate between realistic modal flavors. This benefit of the analysis has not been noted (explicitly) by the authors.

[18] I assume that negation has the meaning in (i).

(i) $[\![not\ p]\!] = 1$ iff $p = 0$.

(63) $[\![will(not\,p)]\!] = 1$ iff $\neg p(s(w,MB(w))) = 1$.
$\equiv 1$ iff $p(s(w,MB(w))) = 0$.

(64) $[\![\neg(will_{temp}\,p)]\!]^{w,s,g} \equiv [\![will_{temp}(\neg p)]\!]^{w,s,g}$

To account for obligatory future-orientation of temporal *will*, Cariani (2021) follows Condoravdi (2002) and suggests that *will* extends forward the time of evaluation of the prejacent proposition. On this analysis, the time of evaluation of the prejacent proposition has to be included in an interval that starts at the local evaluation time of *will* and extends infinitely into the future. This is represented by '$[t,\infty)$' in (65), which is a pared down version of the more sophisticated notation in Cariani 2021. The details of forward-extension are discussed in Section 2.4.1 below.[19]

(65) $[\![will]\!]^{w,t,MB} = \lambda\, p.$ p(s(w,MB(w)))($[t,\infty)$)

This semantics makes *will* equivalent to the assertion of the bare prejacent if will is unembedded and interpreted relative to a metaphysical modal base.

(66) $[\![will_{MB}\ p]\!]^{w,s,g} = 1$ iff $[\![p]\!]^{w,s,g} = 1$. (Cariani and Santorio 2018, p.148)

This is so because any world w is necessarily an element of the historical modal base of itself, since the historical modal base is realistic (cf. Kaufmann et al. 2006). Given the definition of the selection function in (60)-b, it returns w if w is in $MB(w)$. Hence, whenever *MB* is realistic, *will p* is predicted to be equivalent to p, as far as the modal component of the analysis is concerned. Apart from the temporal component, the contribution made by *will* can therefore be said to be vacuous in a certain respect. Accordingly, together with the temporal semantics in (66), *will p* is predicted to be paraphrased adequately by the classical temporal paraphrase in (67).

(67) $[\![will\ p]\!] \approx$ at some time t' after (or simultaneous to) the time of utterance t_0, $p(t)$ =1.

In principle, I consider this an advantage of this analysis: in the light of the data presented in Chapters 4 and 5, which show that *will* is strong (Chapter 4) but not a universal quantifier (Chapter 5), this seems to be a welcome prediction since it accounts for modal strength as well as for the fact that *will p* seems to make a non-maximal claim with respect to a modal base.

There is however one disadvantage and one potential problem to this analysis, neither of which is taken on by the authors. As illustrated above in (65), the suggested entry contains both modal *and* temporal components. While this might not be problematic per se, I will argue that if future-orientation can be derived as a consequence of the modal component (which it can, as I argue in Section 6.2) then positing additional temporal semantics is superfluous. This is the disadvantage. Somewhat more problematic are the predictions this account makes for epistemic readings of *will*. Since *will p* is equivalent to bare *p* whenever the modal base is realistic, such equivalence is also predicted if the modal base is epistemic, which is a realistic modal base (cf. Kaufmann et al. 2006). Crucially though, the following two sentences

[19] This is an updated version of the temporal semantics suggested in Cariani and Santorio 2018, where they suggest a classical forward-shifting analysis.

are not equivalent. While (68-a) sends a signal of indirectness and uncertainty, such a signal is missing in (68-b).

(68) Where are my fake teeth?

a. They will be in the stable.

b. They are in the stable.

Furthermore, since temporal forward-extension is hardwired into the lexical entry, it is not clear without further assumptions why forward-orientation is optional with an epistemic modal base but obligatory if the modal base is metaphysical. That is, Cariani and Santorio's analysis cannot explain the correlation between modal flavor and obligatory forward-orientation that we find.

The way out that I see for the problem of equivalence illustrated in (68) is the following. Even though the truth conditions of *will p* are indeed predicted to be equivalent to that of *p*, *will* is still a modal in the most basic sense that it makes reference to a modal base. In that way, the difference between (68-a) and (68-b) could be derived from non-truth conditional conditions on e.g. the use of a modal in general, or more specifically from certain conditions on the assignment of a modal base. In that case, Cariani and Santorio's account is only as accurate as those additional non-truth conditional conditions. In any case, those restrictions have to be spelled out some way or other. In essence, this is what I will do in my own account, which I will present in Section 6.2. The specific way I will do this derives future-orientation as a direct consequence of a certain condition on (a privileged component of) the metaphysical modal base, which is why my entry for *will* does not involve any dedicated temporal components. Hence, the proposal readily accounts for the correlation between modal flavor and obligatory future-orientation. Whether (near) truth-conditional equivalence between *will p* and *p* is established via a choice function semantics like that of Cariani and Santorio or through some other function is not important to the goal of my thesis.

2.4 How modal analyses account for future-orientation

If alternating futures are modals, then why are temporal readings of the future obligatorily future-oriented? There are multiple strategies to implement future-orientation and the literature makes use of a whole variety of them. In some modal analyses, the future has temporal semantics as a part of its lexical entry; others keep the lexical entry of the alternating future purely modal, assuming that future-orientation (i) comes from some item with temporal semantics in the scope of the future or (ii) results from certain conditions on the interaction between the prejacent and settledness of the modal base (Werner (2006) and less explicitly Condoravdi (2002)). Accounts with temporal ingredients differ with respect to the kind of temporal semantics they assume: some assume a run of the mill forward-shifting operator, others argue in favor of prospective *aspect*.

It has been noted in the literature (Condoravdi 2002; Mucha 2016; Kratzer 2012b, 2013) that future-orientation is not just a property of *will* and other future markers, but rather the default temporal orientation of most root modals. In (69-a), the prejacent *freddy wins the game* is future-oriented, as is the

prejacent in (69-b).

(69) a. Freddy might win the game.
b. Whitney must paint over the mold in her room.

Certain proposals to be explicated below are thus directed not only towards the future-orientation of (alternating) future markers, but towards other modals as well. In this section, I will first illustrate approaches that hardwired temporal orientation into the lexical entry of *will*. Analyses that separate temporal forward-shifting/extension from the lexical entry are discussed in Subsection 2.4.2. In the last subsection, I illustrate how Werner (2006) derives forward-orientation on a purely modal strategy without taking any recourse to temporal semantics proper. My proposal in Section 6.2 will make use of a purely modal strategy too and is indeed similar to Werner's idea.

2.4.1 Mixed modals: temporal and modal semantics in one entry

A very straightforward way of deriving both the modal behavior and future-shifted interpretations of *will* is achieved by assuming an entry that combines modal components with temporal components. This is what e.g. Cariani and Santorio 2018 suggest for *will*, who posit that *will* involves a NON-PAST temporal operator. Assuming, for reasons of simplicity, a necessity analysis, such an entry could be implemented as in (70), where *will* universally quantifies over worlds and existentially quantifies over non-past times.[20]

(70) $[\![will]\!]^{w,t,MB} = \lambda \mathrm{p}.\forall w'.[w' \in MB(w) \rightarrow \exists t'.[t' \geq t \& p(w')(t') = 1.]$

Another account that located the source of future-orientation of *will* (and modals in general) directly in the lexical entry is suggested by Condoravdi (2002, 2003) (and adopted by Cariani (2021)), who proposes that modals *extend forward* the time of the evaluation of the prejacent. That is, modals turn the time of evaluation of their prejacent into an interval that is open into the future. The temporal relation between the runtime of the event expressed by the prejacent and that interval is –depending on the aktionsart properties of the described eventuality– either temporal inclusion ('$\subseteq$') or temporal overlap ('$\circ$') (or *identity*, in case the prejacent already specifies a temporal relation between the eventuality and a temporal parameter, in which case the temporal relation expressed by the prejacent is simply passed further).[21]

[20] Recall that Cariani and Santorio (2018) suggest a choice function semantics for *will*, which is why their final entry for *will* is as in (i):

(i) $[\![will]\!]^{w,t,MB} = \lambda \mathrm{p}.\ \exists t' \geq t.p(s,(w,MB(w)))(t')$

[21] The proposal accounts for the observation that, in English, future-orientation of a modal's prejacent with present morphology is sensitive to aktionsart properties of the eventuality described by the prejacent. In (i), eventive aktionsart gives rise to future-orientation and statives are optionally interpreted with future-orientation. In order for an eventive predicate to be present-oriented, it has to be marked for progressive.

(i) a. Lumpi will **be at home**. (present or future-orientation)
b. Lumpi will **paint** his toilet brown. (only future-orientation)
c. Lumpi will **be painting** his toilet brown. (present or future-orientation)

Furthermore, if the speech time t_0 is conceived of as an instantaneous moment in time lack of a non-future-oriented epistemic reading of (i-b) receives an explanation: by (71), $AT(t,w,p)$ holds between a time t and a property of an eventive eventuality

(71) $\text{AT(t,w,p)} := \left\{ \begin{array}{ll} \exists e[p(w)(e) \& \tau(e) \subseteq t] & \text{if p is eventive} \\ \exists e[p(w)(e) \& \tau(e) \circ t] & \text{if p is stative} \\ \text{p(w)(t)} & \text{if p is temporal} \end{array} \right\}$ (Condoravdi 2002, p.70)

(72) $[\![will]\!]^{w,t,MB} = \lambda \text{p}.\forall w'.\ [w' \in MB(w)(t) \rightarrow AT([t,\infty), w', p) = 1.]$

While the aktionsart-related details of this analysis are not important to the goal of this chapter, note that unlike (70), the entry in (72) is not a quantificational temporal operator. This is relevant because alternating futures have been observed to be 'scopeless' (see Cariani and Santorio 2018; Cariani 2021; Ippolito and Farkas 2021): unlike (72), the quantificational strategy in (70) predicts non-trivial semantic effects of relative scope between negation and *will*, contrary to what has been observed with *will* (which is why Cariani (2021) resorts to the strategy of *forward-extension* as well). See Section 5.1 for *will* in negated contexts.

In sum, both of those accounts derive the future-orientation of *will* (and other modals) with dedicated temporal components at the asserted content of modal expressions. Furthermore, they locate the source of future-orientation directly within the lexical entry.

2.4.2 Purely modal modals 1: Covert future-orientation in a separate head

Other accounts assume a purely modal entry for *will*, with the source of future-orientation being located in a distinct head. The sources identified in the literature are (a) lower prospective aspect or (b) lower future/non-past tense. In languages like English and German there is no overt reflex of such an element, as future-oriented readings of alternating futures (and other modals) do not surface in a phonologically different way than those without future-orientation. However, there exists evidence from other languages, in which the distinctness between (proper) modal and future-orienting components of a modal is arguably reflected in morphology. This is what has been argued by Matthewson (2012, 2013) for Gitksan (Tsimshianic family). In this language, there is a morpheme *dim* which arguably spells out prospective aspect:[22] unlike Modals in e.g. English or German, Gitksan modals fail to be future-oriented on their own. Instead, they are future-oriented if and only if *dim* is present. This behavior is unexpected if future shifting semantics were part of the lexical entry and thus represents evidence against mixed accounts of future-orientation (also see Kush 2015; Skibra 2020 for overviews). The contribution by *dim* is illustrated in the following examples. (73) is compatible with both past- and present-orientation, but crucially not with future-orientation.[23,24]

iff the event's runtime is included in t. But if this time t is identified with t_0, it is not extended in time and thus such a relation cannot be established. If the progressive turns eventive predicates into statives, progressive prejacents are correctly predicted to be compatible with both epistemic and temporal interpretations.

[22] Actually, the entry for PROSP in Matthewson (2012) and Mucha (2016) is not an aspectual but simply a temporal operator which shifts forward the time of evaluation. This is because the languages treated there presumably stack multiple AspP phrases. Since existential closure of the eventuality variable obtains already in the lowest AsP layer, any higher aspectual operator is assumed to be equivalent to a tense. See Bochnak (2019) for a truly aspectual implementation of PROSP (Cf. especially Bochnak 2019, footnote 9 and Matthewson 2012, p. 438.)

[23] 'TO' stands for 'temporal orientation'.

[24] According to Matthewson, Gitksan has a morphologically null NON-FUTURE tense which she takes to be responsible for the availability of both present and past interpretations without morphological reflexes.

(73) yugw=ima'=hl wis (Gitksan, Matthewson 2012, p.435)
IMPF=**EPIS**=CN rain
'It might have rained.' / 'It might be raining.' / ≠ 'It might rain (in the future).'

✓ *Context:* You see the flowers looking fresh and damp and puddles. PAST TO

✓ *Context: You hear pattering on the roof.* PRESENT TO

\# *Context: You hear thunder, so you think it might rain soon.* # FUTURE TO

The example in (74) on the other hand, where *dim* is present, complements the readings found in (73): there is obligatory future-orientation. Past- or present-oriented readings are not available.

(74) yugw=**ima'**=hl **dim** wis (Matthewson 2012, p.435-6)
IMPF=**EPIS**=CN **PROSP** rain
≠'It might have rained.' /≠ 'It might be raining.' / = 'It might rain (in the future).'

\# *Context:* You see the flowers looking fresh and damp and puddles. # PAST TO

\# *Context: You hear pattering on the roof.* # PRESENT TO

✓ *Context: You hear thunder, so you think it might rain soon.* FUTURE TO

The idea of splitting up the semantics of future-oriented modals into two morpheme –one expressing modal, the other temporal semantics– receives support and further elaboration through work on future-orientation in Hausa (Chadic family), Medumba (Bamileke family) (Mucha 2016) and Washo (isolate or Hokan family) (Bochnak 2019, 2021). Those languages have been argued to possess overt prospective markers too. However, unlike in Gitksan, they are licensed only in certain environments. If we follow Mucha, future reference in Hausa always involves two morphemes: (i) a purely modal morpheme *zā* and (ii) a purely temporal morpheme in the scope of *zā*, which expresses prospective aspect and is realized as a low tone on the subject pronoun. According to Mucha, those morphemes do not occur freely: *zā* never occurs without the prospective and the prospective occurs *only* in the scope of *zā* or other modals. Hence, future-orientation is obligatory with *zā*. Accordingly, the low tone on the personal pronoun *tà* in (75) is obligatory. Since there is no aspect-stacking in Hausa, the obligatory presence of prospective aspect blocks any other aspect to occur in the scope of *zā*. This is illustrated in (75-b) and (75-c), which show the incompatibility of *zā* and imperfective and perfective aspect.

(75) **Unembedded** (Hausa; Mucha 2016, p.543)

a. **Zā tà** wȁsā gȍbe.
ZĀ 3SG.F-PROSP play tomorrow
'She will play tomorrow.'

b. ***Zā ta-nȁ** wȁsā gȍbe.
ZĀ 3SG.F-IPFV play tomorrow
Intended: 'She will be playing tomorrow.'

c. ***Zā tā** yi wȁsā gȍbe.
ZĀ 3SG.F.PFV do play tomorrow
Intended: 'She will have played tomorrow.'

A similar case can be made for Medumba, where future-orientation typically involves the preverbal element *á*. Generally, if *á* is not present, future orienation is not available, as suggested by the contrast in (76-a) – (76-b).

(76) Context question: What will Nana and Serge do tomorrow?

a. Bu **á'** ná ŋkwún (nəmndjʉ)
they FUT cook beans tomorrow
'They will cook beans tomorrow.'

b. Bu ná ŋkwún (nəmndjʉ)
they cook beans tomorrow
Intended: 'They will cook beans tomorrow.'

(Medumba; Mucha 2016, p.540)

Certain contexts, however, defy such a generalization: in the scope of negation or modals, with questions and imperatives and in the antecendent of a conditional, future-orientation is indeed possible without *á*. This is shown for the first three of those contexts in (77)– (79).

(77) **Under negation** (Medumba; Mucha 2016, p.541)
Context: Marie has had a very hard time lately. She worked a lot and did not sleep very much. How will she be doing when I visit her tomorrow?

Marie kə̀ mbʉ məbwô
Marie NEG be good
'Marie will not be well.'

(78) **In the scope of a modal** (Medumba; ibid.)
Context: A farmer is looking at the clouds; he says:

mu'djʉ mbəŋ ndú
maybe rain fall
'It might rain."

(79) **In questions** (Medumba; ibid.)
Context: This year Mary is always cooking rice.

Wú kwádə mbə á ná kə ŋgo mu'?
you think that she cook what year other
'What do you think she will cook next year?'

Mucha accounts for the availability of future-orientation is as follows. Like in Gitksan, future-orientation in Medumba is only available with prospective aspect. However, there are phonological and distributional differences between the respective prospective aspects in the two languages: in Gitksan, prospective aspect is realized as *dim* and occurs freely. In Medumba, on the other hand, prospective aspect is phonologically null and restricted to non-veridical (i.e. modally weak) contexts. The preverbal element *á* is a purely modal operator which is a semantically weak (non-veridical) necessity operator. It hence

functions as a licensor of prospective aspect in (76).

Future markers in Washo behave in a very similar way. Out of three future markers *-ašaʔ* (near future), *-tiʔ* (intermediate future) and *-gab* (distant future), only the first occurs freely. (80) illustrates that only *-ašaʔ* is felicitous in unembedded contexts. The other two futures *–-tiʔ* and *-gab–* are licensed only in a set of contexts similar, but not identical to the set of contexts identified for covert prospective aspect in Medumba: they only occur in the scope of a modal (81), in the scope of an attitude verb (82), in questions (83) and in the antecedent of conditionals (no example). However, unlike covert prospective aspect in Medumba, they are not licensed in the scope of negation (see Bochnak 2019, 2021).

(80) **Unembedded** (Washo, Bochnak 2021)

a. *m-íp'am-**tiʔ**-i
2-arrive-**IND.FUT**-IND
Intended: 'You will arrive.'

b. *∅-háʔaš-**gab**-i wáːt
3-rain-**DIST.FUT**-IND tomorrow
Intended: 'It will rain tomorrow.'

c. l-émly-**yášaʔ**-i
1-eat-**NEAR.FUT**-IND
'I'm going to eat.'

(81) **In the scope of a modal** (Washo, ibid.)

a. [m-íp'am-**tiʔ**-i-gi]
2-arrive-**INT.FUT**-IND-NMLZ
M-éʔ-le
2-MOD-REDUNDANT
'You will arrive.'

b. [∅-háʔaš-**gab**-i] k'éʔ-i
3-rain-**DIST-FUT**-IND 3-MOD-IND
wáːt
tomorrow
Intended: 'It will rain tomorrow.'

(82) **In the scope of an attitude verb** (Washo, ibid.)

a. [t'ánu lé-ši démlu ∅-dóːda-ha-**t**-aʔ] ʔ-ít-leg-i
person 1PRO-DU food 3-prepare-CAUS-**INT.FUT**-DEP 3-say-REC.PST-IND
'He said someone is goint to repare food for the two of us.'

b. [lé-w mil-éʔw-uš-**gab**-aʔ] di-hámu-yi
1PRO-PL 2/1-eat-DUR-**DIST.FUT**-DEP 1-think-ind
'I think we will eat you [pine nuts].'

(83) **Questions** (Washo, ibid.)

a. gutéːšŋa héːš ʔ-íbi-**tiʔ**-i
when Q 3.come-**INT.FUT**-IND
'When will he come?'

b. m-íməʔ-héːš-**gab**-i
2-drink-Q-**DIST.FUT-**IND
'Are you going to drink?'

(84) **Negation**

*∅-háʔaš{**-tiʔ/gab**}-i
3-rain-NEG-{**INT.FUT/DIST.FUT**}-ind
Intended: 'It won't rain'.

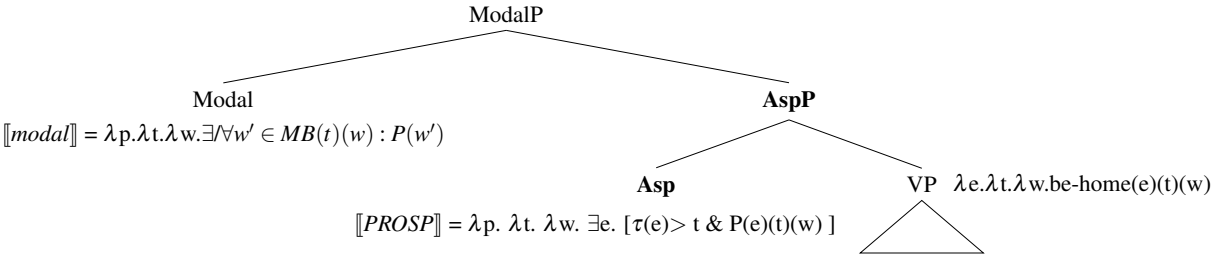
Because negation is not a licensor for prospective aspect in Washo, Bochnak (2021) proposes other characteristics than non-veridicality that might be responsible for licensing prospective aspect in Washo. In sum, the data indicates that future-orientation is not an inherent part of modals, but instead comes from a separate head encoding prosepcetive aspect in the scope of the modal. The picture emerging thus suggests that at least in some languages, future-orientation involves the LF in (86) with the prospective aspect in (85). It is *almost* the semantics of a future temporal operator, except that the posteriority relation is not specified as a relation between two times, but between the runtime of the event and the local evaluation time.[25]

(85) $[\![PROSP]\!] = \lambda p.\ \lambda t.\ \lambda w.\ \exists e.\ [\tau(e) > t\ \&\ P(e)(w)\ ]$ (based on Bochnak 2019, p.6)

(86) **Syntactic configuration for modals with future-orientation**
[$_{\text{ModP}}$ *modal* [$_{\text{AspP}}$ **prosp** [$_{\text{VP}}$ V]]]

As an example, consider the sentence in (87-a) whose modals are intended to be read on a future-oriented reading, as indicated by '(tomorrow)'. Its derivation is roughly as in (87-b).

(87) a. Lui {must/might/will} be home (tomorrow).
b.



The pattern emerging from the cross-linguistic data above suggests that –variably across languages– certain modal operators and PROSP may be covert. Furthermore, PROSP seems to be restricted to certain semantic environments in some languages. This is schematized in Table 2.2 for the languages Gitksan, Hausa, Medumba and Washo. As a point of reference, English is also listed here on the assumption that (i) *will* is a (purely modal) modal and (ii) futurates involve covert modality (see Copley 2002, 2008; Kaufmann 2005; Kaufmann et al. 2006).[26]

	Realization of prospective aspect	**Occurance**
English	∅	scope of modal (e.g. of *will*)
Medumba	∅	non-veridicality
Hausa	low tone on personal pronoun	scope of modal (e.g. *zā*)
Washo	{*-ti?/-gab*}	still not clear (see Bochnak 2019; 2021)
Gitksan	*dim*	free

Table 2.2: Realization and distribution of prospective aspect

In languages such as German or Finnish future reference is much more freely available than e.g. in

[25] See Mucha 2016 for a version that involves aspect stacking.
[26] See Kaufmann et al. 2006 for the view that the modal component involved in futurates is supplied contextually.

English (cf. Bochnak 2019). On the idea that future-orientation is expressed by covert aspect, those languages would have to be of a type where prospective aspect is not only freely available, but also is phonologically null, as schematized in Table 2.3.

	Relization of prospective aspect	Occurance
German	∅	free
Finnish	∅	free

Table 2.3: Finnish and German on a prospective aspect analysis

The other possibility is of course that the present tense in German and Finnish is compatible with both future and present orientation (either because it is completely vacuous (Sauerland et al. 2002) or because it is a NON-PAST tense) and simply does not depend on prospective aspect at all in order to convey future-orientation.

Other research (e.g. Copley 2002; Giannakidou and Mari 2018) proposes to derive future-orientation of modals in a very similar way. The only difference seems to be their assumption that the syntactic projection of modals takes scope over the TP. Accordingly, future-orientation is supplied by some forward-orienting temporal head *T* in the scope of *will* (or another modal) instead of lower progressive *aspect*.

(88) $[_{\text{FutP}}$ *will* $[_{\text{TP}}$ T [... $[_{\text{VP}}$ V]]]]

Also, since those accounts assume that modals take genuine tenses in their scope, their semantics is not defined with respect to the runtime of an event but as a relation between to times. In any case, this approach does not seem to be formulated as an alternative to the prospective-aspect-view.

One representative of such accounts is Copley (2002). On her analysis, temporal readings of the future are the consequence of a temporal operator (which I label FUTURE-TENSE) in the scope of *will* that shifts forward the time of evaluation. The meaning of this operator is simply the mirror image of an ordinary quantificational PAST tense operator. In the scope of *will* (whose modal part is kept quite neutral again) it leads to the denotation in (89-b)

(89) a. $[\![\textit{FUTURE-TENSE}]\!]^{w,t} = \lambda \text{p}.\ \exists t'.[t' > t\ \&\ p(w)(t') = 1]$

b. $[\![\textit{will(FUTURE-TENSE(p))}]\!]^{w,t} = \lambda \text{p}.\ \forall w'.[w' \in MB(w)(t) \rightarrow \exists t'[t' > t \& p(t')(w') = 1]]$

Giannakidou and Mari 2018 derive future-orientation with a lower temporal operator too. The only difference is that the tense responsible for future-orientation is not a FUTURE but a NON-PAST tense, which has the semantics in (90-a). The configuration suggested to lead to the temporal reading has the denotation in (90-b) (with the modal component kept quite neutral again).

(90) a. $[\![\textit{NON-PAST}]\!]^{\text{w,t}} = \lambda \text{p}.\ \exists\ t\text{'} \in (t, \infty) \wedge P(w, t')$

b. $[\![\textit{will(NON-PAST (P))}]\!]^{\text{w,t}} = 1$ iff $\forall w'.[w' \in MB(w)(t) \rightarrow \exists t'.[t' \in (t, \infty) \& P(w, t')]]$

To sum up, the accounts presented in this section locate the source of future-orientation of modals (such as *will*) outside the lexical entries of those modals. The lexical entries of modals like *will* are hence assumed to be purely modal.

2.4.3 Purely modal modals 2: Future-orientation as a consequence of the diversity principle

Werner (2006) (and in a less-explicit way Condoravdi (2002)) proposes a novel answer to the question how it is possible to derive obligatory future-orientation from a purely modal relation. Remember the diversity condition that was adopted (under different names) by several necessity analyses for the future. Roughly, it states that a modal base can only be assigned to a modal if it is heterogenous with respect to the prejacent proposition. In Werner 2006, this requirement does not have the status of a pragmatic condition, but is part of the truth-conditional content of *will*. The at-issue content of *will* assumed by Werner is given in (90), where the last two lines express the diversity requirement for the modal base.

(91) $[\![will]\!]^{w,t,MB,j} = \lambda$p. $\forall w'.[w' \in Best(MB(w)(t), j(w)(t)) \rightarrow \exists t'.[p(w')(t') = 1 \&$
$[MB(w)(t) \cap p] \neq MB(w)(t)$ &
$[MB(w)(t) \cap p] \neq \emptyset]$. (adapted from Werner 2006, p.)

The meaning described by the last two lines demands that the modal base be diverse with respect to the prejacent proposition p (a property of world-time-pairs). Given that the historical alternatives at any world-time-pair ⟨w,t⟩ are identical up to t, a metaphysical modal base can satisfy diversity with respect to a prejacent proposition p only if p is instantiated at a time later t. Hence, the diversity requirement can only be satisfied if the evaluation time of the prejacent is some time after the anchor time of the metaphysical modal base. Future-orientation can thus be derived as a consequence of the diversity condition and the property of forward-branching modal bases. As far as I can see, this reasoning could be applied to Condoravdi's analysis as well.

In Section 6.2.2, I too will suggest a purely modal mechanism of future-orientation. But unlike Werner and Condoravdi, I will do so without resorting to the problematic assumption of the diversity condition.

2.5 A purely temporal proposal: Kissine 2008

To my knowledge, the only accounts explicitly arguing against a modal treatment of the future and in favor of a purely temporal one are Kissine 2008, 2014 and Salkie 2010. In this subsection, I will present the main arguments by Kissine as well as existing (Broekhuis and Verkuyl 2014; Klecha 2014) and novel criticism of his account.

In a nutshell, Kissine's argument against a modal treatment is this. Modal analyses of *will* suggest that

(92) (i) *will* is a necessity modal
(ii) the modal base(s) of *will* are typically taken to satisfy *Transitivity* and *Euclideanness* (and thus *Self-Reflexivity*)

If *will* indeed has the properties in (i) and (ii), then *will p* and *possibly(will p)* are predicted to be equivalent. However, they are clearly not equivalent and hence a modal account along the lines of (i) and (ii) must fail, according to Kissine. Therefore, Kissine argues, a purely temporal account of *will* is more promising. In what follows, I will present this account in a bit more detail.

Kissine's criticism of a modal treatment of *will* is based on the assumption that *will* is a necessity modal. More specifically, Kissine assumes that *will* has the entry in (93), which has been suggested by Enç (1996). In any case, his arguments apply to any analysis that treats *will* as a necessity modal.

(93) Enç 1996
$[\![will\ p]\!] = 1$ iff $\forall w'.[w'. \in MB(w) \rightarrow \exists t'.[t' > t \& p(w')(t') = 1.]$

Throughout the discussion, the modal base used by *will* is taken to be an epistemic one, even though the examples do not involve epistemic but temporal readings of *will.* This will turn out to be problematic.
Next, Kissine shows that if *will* is a (necessity) modal, then the accessibility relation defining its modal base has to satisfy both Transitivity and Euclidianness and hence Self-reflexivity.[27]

(94) a. **Transitivity**
If wRw_1 and w_1Rw_2, then wRw_2. $(\Box p \rightarrow \Box\Box p\ )$

b. **Euclidianness**
If wRw_1 and wRw_2, then w_1Rw_2. $(\neg\Box p \rightarrow \Box\neg\Box p)$

c. **Self-reflexivity** (follows from (a) and (b))
If wRw_1 then w_1Rw_2 iff wRw_2. $(\Box p \leftrightarrow \Diamond\Box p)$

(cf. Kissine 2008, p.132 and von Fintel and Heim 2021)

Why is it justified to assume that the accessibility relation used by *will* satisfies Transitivity, Euclidianness and Self-reflexivity?
First, consider the need for transitivity. Kissine assumes that the meaning of the sentence in (95-a) and that of its corresponding negated sentence (where negation is assumed to have high scope over *will*) in (95-b) are as indicated below. Accordingly, the meaning of a sentence where *not will p* occurs in the scope of a possibility modal should have the indicated meaning in (96).

(95) a. Mary will sing.
1 iff $\forall w'.[w' \in MB(w)(t) \rightarrow \exists t'[t' > t \&$ Mary-sings $(w')(t') = 1.]]$

b. Mary will not sing.
1 iff $\exists w'.[w' \in MB(w)(t) \rightarrow \exists t'[t' > t \&$Mary-sings$(w')(t') = 0.]]$

(96) It is possible that Mary will not sing.
1 iff $\exists w'.[w' \in MB(w)(t)\ \&\ \forall w'' \in MB(w')(t) \rightarrow \exists t'.[t' > t \&$ Mary-sings $(w'')(t') = 0.]]$

Then, if the accessibility relation defining the modal base of *will* would be non-transitive, the sentence

[27] A modal base can be modeled as a so-called accessibility relation. For example, the set of worlds compatible with what is known in *w* is adequately characterized by an accessibility relation *wRw'* that holds between *w* and *w'* iff *w'* is epistemically accessible from *w*, i.e. iff $w' \in \mathrm{MB}_{\mathrm{epist}}(\mathrm{w})$.

in (97) should not be contradictory. This is because, without transitivity, nothing requires that the two occurrences of *will* quantify over an identical set of worlds: the modal base of the first occurrence is anchored to w_0 while the second is anchored to some world accessible from $MB(w_0)$.

(97) ?Mary will sing and it is possible that Mary will not sing.

But (97) is contradictory. Hence, (if *will* is to be a necessity modal) the accessibility relation defining the quantificational domain of *will* in (97) should be taken to be transitive. If the accessibility relation in question is *epistemic*, transitivity captures *positive introspection*: if it is known that p, then it is known that it is known that p, i.e. $\Box p \rightarrow \Box\Box p$. Or in the present case: *will(p)* $\rightarrow \Box$ *will(p)*. Therefore, the quantificational domain of the first occurrence of *will* in (97) is identical to the quantificational domain of the second occurrance, which is why the sentence is contradictory.

As for the justification of Euclidianness, consider the sentence in (98). The oddity of (98) is not yet captured by Transitivity.

(98) ?It is not the case that Mary will sing, and it is possible that Mary will sing.

In order to derive the fact that (98) is contradictory, the accessibility relation must be made Euclidic. In the case of an epistemic accessibility relation, this captures *negative introspection*: if it is not known that p, then it is known that it is not known that p. In short: $\neg\Box p \rightarrow \Box\neg\Box p$. Or, with the example at hand: *¬(will(p))* $\rightarrow \Box\neg$*(will(p))*.
If the accessibility relation is both Transitive and Euclidic, then it follows that it is *Self-Reflexive*. That is, it predicts the equivalence $\Box p \leftrightarrow \Diamond\Box p$. However, *will(p)* and *it is possible that(will(p))* are clearly not equivalent. According to Kissine, this is different with *must*, for which the assumption of self-reflexivity is consistent with the data: the fact that (99-a) is acceptable while (99-b) is not, is due to *must(p)* being logically equivalent to $\Diamond$ *must(p)*, while the same does not hold for *will*.

(99) a. It is possible that Mary will sing.
b. ?It is possible that Mary must sing.

Kissine concludes that a modal treatment of *will* along the lines of Enç (1996) is thus not warranted. He suggests that *will* is a purely temporal NON-PAST operator as in (100).[28]

(100) $[\![\textit{NON-PAST}]\!] = \lambda p.\lambda t.\lambda w.\exists t'[t' \in (t,\infty)\&p(w)(t') = 1.]$

How, then, does Kissine derive epistemic readings of *will*? He suggests that (i) Stalnaker's common-ground approach to discourse contexts and (ii) Kratzer's (1991/2012a Ch4) covert modality in conditionals without overt modals warrants a system where *any* asserted proposition is interpreted in the scope of a necessity operator. The necessity operator in question is restricted to the set of worlds epistemically accessible intersected with the set of shared presuppositions Q in the common ground. This is captured

[28] Kissine briefly considers and then rejects two other modal strategies: the idea that *will* uses a doxastic accessibility relation and the idea that *will* is a possibility modal. Since I take *will* to be a strong modal, I do not consider either of those two a viable idea, which is why I refrain from presenting Kissines arguments against them.

in (101).

(101) For any common ground C and set of propositions Q

> Asserting that p with respect to C amounts to asserting that □p, where □ is an epistemic necessity whose domain is restricted to those worlds that contain every member of Q.
>
> (from Kissine 2008, p. 144)

By its entry in (100), *will p* is compatible with present-orientation, which is why $will(now(p))$ is assumed to be truth-conditionally identical to $now(p)$. Accordingly, Kissine takes all sentences in (102) to be truth-conditionally identical: the overt components of (102-a) and (102-b) are assumed to be non-modal, but a covert epistemic necessity operator makes sure that they are interpreted as epistemic necessity claims. In (102-b), *must* contributes an epistemic necessity operator itself.

(102) a. Lui is in the stable now.
b. Lui will be in the stable now.
c. Lui must be in the stable now.

Nevertheless, their readings are not equivalent. The reading of (102-b) (and (102-c)) is *epistemic*, (102-a) is not. Kissine proposes to account for this fact pragmatically: since the semantic contribution of *will* is redundant in cases where evaluation time of the main verb is restricted to the present, Kissine proposes that an Implicature (based on the Maxim of Manner) is triggered which has the effect of further restricting the domain of quantification of the covert epistemic modal. The specific restriction suggested by Kissine is based on the observation by some authors that epistemic readings of *will* are only felicitous if the truth of the prejacent could in principle be proven wrong or right (in some not too complicated way, I guess).

(103) A: What is the shape of the universe?
B: ?It will be spherical. (from Giannakidou and Mari 2018, p. slightly adapted)

The implicature is thus suggested to restrict the covert epistemic modal to worlds where the truth of the prejacent is actually verified at some point in the future. For languages that do not show that kind of condition, other ways to restrict the covert modal would be needed, I suppose.
As for the difference between (102-a) and (102-c), the suggested effect of *must*, which is also redundant in his system, is to turn the covert epistemic (*knowledge*) modal into a doxastic one (*belief*).
Existing criticism of Kissine's analysis (Broekhuis and Verkuyl (2014); Klecha (2014)) denies the validity of Kissine's reasoning leading him to reject a modal treatment of *will*. I note that I agree with the remarks by those authors (and especially those by Klecha) but I want to focus on an issue concerning the way epistemic readings are derived in Kissine's system. The major problem that I see with the mechanism deriving epistemic readings is that it is pragmatically implausible: what would be a pragmatically plausible reason why the manner implicature triggered by a redundant element should of all things have the suggested effect of restricting the quantificational domain the covert modal. There are, after all, other conceivable ways of adding redundancy to a bare indicative sentence. Take *it is the case that*. Or, in his system, *it is (necessarily) true that*.

(104) a. Lui is in the stable now.
b. It is the case that Lui is in the stable now.
c. It is true that Lui is in the stable.

Clearly (104-b-c) are not interpreted in a similar way as (102-b) or (102-c): the sentence in (104-b) and (104-c) simply lack the epistemic flavor exhibited by the sentences containing *must* and *will* in (102). I conclude that for the mechanism proposed by Kissine to be turned into a viable idea, its proponents ought to come up with a pragmatically principled reason why futures, but not just any other vacuous expression can have the suggested effect. Furthermore, it is problematic to assume that assertion is associated with a covert epistemic necessity operator. In the literature on the norms of assertion, it is far from accepted that assertion is *knowledge*-based. See, for example, Mandelkern and Dorst to appear and the literature therein for a range of weaker conceptions of the norms of assertion.

2.6 Summary of existing analyses

Most of the accounts I presented in this chapter provide *weak* analyses of the future. It is not clear how they can account for the intuition that the future (in German and English) entail the *assertion* of the prejacent proposition, which will be illustrated in the next section. Among the accounts presented, there are two analyses on which *will* preserves the assertion of *p* (i.e. *strong* analyses of *will*): Cariani and Santorio 2018; Cariani 2021 and Kissine 2008. The former is a purely temporal analysis, which is why it is not included in Table 2.4. The latter is a modal treatment of *will*, albeit a non-quantificational one. As I have discussed in section 2.5, the non-modal account by Kissine has severe difficulties to derive the epistemic reading of *will*, which is why I will not consider a non-temporal analysis for *will* and *werden*. The problems of the account by Cariani and Santorio are (i) that equivalence between epistemic readings of *will p* and bare assertion of *p* are predicted, but not found in the data and (ii) that the source of future-orientation is located in the lexical entry of *will* itself, which makes it puzzling that future-orientation is *obligatory* with temporal (i.e. metaphysical)*will* but *optional* with epistemic *will*. The account I propose in Chapter 6 improves on those problems as it maintains (inspired by von Fintel and Gillies (2010, 2021)) that both the epistemic flavor of epistemic readings and obligatory forward-shifting with metaphysical readings can be derived from a pragmatic restriction on a privileged component of epistemic and metaphysical modal bases respectively: the 'kernel' of such a modal base must directly settle the prejacent proposition. In that way, epistemic *will* sends an epistemic signal ($\approx$ epistemic indirectness and non-settledness) even though its lexical entry is non-quantificational and strong (and hence very similar to the asserted content of non-modal assertions). And temporal/metaphysical *will* sends a signal of obligatory forward-orientation even though it does not contain any temporal semantics proper.

	Condoravdi 2002, 2003	**Werner 2006**	**Giannakidou & Mari 2018**	**Copley 2009**
Quantificational force	∀	∀	∀	∀
Modal base	{epistemic/ metaphysical}	{epistemic/ metaphysical}	epistemic(/doxastic)	metaphysical
Ordering source	yes	yes: stereotypical	yes: stereotypical	yes: {bouletic/stereotypical}
Strength	will(p) $\not\rightarrow$ p	will(p) $\not\rightarrow$p	will(p)$\not\rightarrow$ p	will(p)$\not\rightarrow$ p
Derivation of both readings	epistemic vs. metaphysical modal base	epistemic vs. metaphysical modal base	direct correlation between lower tense and reading	n/s
Future-orientation	forward extension semantics in lexical entry of will and diversity principle	result of diversity principle with metaphysical modal base	NON-PAST TP in the scope of *will*	forward shifting TP in the scope of *will*

	Mihoc et. al 2019	**Mari 2010**	**Ippolito &Farkas 2021**	**Cariani (&Santorio 2018) 2021**
Modal force/relation	∀	{∃/∀ }	doxastic likelihood of QUD alternatives	choice function, non-quantificational
Modal base	epistemic	QUD	{epistemic/bouletic}	{metaphysical/epistemic}
Ordering source	yes: stereotypical	yes (multiple)	doxastic likelihood	no
Strength	will(p) $\not\rightarrow$ p	will(p) $\not\rightarrow$ p	will(p) $\not\rightarrow$ p	will(p) $\rightarrow$ p
Derivation of both readings	n/s	indexical vs. non-indexical epistemic MB	n/s	epist. vs. metaph. MB
Future-orientation	n/s	non-perfective aspect in the scope of FUT	n/s	2018: forward shifting in lexical entry 2021: forward extension in lexical entry

Table 2.4: Overview on existing modal analyses

Chapter 3

Basic empirical data

In this chapter, I will first give an overview on the basic semantic properties the alternating future in English (*will*) and German in Section 3.1.[1] I will often present just the English examples if the German counterparts would show nothing more. In the next section, Section 3.2, I point out potential differences between *werden* and *will*. More specifically, I will show that English and German alternating futures differ with respect to: (i) how specific readings can be forced or foregrounded Section 3.2.1, (ii) examples of what might be non-epistemic non-temporal readings of the future, Section3.2.2, (iii) embeddability under PAST tense, Section 3.2.3 and (iv) pragmatic restrictions on the epistemic use, Section 3.2.4. The proposal of this thesis is, however, not specific to either English or German.

3.1 Basic properties of alternating futures

In the introduction to this thesis (1.1) I already established that the epistemic and the temporal interpretation of *will* are indeed two distinct readings: on its temporal reading the future expresses a meaning that can be paraphrased acceptably by (105). The meaning expressed by the epistemic reading can be roughly paraphrased with (106). I maintain the view that those paraphrases do not apply interchangeably.[2]

(105) **Temporal reading**
There is a time t following the time of utterance s.t. the prejacent proposition p holds at t.

(106) **Epistemic reading**
For all I know, it is the case that p.

Temporal *will*-claims seem to be a very unmarked and neutral way to convey a future-oriented proposition, i.e. to talk about actual future events or actual future state of affairs. That is, like bare non-modal assertions, *will*-claims do not seem to make a claim about what is necessary or possible (at some point in the future) but simply about *what is* (at some point in the future). Like Condoravdi (2002), Werner

[1] A very similar overview can be found in Ippolito and Farkas (2021) for the Italian epistemic future.

[2] This view is not shared universally: Giannakidou and Mari (2018) suggest that what I have identified as the temporal reading should be accounted for in terms of a purely epistemic semantics. That is, (104) would be an adequate paraphrase for temporal readings of *will*.

(2006), Copley (2002), Cariani and Santorio (2018) and Cariani (2021) I too will assume that temporal readings arise if the modal base used by *will* is *metaphysical*. Crucially then, while metaphysical readings of *must* evoke future-orientation too, they are not equivalent to corresponding *will*-claims. As I will discuss in more detail in Section 5.2, the main difference between metaphysical *must* and metaphysical *will* is that *will* is not a necessity modal and hence is compatible with metaphysical non-settledness of the prejacent proposition (it is, however, still a *strong* modal).

(107) a. Due to gravity, the cup **must** fall down if you push it over the edge of the table.
b. Due to gravity, the cup **will** fall down if you push it over the edge of the table.

Other (seemingly) non-quantificational ways of conveying future-orientation are *futurates*, which are future-oriented sentences with present indicative morphology. In German, futurates occur quite freely. In English, they are restricted to descriptions of what Copley (2002, 2008) identifies as *planable* events. Compare the English futurates in (108) to their German equivalents in (109). They show that English futurates are straightforwardly odd if they describe a non-planable event while such cases are considerably more acceptable in German. (According to my own intuitions, (109-d) is still a bit marked compared to (109-c) (indicated by '(?)'), but not as infelicitous as (108-d).)

(108) a. Rapid *plays/is playing* against Ried tomorrow.
b. Rapid will play against Ried tomorrow.

c. Rapid will win against Austria Wien tomorrow.
d. #Rapid {wins/is winning} against Austria Wien tomorrow.

(109) a. Rapid spielt morgen gegen Ried.
Rapid plays tomorrow against Ried
b. Rapid wird morgen gegen Ried spielen.
Rapid will tomorrow against Ried play
'Rapid {plays/will play} against Ried tomorrow.'

c. Rapid wird morgen gegen Ried gewinnen.
Rapid will tomorrow against Ried win
d. (?)Rapid gewinnt morgen gegen Ried.
Rapid wins tomorrow against Ried
'Rapid will win tomorrow.'

Nothing more needs to be said about temporal readings at this point.

Let us turn, instead, to epistemic readings of *will* and *werden*. Paraphrases very much like the one in (106) are often used to illustrate the semantic contribution made by epistemic uses of *must*. Of course, (106) is a rather vague paraphrase and neither the semantics of *must* nor of *will* is captured adequately by that paraphrase. Furthermore, the meaning of epistemic *must* is clearly not identical to the meaning of epistemic *will* even though existing analyses (either explicitly (Giannakidou and Mari 2018) or implicitly (e.g. Condoravdi 2002, 2003; Werner 2006)) suggest equivalence between those two modals. In

this section, I will only touch on the issue of shared and distinct properties of *must* and *will*. Further differences between those two modals are discussed in Chapter 5 (see also Mihoc et al. 2019). For now, I just note that there exist contexts revealing a certain contrast between epistemic *must* and epistemic *will*, such as the one in (110).

(110) Chris has lost her ball, but she knows with full certainty that it is either in Box A or B or C. She says: The ball is in A or in B or in C. It is not in A... It is not in B ...

a. So, it ✓must / # will be in C.

b. Also ✓ muss/ # wird er in C sein. (based on von Fintel & Gillies 2010, p.362)

In (110), epistemic *will* leads to the interpretation that the speaker is still not fully certain about the location of the ball, while such an 'uncertainty-flavor' is absent for epistemic *must*. Only if *will* is interpreted temporally, an uncertainty interpretation does not (obligatorily) arise. But there are also contexts where a speaker may resort to either *must* or *will* in one and the same context. In such readings of *will*, there is no obvious reason to assume that the time argument of the prejacent proposition is shifted into the future and no implication that someone is actually *going to* verify the truth of the prejacent is being made.

(111) Where are my Toni Erdmann teeth?

a. I washed them recently. They **must** be in the bathroom.

b. I washed them recently. They **will** be in the bathroom.

c. Ich hab sie kürzlich gewaschen. Die **müssen** im Bad sein.
I have them recently washed. they must in.the bathroom be

d. Ich hab sie kürzlich gewaschen. Die **werden** im Bad sein.
I have them recently washed. they will in.the bathroom be

A permissible inference the hearer may draw is that the speaker of (111-a) or (111-b) did not want to make the claim in (112) because she felt that she was not in a position make it.

(112) I washed them yesterday evening. They are in the bathroom.

Here, the notion of 'the position of the speaker to make statement X' is an epistemic one and like for *must*, there is no consensus in the literature as to what exactly it amounts to. Some authors (e.g. Lassiter (2016), Giannakidou and Mari (2018)) believe that a competent and cooperative speaker uses *must p* if they do *not (strictly) know* whether *p* is the case. On such a view, *must* can be said to signal *uncertainty* with respect to the prejacent proposition. Others (e.g. von Fintel and Gillies (2010, 2021)) have denied the claim that a speaker using *must p* signals uncertainty about *p*. Instead the speaker is signaling that their *knowledge* of *p* is indirect, i.e. *inferred* from what is known directly. Let us hence note that the presence of a certain contrast to bare non-modalized claims does not necessarily indicate that the speaker does not *know p* and also does not indicate that the speaker does not *assert p* or *commit* to *p*. In Section 5.3, I will show that the assertion of *will p* signals uncertainty with respect to the prejacent *p* indeed but nevertheless *asserts p*.

3.1.1 *will* is not a possibility modal

Whatever the difference to *must*, (113) suggests that epistemic *will* is not a possibility modal because possibility modals leave room for the prejacent proposition being false. Neither *but not will p* nor *but* $\Diamond\neg p$ is an acceptable continuation of a *will p*-claim (where '$\Diamond$' stands for an arbitrary epistemic possibility modal and $\neg p$ may also be replaced by a proposition *entailing* ¬p).

(113) a. Maybe my googly eyes are in the kitchen, but maybe they are {not/in the bathroom}.
b. My googley eyes might be in in the kitchen, but they might also {not be there/be in the bathroom}.
c. #My googley eyes will be in in the kitchen, but they will also {not be there/be in the bathroom}.
d. #My googley eyes will be in the kitchen, but they might also {not be there/be in the bathroom}.
e. #My googley eyes will be in the kitchen, but maybe they are {not/in the bathroom}.

The judgment of those examples is a delicate matter. In case the reader does not agree with the judgments in (113-c-e), I refer to Section 4.2.2, where I illustrate what has been said about contextual shifts in modal horizon (see von Fintel and Gillies 2010, 2021) and discuss *maybe not p*-conjunctions in more detail.

3.1.2 *will* is not a likelihood modal

Elements expressing epistemic likelihood, too, are infelicitous in conjunctions of the form *MODAL p but also MODAL* $\neg p$, as indicated in (114).

(114) #It is likely that my googly eyes are in the kitchen, but it is likely that they are not.

However, likelihood modals allow for the continuation of *but maybe* $\neg\, p$, as in (115-a). In case the reader is reluctant to accept *maybe* here, replace it with *there is a slight possibility that*, as in (115-b), and it should become acceptable.

(115) a. It is likely that my googly eyes are in the kitchen, but maybe they are not.
b. It is likely that my googly eyes are in the kitchen, but there is a slight possibility that they are not.

Epistemic *will*, by contrast, is infelicitous with either of them. See (again) (113-e) and (116).

(116) #My googley eyes will be in the kitchen, but there is a slight possibility that they are in the bathroom.

3.1.3 *will* is not a weak necessity modal

By the same test, *will* can be distinguished from yet another class of modal expressions: *weak necessity modals* like English *should* and *ought* or German *sollte* and *müsste*. Unlike *will*, weak necessity modals leave room for the negation of the prejacent proposition. Again, both *maybe not p* and *there is a slight*

possibility that not p are permissible conjunctions. This is illustrated with *there is a slight possibility* in (117).

(117) a. My googly eyes {should/ought to} be in the kitchen, but there is a slight possibility that they are the bathroom.

b. Meine Glupschaugen-Brille sollte/müsste in der Küche sein, aber es besteht die
my googly.eyes-glasses {should/ought} in the kitchen be, but it exists the
geringe Möglichkeit, dass sie im Bad ist.
slight possibility that they in.the bath is

On the interpretation they occur with in (117), weak necessity modals are often identified as exhibiting an epistemic reading. According to Yalcin (2016), those readings of weak necessity modals are only 'pseudo epistemic'. Instead, on the account suggested by Yalcin, they express necessity in view of what is (considered to be) *normal*, where *normality* is modeled as universal quantification over a circumstantial modal base restricted by a normality (or 'stereotypical') ordering source.[3] Evidence supporting that claim are examples like the following.

(118) CONTEXT: Jones is in a crowded office building when a severe earthquake hits.The building topples. By sheer accident, nothing falls upon Jones; the building just happens to crumble in such a way as not to touch the place where he is standing. He emerges from the rubble as the only survivor. Talking to the media, Jones says in wonderment one or other [of the variants in (a-b). His relatives may say one or the other variant in (c-d)]

a. I {should/ought to} be dead right now.

b. Ich {sollte/müsste} jetzt (eigentlich) tot sein.

c. It's incredible! That quake was massive. He should be/ought to be dead. We're so lucky he survived.

d. Unglaublich! Das Erdbeben war so stark. Er {sollte/müsste} (eigentlich) tot sein. Wir sind so froh, dass er überlebt hat.

(from Yalcin 2016, p.231 slightly adapted; my German)

Epistemic *will* is not a normality/weak necessity modal by that test.

(119) [Same context as in (118)]

a. #He will be dead right right now. But luckily he's not.

b. #Er wird jetzt tot sein. Ist er zum Glück aber nicht.

[3] Yalcin explicitly argues against the claim that 'actual' epistemic modals (such as *must*) ever involve normality based (i.e. stereotypical) orderings, contrary to what has been suggested (e.g. Giannakidou and Mari 2018; Mihoc et al. 2019 as well as earlier work by Angelika Kratzer.

3.2 English vs. German

3.2.1 Forcing and foregrounding readings of *will*

One fact worth noting is that English and German are slightly different when it comes to how and when a certain reading of *will* is foregrounded. This seems to be due to the fact that English and German differ with respect to their aspectual system. As already noted in Section 2.4, the absence of progressive marking on the prejacent of an English modal has an effect on whether a present oriented reading is available or not. This in turn has an effect on which reading of *will* is the prominent one: if the prejacent proposition is clearly forward-oriented (e.g. restricted by a future temporal adverbial), the temporal reading is the most prominent one (though I assume that forward-oriented epistemic readings do exist). In English, it is not possible to use the non-progressive present in order to describe an ongoing eventive event. Accordingly, if *will* embeds a non-progressive prejacent describing an eventive eventuality, the prejacent has a future-oriented reading (as indicated by the (un)availability of certain adverbials) and consequently the temporal reading is prominent.

(120) a. Lumpi will **be at home** ({then/now}). (present or future-orientation)
b. Lumpi will **paint** his toilet brown ({then/#now}) (only future-orientation)
c. Lumpi will **be painting** his toilet brown ({then/now}). (present or future-orientation)

In German, by contrast, there is only one strategy (also available to English) to force or make prominent a particular reading of *will*: temporal adverbials. Temporal past frame adverbials will often favor the epistemic or temporal reading respectively: out of the blue, past-adverbials favor epistemic readings and future-adverbials favor temporal readings. However, since there are also 'past in the future' readings of *will* (German 'Futur II') and epistemic readings with future-orientation, those type of adverbials never strictly *exclude* any reading. The only way to really *force* a particular reading is to use a present oriented frame adverbial such as *now/gerade/jetzt*, in which case the only reading available is *epistemic*.[4]

(121) a. Lumpi will be painting the toilet brown right now. (epistemic reading only)
b. Lumpi wird gerade die Toilette braun ausmalen. (epistemic reading only)
Lumpi will right.now the toilet brown paint

3.2.2 Peripheral readings as a difference between English and German

Besides temporal and epistemic interpretations, *will* has been described as having generic and deontic readings as well as readings that can be described as either habitual, dispositional or volitional (Kissine 2008).

(122) a. Oil will float on water. (generic)
b. In winter, Mary will always wear a green coat. {habitual/dispositional/ volitional}

[4] I am not sure whether deictic past adverbials (such as *yesterday*) also can be said to force an epistemic interpretation, because my intuitions about past in the future readings restricted by (e.g.) *yesterday* are fuzzy.

c. You will leave tomorrow by the first train. (deontic)

(from Kissine 2008, p. 130)

The German equivalents of (122-a-b), appear to be acceptable to a lesser extent; some of my consultant liked them more than others.

(123) a. Öl wird auf Wasser (auf)schwimmen (??generic)

b. Mary wird im Winter immer einen grünen Mantel anziehen. (??habitual/dispositional/volitional)

c. Du wirst morgen mit dem ersten Zug verschwinden! (imperative/?deontic)

Suspiciously, similar, if not identical meanings like those in (122) can be expressed without *will*. (The German examples in (123) even become more acceptable without *werden*.)

(124) a. Oil floats on water.

b. In winter, Mary always wears a green coat.

c. You leave/are leaving with the first train!

(125) a. Öl schwimmt auf Wasser (auf).

b. Mary trägt im Winter immer einen grünen Mantel.

c. Du verschwindest morgen mit dem ersten Zug!

In this thesis, I have next to nothing to say about the readings exemplified by the (a)- and (b)-examples except this: I suspect that those readings can probably be summarized as one and the same reading. The reading of the (b)-example seems to be a sort of generic reading with a volitional agent in subject position. In German, bare present tense morphology is used in generic statements while English seems to prefer (but not *depend* on) *will* in order to express generic statements.

(126) a. If a farmer owns a donkey, he (will) beat(s) it.

b. Whenever Chuck owns a donkey, he (will) beat(s) it.

c. Wenn jemand einen Esel besitzt, schlägt er ihn/??wird er ihn schlagen.
if someone a donkey owns, beats he him/??will he him beat

d. Immer wenn Chuck einen Esel besitzt, schlägt er ihn/??wird er ihn schlagen.
always when Chuck a donkey owns, beats he him/??will he him beat

This leads us to another property of English *will*: they are frequently used in consequents of conditionals and in the scope of 'quantificational adverbs' (Lewis 1975).

(127) a. If a badger attacks a snake, it will spring at its head.

b. If a badger attacks a snake, it springs at its head.

c. Badgers will often attack snakes.

d. Badgers often attack snakes.

As a non-native speaker of English, I could not pin down the difference between those sentences and their alternatives without *will*. In German, on the other hand, the equivalents of (127-a) and (127-c) are

considerably less acceptable than their equivalents without *werden*.

(128) a. ??Wenn ein Dachs eine Schlange attackiert, wird er sich oft auf ihren Kopf stürzen.
if a badger a snake attacks, will he REFL often at her head spring

b. Wenn ein Dachs eine Schlange attackiert, stürzt er sich oft auf ihren Kopf
if a badger a snake attacks, springs he REFL often at her head

c. ??Dachse werden oft Schlangen attackieren.
badgers will often snakes attack

d. Dachse attackieren oft Schlangen.
badgers attack often snakes

Once again, it seems that whenever there is an operator quantifying over possible worlds or times, English tends to embed the proposition expressing the scope of that quantifier under *will*. The generic readings in (122-a) and (123-a) fit in that pattern, considering that generic expressions have been suggested to contain a covert generic operator. See Klecha 2014 for further discussion of *will* in conditionals and for cases where *will* undergoes *modal subordination*. As for the putative deontic readings in (122-c) and (123-c), it seems to be even more obvious that the deontic (or rather *imperative*) meaning is not due to the presence of *will/werden*, as imperative meanings seem to be available for bare indicative expressions as well.

(129) Context: Somebody littered a cigarette.

a. You are picking that up!

b. Du hebst das auf!

The only other non-temporal, non-epistemic readings of the future I can think of are found in German expressions like (130). I do not know whether they exist in English.[5]

(130) a. Ich werde doch nicht meine eigenen Kinder schlagen.
I will PART not my own children beat
'I'm not gonna beat my own children.'/'Why should I beat my own children.'/'As if I would beat my own children.'

b. Ich werde doch keine 10 Kilometer gehen nur um dann warmes Bier serviert
I will PART no 10 kilometers walk just in.order.to then warm beer served
zu bekommen.
INF.PART PASS.PART
'I'm not gonna walk 10 kilometers just so I get served warm beer.'

Those meanings do not seem to crucially depend on the presence *werden*, but its very presence in such examples calls for an explanation.

3.2.3 AFs under PAST as a difference between English and German

Recall from section 2.1.1 that *would* has been suggested and is now standardly assumed to be an allomorph of *would*, pronounced *will* in certain contexts. One context assumed to condition *would* is taken

[5] I thank Sarah Zobel, who brought those examples to my attention.

to be PAST tense, where it has the meaning of a 'future in the past', (131-a). Other contexts apparently conditioning *would* are non-realistic environments, (131-b).

(131) a. They raised a daughter who would be a famous writer.
b. If you had touched that fence, you would be dead.

Candidates for German allomorphs of *will* are *würd-* (subjunctive contexts) and *soll-*. But the equivalence seems to be a bit far-fetched. The future in the past interpretation of both *würd-* and *soll-* seems to be not very productive. The latter also adds a certain 'determination by destiny'-flavor. Futhermore, *soll-* lives its own live as a weak necessity operator where it appears in readings that are equivalent to *ought* and *should*.

3.2.4 Conditions on epistemic uses as a difference between English and German

The literature on *will* has identified a couple of restrictions for the epistemic reading of *will*. Some sources (e.g. Kissine 2008; Giannakidou and Mari 2018) claim that *will* cannot get an epistemic interpretation if the truth of the prejacent can not be (*easily*, I guess) verified.

(132) a. He is not at school. ??He will be ill.
b. (What is the shape of the universe?) It will be spherical.
(from Giannakidou and Mari 2018, p. 123-4.)

Except for French, which is argued to underlie the same condition (Mari 2010, 2016), I have found this claim at no other point in the literature. Anyway, if this restriction exists, it is not shared by German *will*. Another restriction is pointed out by Winans (2016). According to her *will*, cannot be used if the prejacent proposition is inferred *abductively*. Abductive inferences are defined as inferences from a result (e.g. a physical consequence like smoke) to a cause (e.g. the neighbors barbecuing). Epistemic *must* is supposed not to be subject to such a restriction. The sentences in (133) are treated as abductive forms of reasoning and the sentence containing *will* is marked as infelicitous. In the context of (134), the same sentences are taken to express non-abductive inferences. The use of *will* is hence judged acceptable by Winans.

(133) *Smoky barbecue: Angela knows that her neighbors barbecue often. A friend is over at her house and they both smell something smoky.* [And BBQs are assumed to be the only reason for smoky smells; JM] *Angela says:*
a. #The neighbors will be barbecuing (right now).
b. The neighbors must be barbecuing (right now). (from Winans 2016, p.26)

(134) *Friday night barbecue: Angela and Matt know that their neighbors barbecue every Friday* night. They are out of town, and Angela realizes it's Friday night. Angela says:
a. The neighbors will be barbecuing (right now).
b. ?The neighbors must be barbecuing (right now).
c. The neighbors must be barbecuing (right now), it's Friday night. (ibid.)

I will not discuss these examples in this thesis since it is unclear how German *werden* behaves with respect to these scenarios. I submit, that the data illustrated in (133) and (134) might boil down to a difference in compatibility with epistemic settledness: as will be shown in this section, epistemic *must* is felicitous in contexts of certainty (*indirect knowledge*) while epistemic *will* always adds an uncertainty flavor.
In the following two chapters, I will present data showing that (i) the semantics of *will* is *stronger* than assumed by most existing analyses of AFs and (ii) that claims of the form *will p* are *not necessity* claims. The structure of my argument will be as follows:

- The meaning of *will* is **stronger** than assumed by most analyses. (Chapter 4)
  - The assertion of $will_{temp}$ *p* is compatible with metaphysical (and epistemic) settledness with respect to p (i.e. compatible with $MB_{met} \subseteq p$). Hence, uncertainty with respect to *p* is not a lexical requirement of *will*. (Section 4.1)
  - A speaker asserting *will p* commits herself to the truth of *p*. This is, I argue, because assertion of *will p* also results in the assertion of *p*. The reason why *will p* asserts *p* is that *will* is a *strong modal*. (Section 4.2)

- The claim *will p* is **not a necessity claim:** (Chapter 5)
  - *will* lacks equivalence to *must*
    Unlike *must*, *will* does not lead to scope-effects under negation. (Sections 5.1)
  - Unlike predicted by necessity-analyses of *will*, metaphysical uses of *must* are not equivalent to temporal *will* and epistemic uses of *must* are not equivalent to epistemic *will*. The assertion of *will p* (on any reading) is compatible with MB being non-settled with respect to *p* (i.e. compatible with MB $\not\subseteq$ p): the assertion of $will_{temp}$ *p* is compatible with metaphysical (and hence epistemic) non-settledness of *p*. The assertion of $will_{ep}$ *p* is compatible with epistemic non-settledness of *p*. (Sections 5.2 and 5.3)

Taken together, the observations that *will* (i) asserts its prejacent and (ii) is not a necessity modal pose an interesting puzzle: if the relation between the modal base and the prejacent proposition is not one of inclusion (MB $\subseteq$ p), then which relation does *will* express? In Section 6, I will propose, adopting the choice function analysis by Cariani and Santorio (2018), that the at-issue meaning of *will* and *werden* is quasi-vacuous. But in order to put this analysis to use, certain assumptions about the not at-issue content of *will/werden* have to be made. I will propose that epistemic *will/werden* is subject to the indirectness requirement that von Fintel and Gillies (2010) propose for epistemic *must*. I will adopt this requirement to fit metaphysical readings in a way on which it derives obligatory future-orientation.

Chapter 4

will is a strong modal: *will p* entails *p*

In the literature on alternating future items, one often finds the view that the common feature of epistemic and temporal *will* is *uncertainty* (this view is either expressed explicitly (Giannakidou and Mari, 2018) or assumed tacitly (Condoravdi, 2002; Werner, 2006)). The basic idea behind that assumption is that since the future is metaphysically unsettled, what lies in the future cannot be known. Temporal *will*-claims are hence proposed to signal metaphysical non-settledness, just like epistemic *will*-claims signal epistemic non-settledness. Accounts deriving temporal and epistemic readings from the use of metaphysical and epistemic modal bases respectively have thus implemented a mechanism assuring obligatory metaphysical or epistemic non-settledness for *will* (and other modals). As discussed in section 2.2, the *Diversity Principle* is such a mechanism.

(135) Condoravdi's diversity condition
The semantics of a modal expression MODAL(p), where p is the prejacent, is defined only if the modal base is compatible with both p and $\neg p$.

As I will argue in Sections 5.2 and 5.3, I believe that certain aspects of this idea are indeed right: the semantics of *will* is well compatible with modal bases that do not satisfy homogeneity with respect to the prejacent proposition. However, non-settledness of the modal base should not be assumed as an *obligatory* ingredient of the meaning of *will*: in existing analyses, the assumption of the diversity condition makes two unwelcome predictions. First: *will p* is predicted to be infelicitous in contexts where p is in fact *known* and hence must be metaphysically settled. Empirical evidence proving this prediction wrong is presented in Section 4.1.1. Second, since *will* is assumed to be a necessity modal in those accounts, its domain of quantification is restricted to a subset of the modal base best conforming to a normality ordering. Hence, the semantics of *will* is predicted to be rather weak. So weak, in fact, that speaker commitment to the prejacent comes as a complete surprise. Data showing that speaker commitment to the prejacent proposition is obligatory with the assertion of *will p* is presented in Section 4.2. I assume that this is because with the assertion of *will p*, the prejacent proposition p always ends up being asserted too. As a consequence, I argue, if *will* is a modal at all (as I think it is), then *will* has to be a *strong* modal. I assume that a modal *mod* is strong if the truth of *MOD p* in w (at some t) entails truth of p in w (at some t'). More formally, I will assume that *will* and *werden* satisfy the condition of strength in (136) (cf. von Fintel and Gillies 2010, 2021).

(136) A modal operator $\mathcal{O}$ is a strong modal iff for any prejacent proposition p:
$[\![\mathcal{O}\ p]\!]^w = 1 \rightarrow [\![p]\!]^w = 1$. It is weak otherwise.

When I say that a speaker who asserts *MOD p* (where MOD is a strong modal) *asserts p*, I do of course not mean that *MOD p* and bare *p* are equivalent, but that assertion of *MOD p implies* the assertion of *p*. If (adopting e.g. a commitment-based view on the norms of assertion) a speaker asserting bare *p* is committed to the truth of *p*, then, if *MOD* logically entails its prejacent, the assertion of *MOD p* commits the speaker not only to the truth of *MOD p* but also to the truth of *p*. That is, on a commitment account of assertion, the speaker's commitment to *MOD p implies* her commitment to *p*. In short, assertion of bare *p* signals commitment to *p* while assertion of *MOD p* signals commitment to *p* plus commitment to something extra (if *MOD* is non-vacuous).
Under a strong view of epistemic *must* defended by von Fintel and Gillies (2010, 2021) for example, *must p* asserts that *p* follows from what is known (directly and inferred) and presupposes that *p* is not known directly. Bare assertion of *p* is not subject to such a restriction. Since what is known (indirectly or not), must be true, it follows that *p* is true if *must p* is true (and *must p* is true only if *p* is true). But of course, this does not make *must p* equivalent to bare *p*, since only *must* carries the evidential signal of indirectness. (137) illustrates how this difference roughly plays out on a commitment-based account of assertion.

(137) **Bare *p* vs. epistemic *must p* in terms of speaker-commitment**

a. **Assertion of *it is raining* in *w*:**
– The speaker is committed that it is raining in *w*.
– Perhaps it is *known* (directly or indirectly) that it is raining.

b. **Assertion of *it must be raining* in *w*:**
– The speaker is committed that it is raining in *w*.
– The speaker is committed that it doesn't follow from what is known *directly* that it is raining in *w*.

In this Chapter I will argue that the assertion of *will/werden p* commits the speaker to the truth of *p* and simultaneously signals compatibility(!) with metaphysical or epistemic non-settledness of *p*. Note that this idea is not well compatible with accounts which take the norm of assertion to be strong belief, knowledge or outright truth. On such accounts, a speaker is said to have violated a speech act norm (that of assertion) as soon as she asserts *p* even though she is not fully certain of *p*, does not *know* whether *p* or if *p* is false respectively. This is why I assume a weaker notion of assertion. My account is, for example, well compatible with an account of assertion that is based on weak belief (e.g. the one in Mandelkern and Dorst to appear).

4.1 First evidence against weakness: temporal *will p* is compatible with knowledge and direct information of *p*

4.1.1 Compatibility with metaphysical settledness and knowledge

For many authors the assumption that AFs are *modal* expressions arises from the idea that it cannot be *known* what happens in the future. This is because, on a modal account, the meaning of an AF can be weakened in a way that captures the supposed weakness of a temporal *will*-claim. The idea seems to be that speakers are mindful about the openness of the future and therefore communicate a certain degree of uncertainty with respect to the prejacent proposition whenever they make a temporal *will*-statement. Accordingly, metaphysical non-settledness (and hence epistemic non-settledness) is proposed to be a precondition for the use of temporal *will*. The diversity principle in (136) above is an implementation of such a condition.

This, I believe, is an over-interpretation of the metaphysical openness of the future: acknowledging that there are multiple (maybe infinite) ways a given world *w* can develop has to be distinguished from the idea that *anything* is a future possibility for *w* and from the claim that there are no future properties of *w* one can possess knowledge about. The view that nothing can be known about the future is undermined by examples in which *will* embeds a proposition that is *known* to be true at the time of utterance and which appears in the perfect. In such cases, there is clearly not a single doubt about whether the prejacent proposition will hold in the world of utterance at some point later than the utterance time. After all, the (non-perfective version of the) prejacent proposition is *known* to be true at the time of utterance and thus also has to be a metaphysical necessity (cf. Kaufmann et al. 2006).

Nevertheless, *will* is felicitous in such examples. In fact, the use of *will* is necessary in order to bring about a past-in-the-future interpretation in English. In such examples, the contribution of temporal *will* merely seems to be to shift the time of evaluation of the perfect to some future time. Consider, for example, (138)–(139), where *will* embeds a perfect clause. The semantic argument of the perfect is a property that is *known* to yield truth in w_0 at speech time already.[1]

(138) A: It is 1pm. The evil butcher comes again at 8pm. If Ida has not foaled by 8pm, he will take her.
B: Ida **will**$_{\text{tem}}$ have foaled by 8pm. [Pulls aside the curtain behind which Ida started foaling.] She is saved!

(139) [Lui is visiting a fountain during his summer holidays. There is a sign, reading: *At the end of the year, anybody who previously has tossed a coin into the fountain will be eligible to apply for a raffle.*]
Lui: Cool! [tossing a coin into the fountain. Blub.] I **will**$_{\text{tem}}$ have tossed a coin into the fountain at the end of the year.

In the context of (139), Lui throws a coin into a fountain just a few moments before the time of utterance

[1] I thank Ryan Bochnak and Valerie Wurm for their help with those examples.

of his *will*-claim. At the time of utterance, the prejacent proposition 'Lui has tossed a coin into the fountain' thus is true at *any* metaphysical alternative of w_0 (and, in fact, at *any* time following t_0) and the prejacent proposition p is hence a metaphysical necessity for w_0 at t_0. And since Lui *knows* that he just threw a coin into the fountain, p is also epistemically settled from the perspective of Lui (which implies that he also knows that p is *metaphysically* settled.[2] On an account that treats temporal *will* as a marker of metaphysical non-settltedness, the fact that the examples in (138)–(139) are felicitous even though the speaker has full certainty in the proposition expressed by the prejacent would be surprising. Instead of epistemic or metaphysical uncertainty, the semantic contribution of *will* in (139) just seems to be to shift forward the time at which the proposition 'Lui has tossed a coin into the fountain' is evaluated. Note that, of course, (140) would have been acceptable and appropriate in the scenario of (139), too. It asserts that the perfect property 'Lui has tossed a coin into the water' holds of the time of utterance.

(140) [Same scenario as in (139)]
Lui: Cool! [tossing a coin into the fountain. Blub.] I have tossed a coin into the fountain.

The difference between (139) and (140) is rather subtle. But it seems that the reason why one may want to chose the perfect-under-*will* construction in (139) over the present perfect sentence in (140) is this: according to the scenario in (139), all that is relevant to Lui's eligibility to apply is whether a certain property holds of Lui *at the end of the year*. By shifting the time of evaluation of the perfect clause to the future, the speaker asserts that Lui fulfills the property that is demanded at the relevant time, i.e. at the end of the year. This is a rather direct way to communicate that Lui will be eligible to apply for the raffle at the end of the year. Arguably, the sentence in (140) follows a strategy which is slightly less direct by merely asserting that the relevant property (the property of having tossed a coin into the fountain) holds at the time of *utterance* and hence leaving the inference that this property will also have applied at any later time. Of course, it should not be hard for any hearer to see that if a property of having done something holds of Lui at the time of utterance, then it will also hold of Lui at the end of the year. Nevertheless, this inference has to be made if the sentence in (140) is to be understood as commenting on Lui's eligibility to apply for the riffle. (139) on the other hand, does not demand that such an inference is made.

Another type of example illustrating that temporal *will* is compatible with metaphysical (and epistemic) settledness is (141).

[2]This is because the way epistemic and metaphysical accessibility relations are modeled, epistemic settledness implies metaphysical settledness. This follows straightforwardly from the properties *Historicity* and *Lack of foreknowledge* of doxastic accessibility relations that are defined relative to historical accessibility by Kaufmann et al. 2006. The property defined in (i-a) assures that the set of worlds epistemically accessible from w is identical to the set of worlds epistemically accessible from any historical alternative of w (with the time parameter being kept identical). I.e. that the epistemic accessibility relation between two worlds *w,w'* does not discriminate between w and historical equivalents of w. The property in (i-b) states the epistemic accessibility relation from two worlds *w,w'* does not discriminate between w' and historical alternatives of w'. It follows, that if two worlds are metaphysically accessible, they are also epistemically accessible, (i-c).

(i) For any worlds w, w', w'', epistemic accessibility relation R_{ep} and metaphysical accessibility relation R_{met}:
a. Historicity
If $wR_{ep}w'$ and $wR_{met}w''$, then $w''R_{ep}w'$
b. Lack of foreknowledge
If $wR_{ep}w'$ and $w'R_{met}w''$, then $wR_{ep}w''$
c. Therefore, if $wR_{met}w'$, then $wR_{ep}w'$.

(141) In 10 hours, 600 minutes **will** have passed.

(141) is an analytical statement involving temporal vocabulary: that 10 hours are equivalent to 600 minutes is a fact about our measure system of time that simply follows from the way its units of measurement are defined. The property denoted by the prejacent, i.e. *that 600 minutes have passed 10 hours after* t_0, is hence a property that is shared by *all* metaphysical alternatives of the world of utterance. Nevertheless, *will* is not only felicitous, but *required* in such examples (in English). Again, it seems that the only contribution by *will* is not to signal some sort of uncertainty, but to shift forward the time of interpretation of its prejacent.

I conclude that the use of temporal *will* is not restricted to contexts of metaphysical unsettledness (see Section 5.3 for the behavior of *epistemic will* in contexts of epistemic settledness). Therefore, the idea, according to which the two readings of alternating futures have in common the requirement of a non-homogeneous modal base, has to be rejected.

4.1.2 Compatibility with direct information

According to a similar idea, epistemic and temporal readings are related by *indirectness* (e.g. Mari 2010, 2016). Epistemic modals in general seem to require that the evidence for the prejacent proposition be only *indirect*, i.e. the truth of the prejacent must not be known through direct experience, but must be *inferred* instead (von Fintel and Gillies 2010, 2021). Since events that lie in the future cannot be perceived directly either, maybe temporal *will* is subject to an indirectness requirement as well and the reason why we often find epistemic meanings with future morphemes is linked in some way to such a requirement. If that would be the case, temporal and epistemic *will* would have to be sensitive to two different notions of epistemic indirectness. As applying to epistemic modals, the indirectness condition rules out, among other things, evidence gained from trustworthy sources, as shown in (142-b-c). Temporal *will*-claims, by contrast, are felicitous if the prejacent proposition is known through such sources, as indicated in (142-a).

(142) *Context: Lui (who is trustworthy) tells Ria that he is going to the protest tomorrow. Ria talks to Liv and tells her:*

a. Ria: Lui $\text{will}_{\text{temp}}$ be at the protest tomorrow.
b. Ria: # Lui will_{ep} be at the protest tomorrow.
c. Ria: # Lui must_{ep} be at the protest tomorrow.

In the context of (142), Ria received the information that Lui is going to a protest the next day from Lui himself. Under the assumption that Lui can be trusted, only the epistemic reading of *will* (and *must*) is infelicitous, while a temporal reading of *will* is indeed acceptable. Under the assumption that reports received from trustworthy sources count as direct enough evidence to be ruled out by the indirectness condition (as witnessed by (142-b)), the acceptability of (142-a) shows that temporal *will* cannot be subject to the same rule.

From the data presented in Section 4.1, I conclude that the assertion of temporal *will p* is compatible with knowledge and hence metaphysical settledness of *p*. Therefore, what epistemic and temporal readings

of *will* have in common is not a requirement of a prejacent-diverse modal base. Furthermore, the reason why epistemic and temporal meanings are often expressed by one and the same lexical item cannot be found in a shared presupposition (or implicature) banning direct information because temporal uses *will* have been shown to be compatible with direct information indeed (i.e. reports from trustworthy sources). This is of course not to say that I do not think *will* and *werden* signal epistemic indirectness on their *epistemic* reading. I assume they do, following von Fintel and Gillies (2010, 2021). However, while I have shown that temporal *will* does not require *epistemic* indirectness, I will propose in Chapter 6 that temporal *will* and *werden* require *metaphysical* indirectness. By applying von Fintel and Gillie's distinction between epistemic non-settledness and epistemic indirectness to the realm of metaphysical modality, I will suggest that metaphysical *will* and *werden* presuppose that the prejacent proposition must not be settled directly by a *privileged part* of their metaphysical modal base (i.e. the 'metaphysical kernel'). According to this treatment, a proposition p can be settled by a metaphysical modal base MB_{met} even though it is (required to be) not directly settled by the kernel K_{met} determining MB_{met}.

4.2 Assertion of *will p* entails assertion of *p*

As I have shown in Chapter 2, modal accounts predominantly suggest *weak* analyses of alternating futures. In this subsection, I will show that a speaker who makes the assertion *will p* is committed to the truth of p - irrespective of the reading of *will*. On its simplest interpretation this observation shows that the assertion of *will p* (also) *asserts p*. Under, again, the simplest assumptions, the reason why the assertion of *will p* implies the assertion of p is because the set of world parameters which p is evaluated at necessarily includes the modal anchor world. That is, I will argue that the alternating futures of English and German are *strong* modals.

4.2.1 The *only*-dialogue

With the following dialogue, von Fintel and Gillies (2010) (and more recently von Fintel and Gillies 2021) show that if the prejacent of epistemic *must* turns out to be false and an objection like (143-a) is made, a speaker cannot talk her way out by alluding to her use of *must*.

(143) a. Alex: It must be raining.
b. Billy: [Opens curtains] No it isn't. You were wrong.
c. Alex: #I was not! Look, I didn't say it *was* raining. I only said it *must* be raining. Stop picking on me! (from von Fintel and Gillies 2010, p.366)

In short, what von Fintel and Gillies conclude from (143) is this. The oddness of (143-c) would be unexplained if the assertion of *must p* would allow for the possibility of $\neg p$. Therefore, the assertion of *must p* is not compatible with $\neg p$ actually being the case. Epistemic *must* thus satisfies the property of *modal strength*: the set of world parameters the prejacent of *must* is evaluated at necessarily includes the world of utterance (see the definition in (136) above). Indeed, if *must* is replaced by *might* or *ought*, both uncontroversial weak modals, the pointer to the use of the modal does make a successful excuse.

(144) a. Alex: It {**ought to/might**} be raining.

b. Billy: [Opens curtains] No it isn't. You were wrong.

c. Alex: I was not! Look, I didn't say it *was* raining. I only said it {**ought to/might**} be raining. Stop picking on me! (ibid.)

Might is assumed to be a possibility modal and hence *weak*. Accordingly, the *might*-claim in (144-a) is perfectly compatible with falsity of 'it is raining'. The modal *ought* is taken to be a *weak* necessity modal, whose lexical semantics is assumed to require that its domain of quantification is restricted by an ordering (see von Fintel and Iatridou 2008 and Yalcin 2016) and therefore does not entail the truth of the prejacent either. It is hence expected that Billy's objection is in (144) clearly unfounded. (I do not list here the equivalent German examples involving *müssen* vs. *sollte/dürfte, könnte*, which behave exactly the same in those contexts.) The following examples show that *will* and *werden* behave like *must* with respect to the *I-only-said*-diagnostic. Let us first have a look at the temporal reading of the future in (145).

(145) **Temporal *will***

a. **Ava:** Rapid will win against Salzburg tomorrow.

b. **Lui:** [After the game] See, they didn't win. You were wrong.

c. **Ada:** #I was not! Look, I didn't say they … [win tomorrow (?)] …. I only said Rapid *will* win against Salzburg. Stop picking on me!

Ava's excuse in (145) is without doubt off. Recall that unlike in German, future-oriented claims in English are not replaceable as freely by bare sentences in the morphological present ('futurates') as indicated by '… [win tomorrow (?)]…'. Part of what makes Ada's response weird is that she is struggling even to find a competing expression that would plausibly make a stronger candidate. In German, where futurates occur more freely, Ava could try to point towards a contrast between the morphological present and her *werden*-claim, as in (146). However, this strategy fails too, as the second sentence by Ava in (146) is still infelicitous as an excuse. Thus, whatever the difference between those two constructions might be, they do not seem to differ in a way where *FUTURATE p* does not allow for $\neg p$ while *werden p* does.[3]

(146) **Temporal *werden***

a. **Ava:** Morgen wird Rapid gegen Salzburg gewinnen.
tomorrow will Rapid against Salzburg win

b. **Lui:** [After the game] Schau, sie haben nicht gewonnen. Du hast unrecht gehabt.

c. **Ava:** #Ich hab nicht unrecht gehabt. Schau, ich habe nicht gesagt Rapid *gewinnt*
I have not wrong had. Look, I have not said Rapid wins
morgen gegen Salzburg. Ich habe nur gesagt Rapid *wird* gegen Salzburg gewinnen.
tomorrow against Salzburg. I have only said Rapid will against Salzburg win.

Verbatim: 'Look, I didn't say Rapid *wins* against Salzburg tomorrow. I only said Rapid *will* win against Salzburg.'

[3] Judging the excuses in (144) and (145) as infelicitous, as I do, is to reject Giannakidou and Mari's claim that the (Greek, Italian and English) alternating future (and *must*) is a doxastic modal. As far as I can tell from certain judgments by Giannakidou and Mari, I assume that they would probably not rate them as unacceptable. As my discussion of the examples (44) and (43) in Section 2.2.2 shows, this would not be the only case where my judgments simply diverge from theirs.

I conclude from (145) and (146) that a speaker who makes a temporal *will*-claim is committed to the truth of the prejacent proposition. Since the speaker has no way of dodging this commitment even if the context would call for it, this commitment has to be *obligatory.* I will refer to this property as 'obligatory speaker commitment'.

So far, I have shown only that *temporal* meanings of alternating futures show obligatory speaker commitment. The following examples show that epistemic uses of *will* and *werden* come with obligatory speaker commitment too. In the scenarios of (147) and (148), Ava makes an epistemic *will*-statement about the location of the air leakage in a flat tire. Lui, noting that the prejacent of Ava's *will*-claim did not correctly identify the source of the leakage, accuses Ava of having made a false statement.

(147) **Epistemic *will***
Context: *Ava and Lui are repairing a flat tire. They want to find out where the air is leaking out.*

a. **Ava:** It will be in the valve.
b. **Lui:** [Checking valve and tube.] No, it's not in the valve. The leakage is in the tube. You were wrong.
c. **Ava:** # I was not! Look, I didn't say the leakage *was* in the valve. I only said it *will* be in the valve. Stop picking on me!

(148) **Epistemic *werden***
[Same context as in (147)]

a. **Ava:** Es wird am Ventil liegen.
it will on.the valve lie
b. **Lui:** [Checking valve and tube] Nein, es ist nicht im Ventil. Das Loch ist tatsächlich im Schlauch. Was du gesagt hast, war falsch.
c. **Ava:** #Ich hab nicht Unrecht gehabt. Schau, ich habe nicht gesagt, es *liegt* am
I have not wrong had. Look, I have not said it lies on.the
Ventil, ich hab nur gesagt, es *wird* am Ventil liegen.
valve, I have only said it will on.the valve lie

Again, the c-examples should actually favor a weak interpretation of the modal (i.e. one on which it is compatible with falsity of the prejacent) since that would be the only way for them to be felicitous. However, neither English (147-c) nor German (148-c) make a successful rejection of Lui's accusation. Since the most prominent reading of *will/werden* is epistemic here, this is evidence that epistemic *will* and *werden* commit the speaker to the truth of the prejacent proposition obligatorily.

4.2.2 Conjunction with *maybe not p*

In this subsection, I investigate another diagnostic of modal strength: conjunction of *MODAL p* with *maybe not p*. The rationale behind this diagnostic is as follows. If a given conjunct containing a modal would allow for the possibility of the prejacent to be false, conjunctions of the form *modal p but might not p* should be valid and hence acceptable. I will show that *will/werden* and epistemic *must* (von Fintel and Gillies (2010, 2021)) are not acceptable in those contexts. As I will discuss below, there are two

possible reasons why *will p* might be infelicitous in conjunction with *maybe not p*: those two conjuncts could be either 'classically inconsistent' (Mandelkern 2019) like *must p* and *might not p* are, or they could be incompatible for the same reason why bare *p* is infelicitous with *might not p* ('Wittgenstein sentences'; ibid.). Given that a necessity-account will be shown to be implausible for *will* (Chapter 5), I suggest that *will p* is infelicitous in those conjunctions because it creates a 'Wittgenstein sentence'. The example in (149), which is taken from von Fintel and Gillies 2010, shows that epistemic *must p* is not conjoinable with a sentence expressing the possibility of the negation of *p*.

(149) a. #It must be raining but perhaps it isn't raining.
b. #Perhaps it isn't raining but it must be. (von Fintel and Gillies 2010, p. 364)

The judgment of those examples, however, is a tricky business. It has been shown by Lassiter (2016) (and subsequently discussed in von Fintel and Gillies (2021)) that there are contexts where conjunctions of the form '*must p but maybe* ¬*p* are judged to be tolerable to acceptable. Lassiter gives the following example where the phrase 'but I am not certain' is assumed to be equivalent to epistemic 'but maybe ¬ p'.

(150) I have an injected TB42 turbo and don't like the current setup. There is an extra injected 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? (Lassiter, 2016, p.126)

Von Fintel and Gillies treat conjunctions like the one in (150) as examples of a speaker extending her 'modal horizon' during the conversation: the set of possible worlds with respect to which the expressions are evaluated are not the same for both conjuncts. Instead, the *must*-claim was made against a more restricted set of possibilities than the second conjunct. For example, the context in (150) might be one where the speaker became aware of other possibilities she had been ignoring before. Admitting uncertainty in the second conjunct might therefore count as a signal that the speaker's epistemic possibilities have changed.
In response, von Fintel and Gillies come up with contexts that are designed to disprefer such live shifts in modal horizon (i) contexts where the speaker is pressed to commit to both conjuncts simultaneously and contexts of (ii) uncertainty-prefixation and (iii) uncertainty-embeddings.In (151), A can respond to B with a plain positive or negative answer, but sticking to her original assertion, which involved a conjunction of *must p* with *maybe not p*, is not an acceptable option for A.

(151) **Forced simultaneous commitment to both conjuncts**
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 that it must be an old DTS diesel setup?
A: I guess not./Yeah, it must be; I'm sure of it./??Like I said: it must be but I'm not certain.
(von Fintel and Gillies, 2021, p.100)

Next, consider (152). Compared to (149), those examples should be even less acceptable since, again,

the context disprefers contextual shifts of the epistemic alternatives. According to the authors, this is because if the *although*-phrase is expressed at the beginning of the sentence, the speaker already must have reasoned about what is the actual set of epistemic alternatives her statement is relating to.

(152) ***Although*-prefixation**

a. #Although I'm not certain, it must be an old DTS diesel setup.

b. #Although I don't know for sure, it must be 138,000. (von Fintel and Gillies 2021 p. 100)

In the third type of context that the authors discuss, uncertainty is again expressed in a way that does not evoke a contextual shift in epistemic alternatives. The example in (153), which is due to von Fintel and Gillies (2021) too, could describe the rules of an insurance company. Here, *likely* in (153-a) is contrasted with the use of *must* in (153-b).

(153) **Uncertainty-embedded *must***

Scenario: *To establish whether a patient has the disease, there are two tests. Test A is cheap, but not always definitive: it can indicate that the patient has the disease but often it merely indicates that a patient is more or less likely to have the disease. There's a second, always definitive test (Test B), which is hugely more expensive. So, the insurance company has rules like [a] but not like [b]:*

a. Test B can only be administered if the results of Test A are that it is not certain that the patient has the disease but that she likely has it.

b. #Test B can only be administered if the results of Test A are that it is not certain that the patient has the disease but that she must have it.

(von Fintel and Gillies 2021, p.100; format adapted)

Again, the conjunction containing *must* in (153-b) is not felicitous as it seems to make a contradictory claim. Based on the diagnostics in (151) – (153), the conclusion reached by von Fintel and Gillies, which I follow, is that *must p* is incompatible with 'but maybe not *p*'-conjunctions. I leave it to the reader to convince themselves that weak modals such as *might* or *ought* are indeed acceptable in such environments. In testing compatibility with 'maybe not *p*'-conjunctions, I will hence make use of the same devices to block contextual shifts in epistemic alternatives.

I will first consider *epistemic* uses of *will* and *werden*. (154) shows that epistemic *will* and *werden* are off in 'forced simultaneous commitment'-contexts. Note that I mark the relevant sentences with '??'. In this case, my consultants readily rejected the sentence, but still preferred it over the equivalent *must/müssen*-sentence if pressed to rank one over the other.

(154) A: What a delicious dumpling! And look at those green things in the filling, they taste a bit garlicky.. that will$_{ep}$ be Chinese chive .. but I'm not certain. Normally, the recipe would contain only spring onions.

B: So, given that you're not certain, do you still think that it will be chive?

A: I guess not./Yeah, it will$_{ep}$ be chive./??Like I said: it will$_{ep}$ be chive, but I am not certain.

(English)

A': Nein, eher nicht./
no, rather not

Ja, es wird Schnittlauch sein./
yes, it will chive be

??Wie bereits gesagt: es wird_{ep} Schnittlauch sein, aber sicher bin ich mir nicht.
as already said it will chive be, but sure am I REFL not

(German)

(155)–(156) are examples that involve epistemic uses of *will* and *werden* and which are prefixed by an *although maybe not p*-phrase.

(155) a. ??Although I am not certain, it will_{ep} be Chinese chive.

b. ??Even though my cleaver might be in the bedroom, it will_{ep} be in the bathroom.

(156) a. ??Obwohl ich mir nicht sicher bin, wird_{ep} chinesischer Schnittlauch drin sein.
although I REFL not sure am, will Chinese chive inside be

b. ??Obwohl mein Hackebeil im Schlafzimmer sein könnte, wird_{ep} es im Bad sein.
although my cleaver in.the bedroom be might, will it in.the bathroom be

Again, the sentences in (155)–(156) are marked with '??'. Again, this means that my consultants had severe difficulties to accept those sentences but preferred those sentences over the respective *must*-equivalent. The same goes for the sentences in (157), which are to be interpreted against von Fintel and Gillies' insurance company-scenario from (153) above.

(157) **Uncertainty-embedded *will***

a. ??Test B can only be administered if the results of Test A are that it is not certain that the patient has the disease, but that she will_{ep} have it.

b. ??Test B kann nur dann erteilt werden, wenn die Resultate von Test A so sind,
test B can only then administered be, if the results of test A such are
dass es nicht sicher ist, ob der Patient die Krankheit hat, aber der Patient die
that it not certain is whether the patient the disease has, but the patient the
Krankeit haben wird_{ep}. (adapted from von Fintel and Gillies 2021)
disease have will

So far, I have tested whether epistemic uses of *must* and *will* are compatible with epistemic readings of 'maybe not *p*' or 'it's uncertain that *p*'. Under the assumption that temporal *will* expresses metaphysical modality, the examples have to be adapted in a way that 'maybe not *p*'-conjuncts get a metaphysical reading, too. With this in mind, let us turn to temporal uses of *will* and *werden*. I follow Condoravdi (2002) in assuming that there exist metaphysical readings of possibility modals. The difference between epistemic and metaphysical interpretations is illustrated by (158) where the (a)-example foregrounds a metaphysical reading of *might*, whereas the (b)-example foregrounds an epistemic one.

(158) a. I might get sick (one day). (metaphysical)

b. I might be getting sick (now). (epistemic)

In (159), the speaker makes a metaphysical (i.e. temporal) *will/werden*-claim which is followed up by a metaphysical 'but might not *p*' conjunct. Subsequently, she is asked if she would defend both conjuncts simultaneously. Again, sticking to that conjunction seems odd.

(159) **Forced, simultaneous commitment to both conjuncts**

A: I didn't do well at that exam. I will$_{\text{met(aphysical)}}$ get an F ... but I (also) might$_{\text{met}}$ get a D, I did kind of okay on the last question.

B: So, given that you might get a D, would you still say that you will get an F?

A I guess not. / Yeah, I will get an F. / ??As I said: I will$_{\text{met}}$ get an F, but I might$_{\text{met}}$ get a D.

A': Nein, eher nicht. /
no, rather not.

Ja, ich werde$_{\text{met}}$ ein F kriegen. /
yes, I will a F get.

??Wie gesagt: ich werde$_{\text{met}}$ ein F kriegen, aber ich könnte$_{\text{met}}$ auch ein D kriegen.
as said: I will a F get, but I could also a D get.

The same result obtains for the examples in (160) and (161), where, again, there is a felt sense of contradiction.

(160) a. #Although I might$_{\text{met}}$ get a D, I will$_{\text{met}}$ get an F.

b. #Even though Rapid might$_{\text{met}}$ lose, they will$_{\text{met}}$ win.

(161) a. #Obwohl ich ein D bekommen könnte$_{\text{met}}$, werde$_{\text{met}}$ ich ein F bekommen.
Although I a D get might, will I a F get

b. #Obwohl Rapid verlieren könnte$_{\text{met}}$, werden$_{\text{met}}$ sie gewinnen.
although Rapid loose might, will the win

(162) and (163) are modified versions of the insurance company examples from above. They are amended to better support a metaphysical reading of the modals involved.[4]

(162) **Uncertainty-embedded temporal *will***

a. The expensive test B can only be administered if the cheaper test A showed that the illness might$_{\text{met}}$ never break out but that it should$_{\text{met}}$/ought to$_{\text{met}}$ break out again.

b. #The expensive test B can only be administered if the cheaper test A showed that the illness might$_{\text{met}}$ never break out but that it *will*$_{\text{met}}$ break out again.

(163) **Uncertainty-embedded temporal *werden***

a. Der teure Test B wird nur dann erteilt, wenn der günstige Test A gezeigt hat
the expensive test B is only then administered if the cheaper test A showed has
dass die Krankheit (zwar) ausbleiben könnte$_{\text{met}}$ aber erneut ausbrechen
that the disease (although) not.happen might but again break.out

[4]For one thing, the prejacent from the epistemic examples (*have the illness*), due to its stative aktionsart, seems to favor an epistemic reading of the modal. Second, *it is uncertain* and *it is likely* cannot easily get a metaphysical reading without the additional use of *will*, which is why I have replaced them by 'might$_{\text{met}}$ not' and 'should/ought to' respectively.

sollte$_{met}$/dürfte$_{met}$.
should/DÜRFTE

b. #Der teure Test B wird nur dann erteilt, wenn der günstige Test A gezeigt
the expensive test B is only then administered if the cheaper test A showed
hat, dass die Krankheit (zwar) ausbleiben könnte aber erneut ausbrechen wird$_{met}$.
has that the disease (although) not.happen might but again break.out will

Again, the examples where the modal of the second conjunct is *will* or *werden* are instantly rated infelicitous as there is a felt contradiction. In sum, the data presented in this subsection shows that *will p* and *werden p* on either reading are not compatible with simultaneous assertion of the possibility of ¬*p*. Now, what exactly does this diagnostic reveal about the semantics of *will* and *werden*?

There are two reasons why *will p* might lead to unacceptability in conjunction with 'might ¬ p'. One of them is logical or 'classical' (Mandelkern 2019) inconsistency. Two conjuncts are classically inconsistent if the first conjunct intersected with the second yields the empty set. On a strong view of *must*, the assertion of (epistemic) *must p* expresses that *all* indices *j* epistemically accessible from *i* are such that *p* yields truth at *j*. Provided that no shift in modal horizon occurs, this claim is *classically* inconsistent with the claim that there are some indices *k* epistemically accessible from *i* such that *p* yields false at *k*. Accordingly, the conjunction of *must p* with *might* ¬ *p* in (164-a) is predicted to be classically inconsistent (and hence infelicitous) the same way the sentences in (164-b-c) are.

(164) a. #It must be raining, but maybe it is not raining.
b. #It must be raining, but it must be not raining.
c. #It is raining, but it is not raining.

However, logical consistency is not the only reason why conjunction with *might not p* might lead to unacceptability. Consider sentences like (165), which have been referred to as 'Wittgenstein sentences' (Mandelkern, 2019).

(165) a. #It might$_{ep}$ be raining but it's not raining.
b. #It's not raining, but it might be raining.

While those sentences are, without doubt, infelicitous, they are according to most accounts not 'classically inconsistent' (Mandelkern 2019, who in fact develops an account on which Wittgenstein sentences are logically inconsistent too). Assume that *might p* has the truth conditions in (166).

(166) $[\![might\ p]\!]^{w,MB} = 1$ iff $\exists w'.[w' \in MB \& [\![p]\!]^{MB,w'} = 1.]$

Then, $[\![p\ \&\ might\ \neg p]\!]^{w,MB}$ is non-contradictory as long as there is there is some w' ∈ MB such that $[\![\neg p]\!]^{w'}$=1, and is true as long as *p* is true in *w*. Based on only the semantics in (167), it is hence unexpected that the Wittgenstein sentences in (165) are unacceptable. While there have been different suggestions as to how the unacceptability of Wittgenstein sentences can be derived (see Mandelkern 2019 for an overview), for the current purpose it suffices to take notice of the fact that conjunction with *might* ¬*p* can be infelicitous even if the other conjunct is not a necessity modal.

There are, hence, two ways in which conjunction with *maybe not p* can result in an infelicitous sentence: such a conjunction can be infelicitous because it creates a classical inconsistency as in (165-a), or because of whatever are the reasons why Wittgenstein sentences are infelicitous. What therefore can *not* be concluded from the fact that *will p* is incompatible with conjunction of *might* $\neg p$ is that *will* is a necessity modal. As I will show in Chapter 5, there are good reasons to opt against a necessity analysis of *will*. What the diagnostic *does* show, however, is that *will p* logically entails *p* (in the sense of (136)). This is because irrespective of whether one follows Mandelkern's (2019) analysis of Wittgenstein sentences or (what Mandelkern calls) a 'classical strategy', conjunction with *might* $\neg p$ is only expected to lead to unacceptability if the second conjunct logically *entails p*.

4.3 Strength conclusion

In this section, I have presented data showing (i) that temporal *will* (and *werden*) are compatible with epistemic and metaphysical settledness of the prejacent proposition as well as with direct evidence; (ii) that a speaker asserting *will p* (on any reading) is obligatorily committed to the prejacent proposition *p* and (iii) that conjunction with *maybe not p* leads to unacceptability of *will p* (on any reading). This is summarized in Table 4.1, where I added the behavior of epistemic *must* as presented by von Fintel and Gillies (2010, 2021).

	epistemic will	**temporal will**	**epistemic must** (following vF&G)
compatibility with settled modal base	–	✓	✓
compatibility with direct evidence	–	✓	×
obligatory commitment to prejacent proposition	✓	✓	✓
compatibility with '$\Diamond \neg$p'-conjunction	×	×	×

Table 4.1: Overview: strong behavior of *will*

Here is what I conclude from this data. The compatibility of *will p* with metaphysical and epistemic settledness undermines a common motto in the literature on *will*: that what lies in the future cannot be known and that hence the modal domain of *will* is restricted to the subset best conforming to a normality ordering (which makes *will* semantically weak). The fact that temporal *will* (and *werden*) can also be used if the prejacent proposition is *known* to be true (and hence metaphysically settled) not only means that the initial motivation for the weakness of *will* is lost but also indicates that *will* does not (obligatorily) signal epistemic or metaphysical uncertainty as its acceptability in those context would be unexpected. Furthermore, the fact that *will* is compatible with direct evidence (albeit a certain type of direct evidence: reports from trustworthy sources) shows that epistemic and temporal uses of *will* are not related by a shared principle ruling out direct evidence for the prejacent proposition.

As witnessed by the *I only said*-test, *will* and *werden* commit the speaker to the proposition expressed by the prejacent. On its most straightforward interpretation, this behavior shows that (unembedded) *will p* obligatorily *asserts p*. On, again, the simplest assumptions, a modal can only be said to assert its prejacent if the set of world indices at which the prejacent is evaluated includes the world of utterance. Therefore, if a modal asserts its prejacent proposition *obligatorily*, the set of worlds at which the prejacent is evaluated has to be said to necessarily include the world of utterance. This receives additional support from the fact that if *will p* would not entail *p*, there would be no way to explain the fact that *will p* leads to unacceptability in conjunction with *maybe not p*. I conclude that *will* satisfies the condition for modal strength in (136), repeated in (167).

(167) A modal operator $\mathcal{O}$ is a strong modal iff for any prejacent proposition p:
$[\![\mathcal{O}\ p]\!]^w = 1 \rightarrow [\![p]\!]^w = 1$. It is weak otherwise.

As indicated by '–' in Table 4.1, epistemic uses of *will* (and werden) have not yet been investigated for their compatibility with epistemic settledness, i.e. full certainty. In the next section, Section 5, I will show that epistemic *will* is in fact not felicitous in contexts of epistemic settledness. In light of the data in 4.1, this cannot be taken to be evidence that *will* is *weak*, however. Instead I take this to show that even though *will* is strong (it entails its prejacent), *will p* is semantically compatible with epistemic and metaphysical unsettledness of *p*. This, of course, is not possible if *will* were a necessity modal. In the following chapter, Chapter 5, I will present data showing that *will* is not a necessity modal.

Chapter 5

will is not a necessity modal

In the last chapter, I have argued that *will* (and *werden*) are *strong* modals: truth of *will p* semantically entails truth of *p*. This argument was based on the observations that (i) temporal *will* is compatible with epistemic and metaphysical settledness, (ii) unembedded *will p* (on both readings) commits the speaker to the prejacent proposition and that (iii) *will p* is incompatible with *might not p*-conjunction.
This section sets forth the idea that *will* is not a necessity modal, more specifically that *will* (i) is non-quantificational and (ii) makes a non-maximal claim with respect to the modal base. By showing that (i) the assertion of temporal *will p* is felicitous if *p* is (known to be) metaphysically unsettled and that (ii) the assertion of epistemic *will p* is felicitous (only) if *p* is not strictly known, I will argue that even though *will* satisfies modal strength, truth of *will p* is semantically compatible with non-settledness of the modal base. I will hence make a case for a non-quantificational treatment of *will* by also building on the work by Ippolito and Farkas (2021) and especially Cariani and Santorio (2018); Cariani (2021).

5.1 Scope: *will* does not interact with negation

It has been noted by Cariani and Santorio 2018; Cariani 2021; Ippolito and Farkas 2021 (neither of which assumes a necessity-account) that alternating futures do not interact with negation in a way that creates scope-related ambiguities. On the assumption that *will* is a necessity modal, this is unexpected. Consider the following two sentences where *will* appears together with *every* and *no* respectively. (It does not matter on which reading *will* is interpreted.)

(168) a. Every goat will have been in danger.
b. No goat will have been save.

If we read *be save* as the negation of *be in danger*, (168-a) is equivalent to (168-b). This is different if *will* is replaced by *must*, where the negative context provides a reading for (169-b) on which it is not equivalent to (169-a).

(169) a. Every goat must have been in danger.
b. No goat must have been save.

On the necessity analysis of *must*, this behavior is expected if different relative scope configurations

between *must* and *no* are assumed. The following two paraphrases represent the two readings of (169-b) that differ with respect to relative scope between *must* and *no*.

(170) a. There is no goat *x* such that all possibilities *w* are such that *x* has been safe in *w*. (*no* > *must*)
b. All possibilities *w* are such that there is no goat *x* that has been safe in *w*. (*must* >*no*)

If *will* is taken to be a necessity modal, it would be expected that (168-b) would lead to the same or a similar reading as in (170). It does not. If, again, we would take *will* to involve universal quantification, only (170-a) but not (170-b) would be a possible paraphrase for (168-b). That is, the meanings *will* gives rise to with negation look as if *will* had obligatorily high scope over negation. Other verbs exhibiting this pattern, such as *think* or *believe* hence have been termed 'neg-raising predicates' (NRPs). Under the assumption that *think* is a universal quantifier over possible worlds compatible with someone's belief, as in (171), it is predicted that different relative scope configurations between negation and *think* lead to the meanings paraphrased in (172-a) and (172-b).

(171) $[\![\textit{think } p]\!] = 1$ iff $\forall w' \in \text{Bel}_{w,x} : p(w')=1$.

(172) Po doesn't think that Jo is fat.
a. All worlds compatible with Po's belief *w* are such that Jo is not fat in *w*. (think(¬p))
b. Not all worlds compatible with Po's belief *w* are such that Jo is fat in *w*. (¬think(p))

But (172-b) is not a possible paraphrase for the sentence in (172). Due to this pattern, NPRs are said to trigger an *excluded middle* inference. In the case of *think* the excluded middle amounts to the inference that the attitude holder is not fully certain of the prejacent proposition, i.e. that there are *p*-worlds and ¬*p*-worlds in their belief-worlds. To capture this inference, it has been proposed by Gajewski (2005) (via Križ 2015) that NRPs carry the presupposition in (173) by requiring that they presuppose that modal space representing the attitude described by a NRP satisfies *homogeneity* with respect to the embedded proposition.

(173) ***think p***
at-issue: (172)
presupposition: either[think(p)]or [think(¬p)]
$\equiv [\forall w' \in \text{Bel}_{x,w}: p(w')=1] \vee [\forall w' \in \text{Bel}_{x,w}: \neg p(w')=1]$

I have already explained in section 2.3 how Cariani and Santorio (2018); Cariani (2021) and Ippolito and Farkas (2021) have derived the excluded middle pattern exhibited by *will*. Building on Gajewski 2005, Križ (2015) assumes a homogeneity-based analysis for NRPs too, but he dismisses the view that they denote modal necessity operators. Instead he suggests a treatment that parallels the analysis of definite plural descriptions by treating NRPs as definite descriptions of a plurality of possible worlds. The complement of the NRP, a proposition of type $\langle s,t \rangle$, is then predicated of the plurality of worlds denoted by the NRP.[1]

[1] I thank Viola Schmitt, who pointed this out to me.

(174) Nina believes that Adam will come.

a. $\lambda w.\ \text{come}_w(\text{a})$

b. $\iota v.\text{Bel}_w(\text{i},v)$ (from Križ 2015, p.152)

Križ goes on to develop a model in which the predicate constants satisfy homogeneity by default, while non-homogeneous predicates correspond to more complex semantic expressions. The details of the account are not relevant here. It suffices to note an analysis of *will* analogous Križ' treatment of *believe* would explain its neg-raising behavior. At a first glance, the fact that homogeneity is said to lead to non-maximality (see especially Chapter 3 of Križ 2015) lends this idea additional support, especially given the data presented in the next two sections. However, the reason I will instead adopt the choice function analysis by Cariani and Santorio is that the world-plurality account does not offer a way to treat the matrix world as a privileged member of the modal background. Hence, commitment to the truth of the prejacent proposition in the world of utterance would be predicted to be non-obligatory with, which is not what we find with *will*.

5.2 Temporal *will* is compatible with metaphysical non-settledness

Work suggesting a necessity analysis of *will* is discussed in section 2.2. Like other authors (e.g. Cariani and Santorio 2018; Kissine 2008; Ippolito and Farkas 2021) I am skeptical about the idea that the future expresses *necessity*. In this section I will argue that *will* is not a necessity modal and that truth of *will p* is compatible with metaphysical unsettledness. That is, the relation established between the prejacent proposition and the modal base is *non-maximal*.

5.2.1 The problem of credence

Recall from chapter 2 that Enç (1996) and Condoravdi (2002) treat temporal *will* as the dual of a certain reading of *may* and *might*. The modals in (175) exemplify such readings.[2]

(175) A: Why do you want to get health insurance?

B: Because I {**may/might**} get sick. Anybody {**may/might**} get sick any time.

The parallel between those uses of *might/may* and temporal *will* suggested by Condoravdi is that both quantify over a *metaphysical* modal base (taken to be a form of *circumstantial* modality, in more recent work e.g. Abusch 2012; Kratzer 2012b; Thomas 2014). Temporal *will* quantifies universally over the metaphysical modal base, *may* and *might* quantify existentially, as in (176).

(176) a. $[\![\textit{might/may/can } p]\!]^{w,MB} = 1$ iff $\exists w'.[\text{w'} \in \text{MB}_{\text{met.}} \ \& \ [\![p]\!]^{MB,w'} = 1.\ ]$

b. $[\![\textit{will } p]\!]^{w,MB} = 1$ iff $\forall w'.[w' \in \text{MB}_{\text{met.}} \rightarrow [\![p]\!]^{MB,w'} = 1.]$

[2] $\Diamond$ and $\Box$ are the duals of each other iff

(i) a. $\Diamond p \equiv \neg\Box\neg p$

b. $\Box p \equiv \neg\Diamond\neg p$

(cf. Portner 2009, p.13)

But if temporal *will* were a metaphysical necessity modal, its meaning would be very strong. So strong that almost all naturally occurring *will* claims would have to be simply false. However, temporal *will*-claims are acceptable even if it is *known* to all interlocutors that the prejacent proposition is *not* a metaphysical necessity. Consider the temporal *will*-claims in (177) and (177).

(177) [**Scenario:** A coin is being tossed. It is known to everyone that this is a fair coin.]
The coin will come up tails.

(178) [**Scenario:** *Before we start a new round of Backgammon, I say:*]
This time, I will win.

If those sentences would be metaphysical necessity claims, then (177) would assert that it is a metaphysical necessity that the coin will come up heads and (178) would make the claim that me winning the next round is metaphysically necessary. However, given that communicators can be safely assumed to *know* that the outcome of any coin-tossing or game of Backgammon is metaphysically open, they also have to know that the coin falling heads or me losing Backgammon are metaphysical possibilities as well. Hence, if temporal *will* would be a metaphysical necessity modal, we would have to assume that communicators make and accept temporal *will*-statements even though they *know* them to be false. This is not an optimal outcome.

Reacting to the same problem, Cariani and Santorio (2018) imagine a scenario where metaphysical alternatives are evenly divided between three possible outcomes *p, q, r* of a draw. They then ask what credence one should have in the claim that *will p*.

(179) [**Scenario:** *Suppose that Cynthia comes to work each day wearing a Warriors cap, a Giants cap, or no cap, depending on a random draw (with each option having equal probability). You are certain that for each of the three caps, it is an open possibility that Cynthia wears that cap tomorrow. What degree of belief should you assign to* [the following proposition:]]
Tomorrow she'll wear a Warriors cap. (Cariani and Santorio 2018, p.136)

I follow the authors' intuition that it would be natural for a listener to have roughly 0.3 credence in the *will*-claim in (179). (Whether this amount of credibility is actually enough for this sentence to be accepted in this context is orthogonal to the current issue). What is crucial is that this amount of credence is unexpected if *will* would actually make a metaphysical necessity claim. Instead, the amount of credence any rational communicator would assign to the claim that Cynthia wearing a Warrior's cap tomorrow is a metaphysical necessity is expected to be 0.0. Note that the classical, purely temporal paraphrase of *will* in (180) does not lead to those problems.

(180) There is a t such that t is after t_0 and within *tomorrow* and Cynthia wears a Warriors cap at t in w_0.

If the draw is fair, the probability of w_0 to be an element of either of the three partitions of the metaphysical modal space is evenly distributed among those partitions. Hence, on the purely temporal treatment of *will*, it is correctly predicted that credence in the sentence from (179) is 0.3.

5.2.2 *will* is not the dual of metaphysical *might/may/can*

Does this mean that there is no English morpheme expressing the dual of metaphysical *might* and *may*? I believe there indeed are such expressions: metaphpysical readings of *must* or *have to*. But examples that do not sound strange out of the blue are hard to come up with. I suspect that this is because metaphysical necessity claims are very strong claims that do not fit well into the way how people think about metaphysical possibilities. Consider the following dialogue about a law of nature (gravity), where the *must/have to* claim is plausibly the dual of metaphysical/circumstantial *might, may* and, I assume, *can* and *could* (what exactly is the difference between those modals is not important to our current purpose).

(181) [**Metaphysically settled context:** *a child contemplating falling objects with its parent*.]
A: Why will the mug fall to the ground when I push it over the edge of the table?
B: Well, if you push it too far, there is nothing between the mug and the floor. Due to gravity, it {**must/has to**} fall to the ground./It **cannot** stay up in the air.

Consider those sentences in isolation. Interpreted against the context in (181), it is clear that the equivalent of (181-a) is the *must* sentence in (182-b), not the *will*-claim in (181-c).

(182) a. The mug **cannot** stay up in the air.
b. The mug **must** fall down to the ground. ($\approx$(a))
c. The mug **will** fall down to the ground. ($\not\approx$(a))

Another context where *must/have to* seems to have a reading on which it is the dual of metaphysical *might* is (183). Here, since the first two sentences roughly express the same meaning (where 'survive' is taken to be equivalent to 'not die' here), *not have to p* patterns as an equivalent of metaphysical *might* $\neg p$.

(183) Lui: How severely injured is Jim?
Ata: I gotta tell you, he does not **have to** survive that. He **might** die.
But, of course, I hope he **will** survive.
Ila: Yes. He **will** survive!

Note that Ata's commitment to the metaphysical openness of Jim's survival is not in conflict of his desire that Jim 'will survive'. This would be surprising if *will*, like *must*, would express metaphysical necessity in (183): with his first two sentences, Ata asserts that there is a metaphysical possibility for Jim not to survive (i.e. die of) his injuries, nevertheless he can felicitously hope Jim 'will survive'. This indicates that *will p* is compatible with metaphysical unsettledness of the prejacent proposition. Furthermore, if it finally turns out that Jim actually survived his injuries, like Ila claimed he would, then Lui can say the following in hindsight.

(184) [**Context:** Luckily, Jim survived. Lui, by taking recourse to Ila's claim in (183), makes the following statement.]
Lui: Thank goodness, you were right, Ila! He survived. But he could have died.

Again, stating that Ila was right when she said 'He will survive' does not create a conflict with again noting that he very well 'could have died'.

Therefore, we can conclude that if *will* is a metaphysical modal, then for *will p* to be true it has to be sufficient if *p* holds only at a non-maximal set of the metaphysically accessible worlds as long as that set includes the actual world. Existing necessity-accounts of *will* seem to implement this intuition by using a (necessarily non-empty) ordering source of normality/stereotypicality (see Section 2.2). But since this makes the quantificational domain of *will* non-realistic (i.e. it does not necessarily contain the anchor world), this cannot be an option: first, we saw in Section 4.2 that *will p* obligatorily commits the speaker to *p* and that *will p* is incompatible with *might not p*-conjunction. Those observations would be unexplained if *will p* uttered in w_0 would not imply the assertion that *p* is true in w_0. I concluded that *will* has to be a strong modal. Second, if *will p* had the meaning proposed by existing necessity-accounts, the paraphrases in (185-a) would be roughly equivalent to the sentences in (185-b) and (185-c).

(185) a. I hope Jim will survive.
b. ≈ I hope (in w_0 at t_0) that all maximally normal/stereotypical/likely metaphysical alternatives *w'* are such that Jim survives in *w'* (at some point later than t_0).
c. ≈ I hope Jim is likely to survive.

However, what the sentence in (185-a) intuitively means is not the hope that Jim is likely to survive, but rather that he *actually* survives. The classical temporal analysis, which leads to the paraphrase (186), again seems to capture the meaning of *will* much better than a necessity analysis does.

(186) I hope (in w_0 at t_0) that at some *t'* later than t_0, Jim survives in w_0 at *t'*.

For a metaphysical *must* statement, by contrast, the temporal strategy does not seem to be anywhere close to an accurate paraphrase. Consider again the *must*-claim from (181) repeated in (187-a).

(187) [Same context as in (181)]
a. The mug must fall to the ground.
b. $\not\approx$ At some *t'* later than t_0, the mug falls to the ground at *t'*.

Instead, *must* seems to express the stronger meaning that given actual present circumstances, it *has to* be the case that the mug falls to the ground (in the future). Of course, it follows from this meaning that if (187-a) is true, then (187-b) is true also. But crucially, they are not *equivalent*.
I conclude that the above examples involve *metaphysica/circumstantial* uses of *must* whose quantificational domain can be represented as the set of historical alternatives in w_0 at t_0. Given that these uses of *must* are clearly not equivalent to temporal uses of *will*, we have to assume that they lexicalize distinct semantic meanings. I think the above examples have shown that *must* deserves an analysis roughly along the lines of Condoravdi's and Werner's entries for temporal *will*, as in (188). Temporal *will*, on the other hand, needs to receive an analysis on which *will p* can be true, even if *p* holds only at a non-maximal set of the metaphysically accessible worlds. Furthermore, this set has to include the modal anchor world.

5.3 Epistemic *will* is compatible with epistemic non-settledness

Epistemic uses of *will p* seem to be acceptable if *p* is not epistemically certain. There are, for example, contexts in which *will p* is felicitous where *probably p, should p*, *I believe p* and even *must p* are acceptable too. (Which, of course, should not make us think that they communicate the same meaning in this context.)

(188) [Scenario: Lui has washed his fake teeth 2 hours ago and left them to dry by the sink in the bathroom. Knowing that his dog Jossi often likes to wear them as well, he is not absolutely certain about the whereabouts of his fake teeth. Jossi might have stolen them again. But since Jossi is in a grumpy mood, he doesn't consider that likely. Ila asks Lui 'Where are your fake teeth? I'd like to try them on.' Lui responds with:]

a. They'll be in the bathroom.
b. They should be in the bathroom.
c. They are probably in the bathroom.
d. I belief they are in the bathroom.
e. They must be in the bathroom.

It has been contexts like this one which have led authors to the conclusion that *must* and *believe* are modally *weak* and that they indicate that the speaker is not fully certain of the prejacent proposition (for *must* see Giannakidou and Mari (2018), for *believe* see Hawthorne et al. (2016)). As for *will*, we have already seen weak accounts as well as evidence supporting a strong analysis. But, as the following example shows, this is a hasty conclusion for *must* (according to von Fintel and Gillies (2010)).

(189) Chris has lost her ball, but she knows with full certainty that it is either in Box A or B or C. She says:
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. (from von Fintel & Gillies 2010, p.362)

In (189), the contribution of *must* does not seem to be one of uncertainty. Chris *knows* that her ball is either in Box A, B or C. After ruling out the possibilities that the ball is in Box A or Box B, she *knows* with full certainty that the ball is in Box C because given her evidence it *has to* be in Box C. In this context, Chris could also have felicitously said (190).

(190) So, it **is** in C.

However, (189) and (190) are not always felicitous in the same context. Imagine that the boxes are transparent and Chris *sees* that her ball is in Box C. Then, she could felicitously (190) but not (189). To rule out equivalence between *must p* and bare *p*, von Fintel and Gillies therefore propose that *must p* signals that the evidence for *p* is only *indirect* (e.g. inferred). In sum, the fact that a modal is felicitous alongside of uncontroversially weak expressions like *probably* or *should* in contexts like (188) is not conclusive evidence that (i) the modal is *weak* or (ii) that it is incompatible with knowledge of the

prejacent proposition (see Section 6.2 for details). How, then, do epistemic *will* and *werden* perform in scenarios like (189)? As indicated by '??' they are odd in such contexts.

(191) Chris has lost her ball, but she knows with full certainty that it is either in Box A or B or C. She says: The ball is in A or in B or in C. It is not in A. . . It is not in B . . .

a. ??So, it will be in C.

b. ??Er wird also in C sein.
he will hence in C be

As we have seen in Section 4.2, it is safe to assume that the speaker of the sentences in (191) commits that the ball is in C. But nevertheless, the sentences can only be understood in way that the evidence is still not fully conclusive of *p*. Building on data like (191), it has been argued that *will* is semantically *weak*. I will argue below that there is no conflict between the assertion of some proposition *p* and sending the signal that evidence is (or might be) not fully conclusive of *p* (see Section 7.1). Let's have a look at those other examples that have been used to argue in favor of a weak analysis of *will*.

Mihoc et al. (2019) compare English epistemic *must* to English epistemic *will* and Romanian *va* (the Romanian future) to *o* (a special form of *va* which has only the epistemic interpretation). Presenting their examples, I will keep *will* but omit its Romanian equivalents (which behave like *will*) and replace them by German *werden*. As presented by Mihoc et al., epistemic *must* is compatible with both low and high (up to full certainty) degrees of speaker confidence. The epistemic future in English and Romanian, on the other hand, is less acceptable in contexts where the speaker has a maximal degree of confidence with respect to the prejacent. The first type of evidence examined by Mihoc et al. is based on contexts involving different types of certainty in context. Much like the ball-example from above, (192) and (193) show that *will* sounds strange if the evidence can be presupposed to be conclusive of the prejacent presupposition.

To show that *must* is compatible with a maximal level of speaker certainty while the epistemic future is not, the authors create contexts like (192) and (193).[3]

(192) If x is divisible by 2, then x is even. 2 is divisible by 2.

a. So, 2 ✓must /?? will be even.

b. Also ✓ muss/?? wird 2 gerade sein. (adapted from Mihoc et al. 2019, p.354)

(193) Jo is looking for Anna. Jo checks the time: It's 7 pm. Jo knows that at 7 pm Anna is *always* home. [She sees that the lights in Anna's apartment are on and her car is parked on front of the house. She knows that Anna being home can be the only reason for it. JM]. Jo concludes:

a. Anna must be home now.

b. (#) Anna will be home now.

c. Anna muss zuhause sein.

d. (#)Anna wird zuhause sein. (based on Mihoc et al. 2019, p. 353)

[3]I have modified the scenario in (ii) a way that brings out more clearly what kind of evidence the statements are based on.

As expected from their behavior in the ball examples, *will* and *werden* are odd with maximal levels of certainty while *must* is not. The only way the *will/werden*-claims in (192)–(193) can be understood is that the speaker still has not full confidence in proposition expressed by the prejacent propositions (which would be very strange in the context of (192) and, if the scenario is interpreted as providing full certainty, also in (193)).[4]

Next Mihoc et al. consider data like (194), where the speaker does not have conclusive evidence for the prejacent proposition and where both *must* and *will* are acceptable (much like in example (188)).

(194) **Uncertainty certainty context**

Jo is looking for Anna. Jo checks the time: It's 7 pm. Jo knows that at 7 pm Anna is *typically* home. [Plus: there is car a parked in the driveway that looks like Anna's from a distance. JM] Jo concludes:

a. Anna must be home now.
b. Anna will be home now.
c. Anna muss zuhause sein.
   Anna must at-home be
d. Anna wird zuhause sein.
   Anna will at-home be

(based on Mihoc et al. p. 353)

Based on their behavior in contexts of maximal vs. non-maximal speaker-certainty they conclude that both *must* and *will* (and its Romanian equivalents) have available semantically *weak* meanings. They suggest an analysis on which weakness is optional for *must* but obligatory for *will*. Assuming a necessity-treatment of both *must* and *will*, they implement this generalization as a condition on the ordering source restricting the quantificational domain of epistemic futures: the epistemic future (in English and Romanian) has a lexical requirement demanding that the ordering source be *non-empty*. Epistemic *must* does not have a requirement to that effect; its ordering source can be empty (full certainty) or non-empty (non-maximal certainty).

According to Mihoc et al., examples where *must* and epistemic futures appear under factive and non-factive attitude verbs offer additional support for their analysis. Epistemic *must* occurs felicitously under both factive and non-factive verbs whereas the epistemic future is less acceptable under factive attitude verbs, which presuppose the truth of their complement. The epistemic future is felicitous in (195) but not in (196).

(195) **Embedded, complement of non-factive cognitive attitude**

a. I think that Anna must be home now.
b. I think that Anna will be home now.
c. Ich denke, Anna muss zuhause sein.
d. Ich denke, Anna wird zuhause sein.

(from Mihoc et al. 2019, p.354)

[4]Note that I replaced Mohoc et al.'s '#' with '??'. This is because the sentences in question are as infelicitous as the epistemic future is in the ball-example, but certainly not more.

(196) **Embedded, complement of factive cognitive attitude**

a. I just found out that Anna must be home now.

b. ??I just found out that Anna will be home now.

c. Ich habe herausgefunden, dass Anna jetzt zuhause sein muss.

d. ??Ich habe herausgefunden, dass Anna jetzt zuhause sein wird. (ibid.)

To make sense of the data, the authors assume (following Hacquard (2010)) that the quantificational domain of a modal in the scope of an attitude verb is overwritten by the attitude expressed by the attitude verb, as in (197-a). But then, since the quantificational domain of the attitude verb and the embedded modal are identical, the universal quantifier of the attitude verb quantifies vacuously, which is why its semantic contribution is subsequently disposed (by some mechanism not further explicated by the authors). In that way, the final meaning of (197) can be represented as in (197-b).

(197) John believes it might be raining.

a. $\forall$w' $\in$ BELIEVE$_{w,j}$ $\exists$w" $\in$ **BELIEVE$_{w,j}$**[p(w")]

b. $\exists$w" $\in$ **BELIEVE$_{w,j}$**[p(w")]

'There is a world compatible with what John believes x in which it is raining.'

(Mihoc et al. 2019, slightly modified)

As for the semantics of *find out* (and *know*), the authors assume the same at-issue meaning as for *believe* and a presupposition stating that the propositional complement is epistemically settled.

(198) **find out**

at-issue: λp. $\forall$w' $\in$ BELIEVE$_{w,sp}$[p(w')]

presupposition: λp. $\forall$w' $\in$ MB$_{ep.}$(w)(sp) [p(w')=1.] (based on Mihoc et al., p.)

Note that (198-b) does not simply presuppose that the propositional complement is true in *w* but that it is epistemically settled (and therefore true) in *w*. In that way, the presupposition is of the same semantic type as the at-issue meaning.

Now, if *find out* embeds a modal, the mechanism proceeds as in (198). But in addition to the at-issue meaning of *find out* replacing the quantificational domain of the modal, the presupposition of *find out* is proposed to target the prejacent of the modal.

(199) I found out that Anna ✓**must / #will / #wird** be home now.

at-issue: $\forall$w" $\in$ BELIEVE/THINK(w)(sp)[p(w")]

presupposition: $\forall$w" $\in$ MB$_{ep.}$(w)(sp)[p(w")]

(adapted from Mihoc et al., p.15)

If I understood them correctly, they argue that because the presupposition of epistemic settledness transfers to the prejacent proposition of the modal, this leads to a conflict with the lexical requirement on epistemic futures that the ordering source must be non-empty. Personally, I share the intuition that something about *will* and *werden* under factive attitude verbs sounds strange, but I remain agnostic as to whether Mihoc et al. have succeeded in pinning down the actual reason for it. I conclude that epistemic

will and *werden* are not (fully) acceptable in contexts of full certainty.

5.4 Wrap-up and conclusion

	epistemic will	**temporal will**	**epistemic must** (following vF&G)	**metaphysical must**
compatibility with non-settled modal base	✓	✓	×	×
interaction with negation	×	×	✓	✓

Table 5.1: Overview: non-necessity and non-maximality of *will*

Epistemic *will* is pragmatically not well compatible with full certainty. Existing approaches have taken this fact as evidence for a semantically weak treatment of the epistemic futures. More specifically, they have tried to implement the fact that *will p* can be felicitously asserted (only) in contexts of non-maximal epistemic certainty by (obligatorily) restricting the epistemic modal background in a way that it does not satisfy realism anymore (cf. Kaufmann et al. 2006). Hence, it is predicted that *will p* is true also if (it turns out that) *p* is false – contrary to fact, as has been shown in Section 4.2 and again illustrated by Table 5.2.

	epistemic will	**temporal will**	**epistemic must** (following vF&G)
compatibility with settled modal base	semantics: ✓ pragmatics: ×	✓	✓
compatibility with direct evidence	–	✓	×
obligatory commitment to prejacent proposition	✓	✓	✓
compatibility with '◇ ¬p'-conjunction	×	×	×

Table 5.2: Overview: strong behavior of *will*

Therefore, I wish to make a less strong claim: semantically, the truth of *will p* (on any reading) is *compatible* with a non-settled metaphysical or epistemic modal base. However, the set of indices in the modal base at which the prejacent is evaluated has to include the anchor world obligatorily. What a semantic treatment along this lines can *not* readily explain, is why epistemic uses of *will/werden p* signal epistemic unsettledness of *p* (even though they entail assertion of *p*) and thus are infelicitous in contexts of epistemic settledness, while temporal readings of *will/werden p* do not signal metaphysical unsettledness. I will suggest that this has pragmatic reasons (as indicated in the table by 'semantics: ✓, pragmatics:×'): epistemic *must* is a pragmatic competitor with epistemic *will* but metaphysical *must* does not compete with metaphysical *will*. In the next chapter, I will probe into a possible implementation of this idea.

Chapter 6

Towards an analysis

6.1 The basic idea

Based on the data in the preceding Chapters (4 and 5), I propose that the relation between the lexical meaning of *will* and its communicative meaning should be characterized as in (200)–(201).

(200) **Metaphysical *will/werden p***

asserts:	Metaphysical possibilites are such that the actual world satisfies p. (Not 'has to satisfy p'.)
presupposes:	p is not directly settled by past or present properties of the utterance world.
signals:	p is true and the evaluation time of p is some $t' > t_0$.

(201) **Epistemic *will/werden p***

asserts:	Epistemic possibilities are such that the actual world satisfies p. (Not 'has to satisfy p'.)
presupposes:	p is not directly settled by direct knowledge.
signals:	p is true and not known directly.

It should be clear from that loose description of my idea that an analysis along the lines of (200)–(201) would have the following properties:

(202) **Main properties of the idea**

a. **This is a unified analysis of *will/werden*:** The difference between temporal and epistemic readings is accounted for solely by modal base selection: the descriptions of the asserted content in (200) and (201) differ only with respect to modal flavor.

b. ***will/werden* is compatible with unsettledness:** *will/werden p* can be true, even if not all metaphysical or epistemic possibilities satisfy p (i.e. 'non-maximality'). The content of *will/werden* does not make restrictions to the effect of either requiring or excluding settledness.

c. ***will/werden* is compatible with settledness:** *will/werden p* can be true, even if all possibilities satisfy p. (As desired for temporal *will/werden*, but potentially problematic for epistemic *will/werden*, see Section 7.2).

d. ***will/werden* is strong:** *will/werden p* is true in *w* only if *p* is true in *w*.

The challenge now is (i) to make the suggested lexical content more precise and (ii) to spell out a strategy of how the lexical content leads to the suggested communicative meaning.

6.2 Implementation: a kernel-relative account

In this section I set forth an idea inspired by von Fintel and Gillies (2010). According to this idea, the asserted content of alternating futures is quasi-vacuous but they are subject, in both of their readings, to a definedness constraint requiring that their prejacent is not directly settled by some privileged part of the modal base. This derives the contrast between *will/werden* and bare assertion of *p*: it derives the epistemic flavor of their epistemic readings and the obligatory forward-orientation of their temporal readings. Von Fintel and Gillies suggest that the modal bases of epistemic modals relate in a specific way to information that is 'directly known', i.e. to what the authors call the epistemic 'kernel'. What is 'directly known' is assumed to be a privileged kind of information which is not treated in the same way as knowledge in general (which includes also *inferred* knowledge). A kernel is represented as a set *K* of propositions *p* such that *p* is known directly (enough) in context *c*. This set of propositions can then be said to determine a modal base (i.e. the quantificational domain of a modal) the way specified in (203), which states that an epistemic modal base corresponds to the big intersection of the epistemic kernel.

(203) *K* is a kernel for B_K [the epistemic modal base;JM], B_K is determined by the kernel K, only if:

a. *K* is a set of propositions (if $P \in K$ then $P \subseteq W$)

b. $B_K = \bigcap K$ (von Fintel and Gillies 2010, p.371)

For reasons of transparency, I will henceforth indicate within parentheses following *K* an index relative to which *K* is said to represent direct knowledge. I will assume that possible worlds (too) can be such indices, as illustrated in (204).

(204) *K(w)* = {p: p is direct (enough) knowledge in *w*}

For example, in the ball-box scenario in (189) the kernel would look like (205).

(205) If *w* is the context of the ball-box-scenario in (189)[1]
$K(w) = \{p_1$: The ball is either in box A, B or C,
p_2 : The ball is not in box A,
p_3 : The ball is not in box B$\}$

The requirement of epistemic modals that the prejacent proposition must not be known *directly* can then be defined relative to propositions in the kernel. (206-a) states that (e.g.) epistemic *must* is defined only if no single proposition in the kernel entails or contradicts the prejacent proposition. If defined, *must* asserts that the prejacent entails the modal base determined by the kernel (i.e. the big intersection of the kernel).

[1] P1 is equivalent to *If the ball is not in A or C, then it is in B and if it is not in B or C, then it is in A and if it is not in A or B, then it is in C.*

(206) **epistemic *must*: Implementation 1 of definedness**

a. $[\![must\ P]\!]^w$ is defined only if
$\neg\exists X \in K(w).\ [X \subseteq P \text{ or } [X \cap P = 0]]$.

b. If defined, $[\![must\ p]\!]^w = 1$ iff $\bigcap K(w) \subseteq P$. (adapted from von Fintel and Gillies, p.374)

But this is not the only one way indirectness can be captured. A different (and non-equivalent) way to capture the indirectness requirement of modals is defined relative to the 'subject matter' imposed by a kernel. A subject matter is an equivalence relation between two worlds. Two worlds are in the same equivalence class only if their truth values for any proposition that is 'an issue' in the subject matter are identical. That is, a subject matter induces a partitioning on the set of possible worlds W. How it partitions W depends on which propositions are an issue in that subject matter, i.e. which propositions that subject matter is 'about' (see also Lewis 1988 and Groenendijk and Stokhof 2011 (via vF&G 2010)). This is defined in (207).

(207) Let P be a proposition

a. A subject matter S is an equivalence relation on W

b. $S[P] = \{\langle w, v\rangle \in S : w \in P \text{ iff } v \in P\}$

c. P is an issue in S iff $S[P] = S$ (from von Fintel and Gillies, p.377)

A set of propositions, such as a kernel K, can determine a set of issues by determining a subject matter as in (207). I will use this implementation instead of (206) because it fits with my analysis of the definedness condition for temporal *will*. According to (208-a), *must* is defined only if the prejacent proposition p is not an issue in the subject matter determined by K. That is, only if the information in the kernel is not *about* p.

(208) Let $K = \{P_1, \ldots, P_n\}$. Then:

a. $S_K = S_{\mathbf{0}}[P_1] \ldots [P_n]$

b. K directly settles whether P iff P is an issue in S_K (ibid.)

Essentially, a kernel K directly settles a proposition only if this exact proposition or an equivalent proposition is among the set of propositions denoted by the kernel. The indirectness requirement of an epistemic modal like *must* can then be stated as a definedness condition as in (209).

(209) **epistemic *must*: Implementation 2 of definedness**

a. $[\![must\ p]\!]^{c,w}$ is only defined if p is not an issue in S_K.
(I.e. only if $S_{K(w)}[P] \neq S_{K(w)}$)

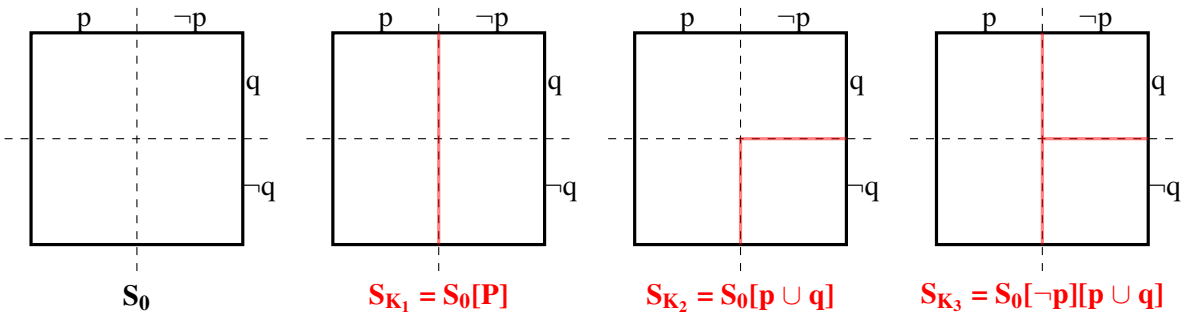
b. If defined, $[\![must\ p]\!]^{c,w} = 1$ iff $\bigcap K(w) \subseteq P$.

The following example by von Fintel and Gillies illustrates how this account predicts that *must* can only be used if the prejacent does not follow from what is known directly. Consider the subject matter S_0 in (210-a). The elements in this set are simply all possible pairs of possible worlds. For example, it consists of pairs $\langle$w,w'$\rangle$ such that w is in p but w' is in $\neg$p. That is, S_0 also allows for pairing across the boundary of proposition p (the dashed line marks the boundary between p and $\neg$p). This is different for

the subject matter $S[p]$ in (210-p). This relation only pairs two possible worlds if they agree on whether p (as indicated by the red line). $S[p]$ hence contains all possible pairs between worlds that are in the p-partition and all possible pairs between worlds that are in the $\neg p$-partition. But it contains *only* such pairs, since $S_0[P] = S_0[P][P]$, P is an issue in $S_0[P]$.

Suppose, so the example by the authors goes, that the proposition $\neg p$ corresponds to the proposition that *there are people with wet rain gear*. If this is the only direct information there is, a kernel which I label 'K_1 contains ¬p and nothing more. Then, the subject matter determined by the kernel $S_{K_1} = S_0[\neg p]$ illustrated in (210-b) (which, of course, is equivalent to $S_0[p]$). Compare this subject matter to the subject matter induced by a kernel K_2 containing only the proposition that *the only reason for wet rain gear is rain*. If q is the proposition that it is raining, we can label this proposition as '$p \cup q$'. Accordingly, the subject matter determined by K_2 corresponds to $S_0[p \cup q]$, which partitions the modal space as in (210-c). Then, if a kernel K_3 contains both the proposition that *there is wet rain gear* (¬p) and the proposition that *if there is wet rain gear, there is rain* (p ∪ q), then the subject matter determined by K_3 corresponds to the partitioning in (210-d).

(210) a. b. c. d.



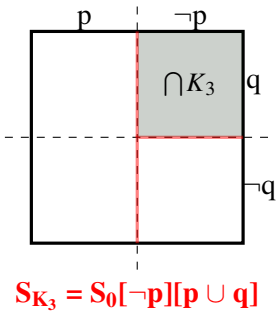
Let's see how this can be applied to *must*. (209) tells us that an epistemic modal can only be used if the prejacent proposition is not an issue in the subject matter determined by the kernel. We know that in a context where the direct information corresponds to K_3 in (210-a) it is possible to utter (211-b).

(211) a. [**K_3-context:** Lui sees people with wet rain gear. He knows that rain is the only explanation. He utters:]

b. It must be raining.

If the definedness condition for *must* in (209-a) is right, the proposition *it is raining* ('q') must not be an issue in the subject matter determined by K_3. I.e. S_{k_3} must not be equal to $S_{k_3}[q]$. As illustrated in (210-d), this is indeed the case: in (210), the red lines correspond to propositions that are an issue in S. In (210-d), there is no red line separating [p∪¬q] from the [p∪q]-space. This means that the pairs in S_{k_3} cross the q-/$\neg q$ boundary. The pairs in $S_{k_3}[q]$, by contrast, would per definition *not* cross the q-/$\neg q$-boundary. Since S_{k_3} and $S_{k_3}[q]$ are non identical, q is not an issue in the subject matter induced by the kernel K_3. K_3 is not *about* q. This means that by (209-a), *must* is defined in the context of (211). And because the modal base informed by K_3 is a subset of q, *must p* is true in (211). This is because all the worlds in the big intersection of K_3 are in q. The modal base determined by K_3 is represented in (212) as the gray region.

(212)



6.2.1 Epistemic *will*

I suggest that epistemic *will* compares to *must* in the following way. Both epistemic *must* and *will* presuppose that what counts as direct information in the context (the epistemic kernel, which I will label 'K_{ep}') does not directly settle the prejacent proposition. Epistemic *must*, following von Fintel and Gillies, asserts that the modal base determined by K_{ep} (the big intersection of K_{ep}) is a subset of the prejacent proposition p. That is, *must p* asserts that given what can be *inferred* from the information in K_{ep}, p is a necessity, as in (213-a). The asserted content of *will p* on the other hand, is not at all about what can be inferred from K_{ep}. According to (213-b), *will p* is true iff the world selected by the choice function proposed by Cariani (2021) satisfies the prejacent proposition. The world selected by the choice function s is always the modal anchor of the modal base, if the modal base is realistic.[2] As I have noted in Section 2.3, this makes the at-issue contribution *will* trivial (in unembedded contexts) and *will* is a modal only in the basic sense that it uses a modal base. The fact that *will p* is nevertheless not equivalent to bare assertion of p is then explained solely by some definedness condition on the modal base. I propose that von Fintel and Gillie's indirectness requirement implemented relative to the subject matter determined by the kernel is that condition.

(213) **Definedness condition for epistemic modals**

$[\![must_{ep}/will_{ep}\ p]\!]^{c,w}$ is defined only if p is not an issue in $S_{K_{ep}}$.

I.e. only if $S_{K_{ep}}[P] \neq S_{K_{ep}}$.

(Where K_{ep} is the set of propositions p such that p is direct evidence in c.)

a. If defined, $[\![must\ p]\!]^{c,w} = 1$ iff $\forall$ w'.[w' $\in \bigcap K_{ep} \rightarrow$ p(w')=1]. (vF&G)

b. If defined, $[\![will\ p]\!]^{c,w} = 1$ iff $p(s\langle w, \bigcap K_{ep}(w)\rangle) = 1$.

Given that *will p* is only defined if p is not an issue in $S_{k_{ep}}$, the speaker cannot utter *will p* if she knows p from direct evidence. It follows that a *will p*-claim cannot be based on what is known *directly*. This is what bans epistemic *will* from contexts of direct knowledge. Furthermore, an epistemic *will*-claim is not

[2] The definition of the selection function s is repeated from (60) in (i).

(i) A function s: $\mathscr{W} \times (\mathscr{W} \rightarrow \mathscr{P}(\mathscr{W})) \rightarrow \mathscr{W}$ is a selection function iff:

a. if $MB(w)$ is non-empty, then $s(w,MB(w)) \in MB(w)$, and

b. if $w \in MB(w)$, then $s(w,MB(w)) = w$

(adapted from Cariani and Santorio 2018; Cariani 2021)

based on an *inference* about what is known directly either. It is merely a statement that localizes w_0 in a certain *p*-partition of the worlds compatible what is known directly and indirectly. But this statement itself is not based on an *inference* about what's known. If it were, i.e. if given what (can be inferred from what) is known, w_0 *has to be* in the *p*-cell rather than in the ¬*p*-cell, then $\bigcap K_{ep}(w_0)$ is a subset of *p*. Hence, on a more or less standard account of scalar implicatures (e.g. the one in Sauerland 2004), the speaker should have used the pragmatic competitor *must p*, which asymmetrically entails *will p*. This is how I account for the 'best guess'-flavor often attributed to epistemic *will*.

Consider the simple scenario in (214). The direct evidence available in this scenario corresponds to the two propositions ¬p (that *there is no ball in box A*) and p∪q (that *if there is no ball in box A there is a ball in box B* (where q= *there is a ball in box C*)) in (214-i) and (214-ii). The subject matter determined by those two propositions, $S_{K_{ep}}$, contains pairs that do not live in the same *q*-equivalence class, so $S_{K_{ep}(w)}$ is not 'about' *q*.

(214) [Scenario in *w*: Lui is looking for a ball. If there is no ball in box A, there is a ball in box B. There is no ball in box A.]

Kernel $K_{ep}(w)$ ={There is no ball in box A.; If there is no ball in box A, then there is a ball in box B.}

(i) ¬p = There is no ball in box A.

(ii) p∪q = If there is no ball in box A, then there is a ball in box B.
(where 'q' = There is a ball in box B.)

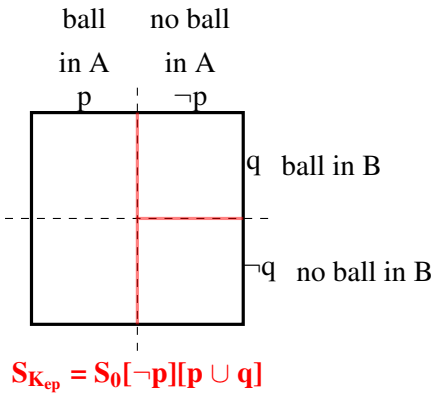
Utterances:

(iii) So there must$_{ep}$ be a ball in box B.

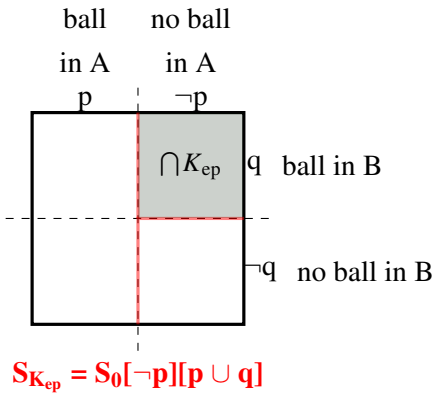
(iiii) ??So there will$_{ep}$ be a ball in box B.

The partition induced by $S_{K_{ep}}$ is illustrated in (215-a): since the union of [p∩q] and [p∩¬q] corresponds to one single equivalence class in $S_{K_{ep}}$, the kernel does not settle the prejacent proposition *q*. (215-b) shows where the big intersection of K_{ep} is located within the same modal space.

(215) a.



b.



As indicated, the assertion of *must$_{ep}$ q* is felicitous in the context of (214), while *will$_{ep}$ q* sounds odd. I attribute this to the following reason. In a context like (215), the direct evidence available is clearly

sufficient and manageable enough that the speaker can make an absolutely watertight inference about q. The speaker can therefore use a *must* claim to signal that q indeed *follows* from what can be inferred from K_{ep}. The corresponding *will*-claim in contrast, too, signals indirectness, but does not indicate that q follows from such an inference. Given that $will_{ep}$ p is a statement *about* an epistemic modal base ($\bigcap K_{ep}(w_0)$) and asserts that p is true in w_0, it is interpreted as a statement indicating which q-partition of $\bigcap K_{\text{ep}}(w)$ w_0 is an element of. Since this claim can be true even if (direct and indirect) evidence is not fully conclusive of q, *will* q makes a weaker claim than *must* q. Because the claim that q is true in w_0 (as communicated via *will* q) is explicitly based neither on direct knowledge nor on an inference, *will* q is interpreted as an assessment of how w_0 most likely relates to q. Nevertheless, *will* q is only a *correct* assessment (and hence true), if w_0 actually satisfies the prejacent proposition. Therefore, this is a strong account of *will*. And since epistemic *must* q asymmetrically entails *will* q, a scalar implicature account of the uncertainty signaled by epistemic *will* is justified.

Note that this account does not predict equivalence between *will* q and bare assertion of q. Unlike *will*, bare assertion of q does *not* presuppose indirectness, as witnessed by the example in (216).

(216) **Context:** Lui *sees* the ball in box C.
Lui: The ball is in box C.

Whether the assertion of bare p comes with other directness-related presuppositions (e.g. a presupposition of *directness*) or not, is beyond the scope of this thesis. Let me note, though, that while bare assertion of p also occurs felicitously if p is inferred (see vF&G) and in 'best-guess'-contexts (see Mandelkern and Dorst to appear), this does not rule out a directness requirement for bare assertion of p. It may be, for example, that direct settledness of some proposition p is easily accommodated if the context does in fact not provide direct settledness of p (or no epistemic settledness of p at all) and that, hence, the assertion of bare p might be understood as the claim that p constitutes direct knowledge even in cases where p is inferred (or, for what it's worth, conjectured or wildly guessed).[3] We have already come across examples which, on a strong account of *must*, present cases of a similar type of accommodation. Those

[3]That epistemic kernels do not only contain propositions corresponding to sensual information is easily verified. First, as already mentioned, information received through trustworthy reports counts as direct information. Second, inferred knowledge seems to be able to *become* treated as direct information. This becomes especially evident in an example by Valerie Wurm in (i)–(ii). In the scenario of (ii), the prejacent proposition (*5x2 is 10*) is treated as direct information (hence the unacceptability of *must*). This is so, even though the way Lisa came to *directly* know the truth of the prejacent was (plausibly) due to an inference too.

(i) The teacher explains how to perform multiplication by giving the rule for addition. Lisa is asked to perform her first multiplication. After contemplating briefly, she replies:

5 mal 2 muss 10 sein
5 times 2 must 10 be
So, 5 times 2 must be 10.

(ii) Lisa learned how to perform multiplications seven years ago. Her little brother asks her what '5 x 2' is. She replies:

#5 mal 2 muss 10 sein
5 times 2 must 10 be
So, 5 times 2 must be 10.

where examples of felicitous assertion of *must p* in contexts that do not provide evidence fully conclusive of *p* (see Section 5.3). The contexts where *must* is felicitously used therefore overlap with the contexts where genuine *weak* epistemic modal expressions are felicitous (see e.g. example (188)). I believe this supports a view on which it is relatively easy for an item expressing rather high certainty (or directness) to be acceptably used in contexts where epistemic certainty (or directness) is in fact very low. This does not work in both directions, though. In contexts of inferred certainty such as the ball-box example, the use of *might, maybe, ought* or *should* is not acceptable.

In any case, the account fully predicts the pattern illustrated in Table 6.1: epistemic *will* is felicitous in contexts of non-maximal epistemic certainty but not in contexts of maximal certainty (direct or indirect). The use of *must* is compatible with full indirect knowledge of the prejacent but is incompatible with direct knowledge of the prejacent. Finally, bare assertion of *p* is felicitous if *p* is settled by direct knowledge. To indicate that I do not commit to the status of *must p* and bare assertion of *p* in contexts of indirect knowledge and non-maximal certainty respectively, I use '$\sim$' in Table 6.1.

	direct knowledge of p	indirect knowledge of p	not full knowledge of p
bare *p*	✓	$\sim$	$\sim$
$must_{ep}$ *p*	×	✓	$\sim$
$will_{ep}$ *p*	×	×	✓

Table 6.1: Compatibility of epistemic *will p* vs. epistemic *must p* and bare *p* with contexts of different levels of certainty.

6.2.2 Temporal *will*

I will now turn to temporal uses of *will*. I suggest that the lexical meaning of temporal *will* is identical to the entry for epistemic *will*. The only difference between the two is the type of *kernel* that is involved in those readings. I follow Condoravdi (2002, 2003) in deriving the temporal meaning of *will* from a metaphysical modal base. While epistemic *will* relates its prejacent to an epistemic kernel K_{ep} (representing propositions that are known directly), the temporal (or 'metaphysical') meaning of *will* is expressed relative to a metaphysical kernel K_{met}. Since the temporal parameter becomes relevant in the case of temporal *will*, the kernel will be defined relative to a world and a time (represented by $K_{\text{met}}(w)(t)$).

(217) **Metaphysical *must* and *will***

$[\![must_{met}/will_{met}\ p]\!]^{c,g,w,t}$ is defined only if p is not an issue in $S_{K_{\text{met}}(w)(t)}$.

I.e. only if $S_{k_{\text{met}}(w)(t)}[P] \neq S_{K_{\text{met}}(w)(t)}$.

a. If defined, $[\![must\ p]\!]^{c,g,w,t} = 1$ iff $\bigcap K_{\text{met}}(w)(t) \subseteq$ P.

b. If defined, $[\![will\ p]\!]^{c,g,w,t} = 1$ iff $p(s\langle w, \bigcap K_{met}(w)(t)\rangle)$

I will now specify which kind of propositions I think are contained in a metaphysical kernel K_{met}. Consider again how the metaphysical modal base was defined in (35), repeated in (218). This version of historical equivalence is defined completely without taking recourse to the *properties* shared by two worlds that are historically equivalent. Essentially (218) states that the set of historical alternatives of

any w at t entails the set of historical alternatives of w at any t' later than t.

(218) **Historical equivalence** (based on Condoravdi (2002, 2003))

Historical equivalence ($\simeq$) is a relation on T×W×W

(T the domain of times and W the domain of possible worlds) such that:

for all $t \in$ T, $\simeq_t$ is an equivalance relation on W×W such that:

for any w,w' $\in$ W and t,t' $\in$ T, if $w \simeq_t w$', and $t' \prec t$, then $w \simeq_{t'} w$'

But the relation of historical equivalence can also be defined as a shared set of propositions. Intuitively, two worlds w and w' are historical alternatives of each other at t, iff for any $t' \leq t$ the set of untensed propositions yielding truth in w at t' is identical to the set of untensed propositions yielding truth in w' at t'. This is defined in (219).

(219) **Historical equivalence via shared propositions**

Two worlds w, w' are historical alternatives of each other at t ('$w \simeq_t w'$') iff, for any t' $\leq$t and any untensed proposition p:

$\{p : p(w)(t') = 1\} = \{p : p(w')(t') = 1\}$

Accordingly, we can define a kernel that determines a metaphysical modal base as the set of propositions in (220-a). It follows from (219) that the relation of historical equivalence can then be defined as in (220-b), which states that two worlds w, w' are historically equivalent up to t iff the metaphysical kernel in w at t is identical to the metaphysical kernel in w' at t. The modal base determined by a metaphysical kernel K_{met} is the big intersection of K_{met}, (220-c).

(220) **Kernels determining metaphysical modal bases**

a. $K_{\text{met}}(w)(t)$ is the set of propositions p such that for any $t' \leq t$: $p(w)(t') = 1$.
$\equiv \{p : \forall t'.[t' \leq t \rightarrow p(w)(t') = 1]\}$

b. Any worlds w and w' are historically equivalent up to t iff $K_{\text{met}}(w)(t) = K_{\text{met}}(w')(t)$

c. K_{met} determines a modal base $\text{MB}_{K_{\text{met}}} = \bigcap K_{\text{met}}$

According to (220), we can think of kernels that determine metaphysical modal bases as protocol-like descriptions of what a world is and has been like up to the anchor time of the kernel.

(221) Scenario: Ida foaled at t_1. Lui said moo at t_1. A glass of water fell to the ground at t_2. Piggy grunted at t_2.

$K_{\text{met}}(w)(t) = \{$

$\lambda w'$. Ida foals at t_1 in w',

$\lambda w'$. Lui makes moo at t_1 in w';

$\lambda w'$. no glass of water falls to the ground at t_1 in w',

$\lambda w'$. Piggy doesn't grunt at t_1 in w',

...

$\lambda w'$. a glass of water falls to the ground at t_2,

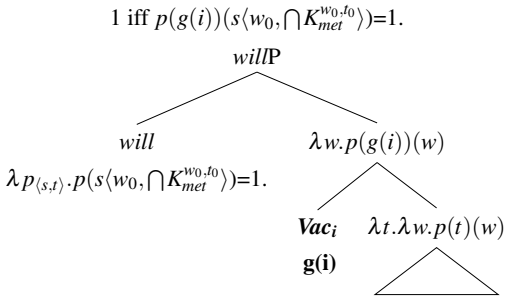
$\lambda w'$. Piggy grunts at t_2 in w',

$\lambda w'$. Ida doesn't foal at t_2 in w',
$\lambda w'$. Lui doesn't say moo at t_2 in w',
$\dots\}$

I assume that the semantic argument of *will* is, like the elements in K_{met}, a property of worlds with the time argument of the prejacent already being closed. On my implementation, the prejacent contains a tense pronoun that is semantically vacuous, as specified in (222-a). As illustrated in (222-b), the temporal pronoun combines with a property of world-time-pairs yielding the property of worlds that is the semantic argument of *will*.[4]

(222) a. $[\![Vac._i]\!]^{\text{g}}$ = g(i) if g(i) is a time and undefined otherwise

b.



If *will* occurs unembedded, the output of the choice function s is always the anchor world w_0, which is why the at-issue contribution of *will* is vacuous in such cases. The at-issue meaning of the structure in (222) can therefore be reduced as in (223), in case it occurs unembedded. The contrast to bare assertion of p hence springs only from the indirectness presupposition of *will*.

(223) $[\![(223)]\!]^{w_0,t_0,\text{g}} \equiv 1$ iff $\text{p}(g(i))(w_0) = 1$ (if unembedded)

Now let's see which predictions the indirectness condition in (217) makes together with the definition of metaphysical kernels above. The definedness condition in (217) states that *will* is only defined if the metaphysical kernel $K_{\text{met}}(w_0)(t_0)$ does not directly settle the prejacent proposition p, i.e. only if the subject matter induced by $K_{met}(w_0)(t_0)$ is not about p. $K_{\text{met}}(w_0)(t_0)$ contains for every time $t' \leq t_0$, all the untensed propositions which are true of w at t' (and only those propositions). It follows that the temporal argument *g(i)* of the prejacent proposition must be some time following t. If *g(i)* would not be a time after t but, say, the time t' which is exactly 10 minutes prior to t_0, $K_{\text{met}}(w_0)(t_0)$ would directly settle the prejacent because w_0 is fully specified at t' by the kernel.

Let's have a look at an example. Suppose that the properties of a world w up to t are perfectly described by the two propositions in (224) and that the utterance in (225) is being made.

[4]For the sake of readability, I write the time and world argument of the kernel as superscripts, such that: $K_{met}(w_0)(t_0) = K_{met}^{w_0,t_0}$.

(224) **Scenario:** Lui makes moo at t_1. Ida neighs at t_1. Piggy makes a grunt at t_2. Nothing else happened prior to t in w.

a. **Timeline:** Suppose t_1 is the earliest time there is; t_2 is the time immediately following t_1. And that $t_0 = t_2$. I.e. that the timeline is: $\boldsymbol{t_1 < t_2 = t_0}$

b. $K_{\text{met}}(w_0)(t_0) = \{$
p_1 : $\lambda w'$. Ida neighs at t_1 in w',
q_1 : $\lambda w'$. Lui makes moo at t_1 in w',
...
p_2 : $\lambda w'$. Ida doesn't neigh at t_2 in w',
r_2 : $\lambda w'$. Piggy makes a grunt at t_2 in w',
$\ldots\}$

(225) **Same context as in (224).**

a. **Utterance at $\boldsymbol{t_0}$:** Ida will$_{\text{temp}}$ neigh.

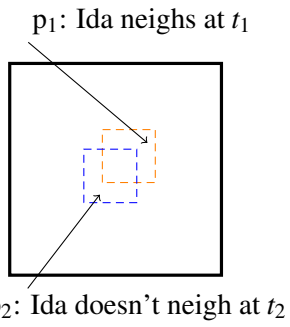
b. [$_{\text{willP}}$ *will* [$_{\text{prejacentP}}$ [$_{\text{Vac}}$ $g(i)$] [$\lambda t'$. $\lambda w'$. Ida neighs at t' in w']]]

In this scenario the subject matter determined by $K_{\text{met}}(w_0)(t_0)$ is such that any two worlds that are in the same equivalence class in $S_{K_{\text{met}}(w_0)(t_0)}$ agree on the value they yield for p_1, p_2, q_1 and r_2 respectively. Does the metaphysical kernel in this scenario directly settle the prejacent proposition? Well, it depends on the assignment of i. Under an assignment g that maps i to the time t_1 or the time t_2, yes, the kernel would settle *Ida neighs at* $g(i)$ (that is, positively for t_1, negatively for t_2). This is because the propositions *p1* and *p2* are *about* Ida neighing at t_1 and at t_2 respectively. It follows that if the prejacent of a metaphysical modal must not be directly settled by $K_{\text{met}}(w_0)(t_0)$, then a *will*-claim is only defined on an assignment g such that *g(i)* is some point later than t_0. I suggest that this is how obligatory future-orientation not only of *will* but of *any* metaphysical modal can be explained.

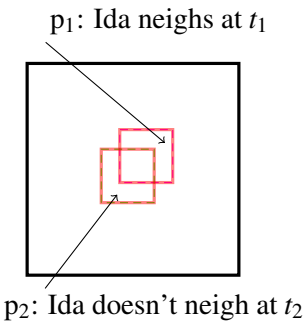
The logic behind this mechanism is illustrated in (226). This example involves the propositions p_1 and p_2 from (224): p_1 corresponds to the proposition that *Ida neighs at* t_1 and p_2 to the proposition that *Ida doesn't neigh at* t_2. If *p1* and *p2* distribute in the logical space as indicated in (226-a), then the partition induced by those propositions ($S_0[p1][p2]$) corresponds to the cells circumscribed by the red lines in (226-b). On an assignment that maps the temporal argument of the prejacent proposition $g(i)$ to either t_1 or t_2, the prejacent proposition would follow directly from the metaphysical kernel. On such assignments, the prejacent proposition would denote the proposition that *Ida neighs at* t_1 or the proposition that *Ida neighs at* t_2. On either of those assignments, the prejacent proposition is an issue in the subject matter $S_0[p_1][p_2]$ (illustrated in (226-b)) since it does not add any partition to it.

(226)

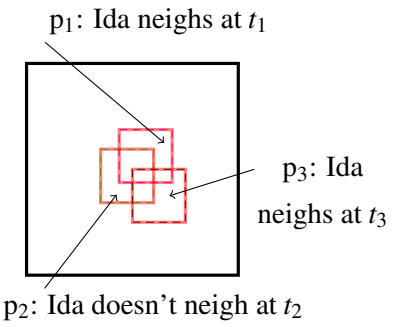
a. S_0



b. $S_0[p1][p2]$



c. $S_0[p_1][p_2][p_3]$



Therefore, *will p* is only defined if g assigns to i some time following t_0. For example, suppose that the time assigned is t_3 (i.e. the time immediately following t_0. Recall that t_0= t_2 in scenario (224)), in which case we could label the prejacent 'p$_3$'. Then, the metaphysical kernel in (224) does not settle the prejacent proposition p_3. This is because the subject matter $S_0[p_1][p_2]$ is not equal to $S_0[p_1][p_2][p_3]$, as illustrated in (226-b) vs. (226-c). The partition $S_0[p_1][p_2]$ bundles two worlds into the same equivalence class if they yield the same value for p_1 and p_2 respectively. The question whether Ida neighs at some time *t'* is, from the perspective of what is circumstantially possible, completely orthogonal to the question whether Ida neighs at some other time *t"*. Therefore, the equivalence classes in $S_0[p_1][p_2]$ cut across the p_3-boundary. By definition, if the equivalence classes in a subject matter S cut across the boundary of some proposition p, then that p is not an issue in S. We can conclude that p_3 is not an issue in the subject matter determined by the metaphysical kernel in (224) and is thus an eligible prejacent, simply because the temporal pronoun in the prejacent proposition has been assigned a time following the time of utterance t_0.

The reader may wonder whether this mechanism also makes the right predictions for cases of metaphysical certainty like (227). More specifically, there is the question whether the definedness condition in (217) allows for prejacent propositions that are *known* to be true, as desired, or if it incorrectly rules out such prejacents.

(227) A: It is 1pm. The evil butcher comes again at 8pm. If Ida has not foaled by 8pm, he will take her.

B: Ida **will**$_{\text{tem}}$ have foaled by 8pm. [Pulls aside the curtain behind which Ida started foaling.] She is saved!

I assume that in (227), *will* embeds a perfect as in (228-a) and that the meaning of the perfect is as in (228-b).

(228) Ida will have foaled.

a. [$_{will\text{P}}$ [*will*] [$_{\text{prejacentP}}$ [$_{\text{Vac}}$ $g(i)$] [$_{\text{PerfectP}}$ λt. λw'. PERF(w)(t)(ida-foal)]]]

b. PERF(w')(t)(P) := $\exists$e. P(e)(w') & τ(e)$\leq$ t.

To simplify the presentation, let's assume that, again, the set of times preceding t_0 (the utterance time) is very limited, as in (229-a). Furthermore assume that the history of w_0 up to and including t_0 is perfectly described by the propositions in (229-b). Against this scenario, we consider the assertion in (229-c) and ask whether the prejacent proposition is directly settled by metaphysical kernel in (229-b).

(229) a. **Timeline:** Suppose that t_1 is the earliest point in time there is. In w_0 there have been only two times prior to t_0: t_1 and t_2. Time t_3 is equal to the time of speech t_0.
I.e. the timeline is: $\boldsymbol{t_1 < t_2 < t_3 (= t_0) < t_4 < t_5 \ldots}$

b. **Scenario:** At t_1, Ida foals. At t_2, Ida does not foal. At t_3(=t_0) Ida foals. Nothing else has happened before or at t_0.
$K_{\text{met}}(w_0)(t_0) = \{$
p_1 : Ida foals at t_1,
p_2 : Ida doesn't foal at t_2,
p_3 : Ida foals at t_3,… $\}$

c. **Utterance in w_0 at t_0:**
Ida will$_{\text{temp}}$ have foaled.
Abbreviated: will(PERF(g(i))(w)(Ida-foals))

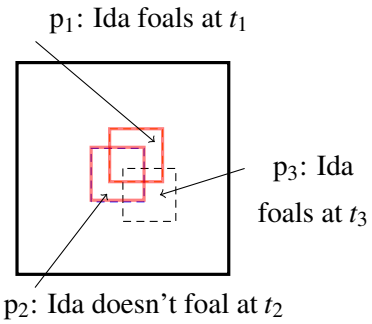
Suppose the value assigned to i is t_2. Then, the prejacent would denote the property that a world w' has if w' at t_2 is such that Ida has foaled (at some ($t' \leq t_2$)), i.e. the proposition in (230-a).

(230) $[\![Ida\ has_i\ foaled]\!]^{w',g^{i \to t_2}} = \lambda w'.\ \text{PERF}(t_2)(w')(\text{Ida-foal})$
$\equiv \lambda w'.\ \exists e.\ [\text{Ida-foal(e)(w')} \ \&\ \tau(e) \leq t_2]$

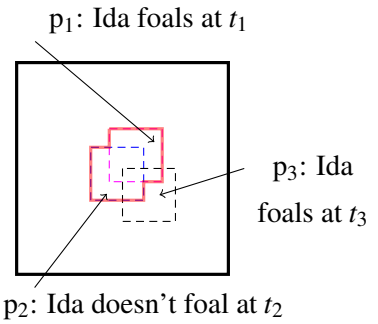
Let's label that proposition $prej(t_2)$. Now, is this prejacent an issue in the subject matter determined by the metaphysical kernel in (229-b)? Yes. According to the definition in (228-b) PERF(t)(P) is true whenever P holds (of an event happening) at t or at some $t' < t$. It follows that the equivalence classes determined by *prej(t_2)* are identical to the equivalence classes determined by the union of p_1 and p_2. The subject matter $S[prej(t_2])$ is hence entailed by $S_0[p_1][p_2]$, which is why the subject matter $S_0[p_1][p_2][prej(t_2)]$ would be equal to $S_0[p_1][p_2]$ (and, of course, also to $S_0[p_1][p_2][p_3]$). The proposition *prej(t_2)* is therefore not an eligible prejacent for *will*. This is illustrated in (231).

(231)

a. $S_0[p_1][p_2]$



b. $S_0[prej(t_2)]$

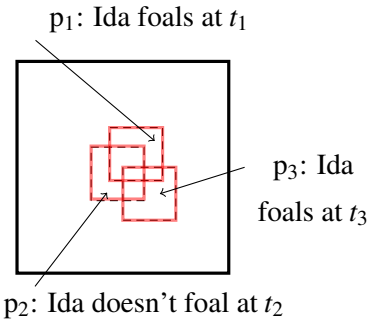


The subject matter $S_0[p_1][p_2]$ partitions the modal space into four cells; the subject matter $S_0[prej(t_2)]$ partitions the logical space into two cells (highlighted by the red lines in (231-a) and (231-b) respectively). As illustrated in the diagram, the subject matter $S_0[p_1][p_2]$ in (231-a) is a refinement of $S_0[prej(t_2)]$ in (231-b) which is why $S_0[p_1][p_2]$ has to be equal to $S_0[p_1][p_2][prej(t_2)]$. It follows that *will* is not defined if its prejacent proposition is *prej(t₂)*.

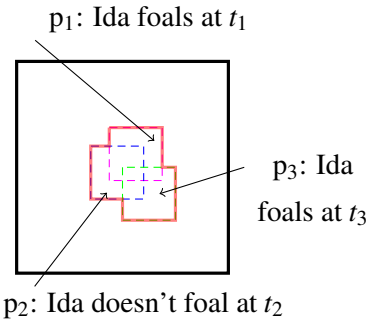
The same result would of course obtain if the time argument of the prejacent was be assigned the value t_3, i.e. the time of the utterance. The partition determined by the proposition *prej(t₃)* would run along the boundary of the union of p_1, p_2 and p_3 and the subject matter and $S_0[p_1][p_2][p_3]$ would be equal to $S_0[p_1][p_2][p_3][prej(t_2)]$.

(232)

a. $S_0[p_1][p_2][p_3]$



b. $S_0[prej(t_3)]$



Even though the metaphysical kernel does not directly settle the prejacent proposition, it straightforwardly follows from the meaning of the perfect that if a proposition p is true at t, then so is the proposition PERF(t')(p) for any t' following t. This logical truth is represented in (233).[5]

(233) For any untensed proposition p and times t, t' such that $t < t'$:

$$\{w \mid p(t)(w) = 1\} \subset \{w' \mid \text{PERF}(t')(w')(p) = 1\}$$
$$\equiv \{w \mid \exists e.p(e)(w) \& \tau(e) \circ t\} \subset \{w' \mid \exists e'.p(e')(w') \& \tau(e') \leq t' = 1\}$$

This account successfully explains how obligatory future-orientation of temporal *will* can be derived without any proper temporal semantics involved in the lexical entry of *will*. It also explains why *will* is compatible with both metaphysical settledness and non-settledness in a way that still captures the modal strength of *will*. For an illustration, suppose the utterance that *the barn will$_{met}$ collapse* is made in scenario (229) at t_0. As defined in (217), the assertion of *will p* states that the world of utterance w_0 (which is selected from the metaphysical modal base) satisfies the prejacent proposition (i.e. that w_0 is among those worlds in $\bigcap K_{met}(w_0)(t_0)$ that yield truth for the prejacent proposition), as in (234).

[5] It would do no harm if we assumed that non-contingent propositions like (232) are elements of metaphysical and epistemic kernels in order to explicitly represent what speakers know about logical truths.

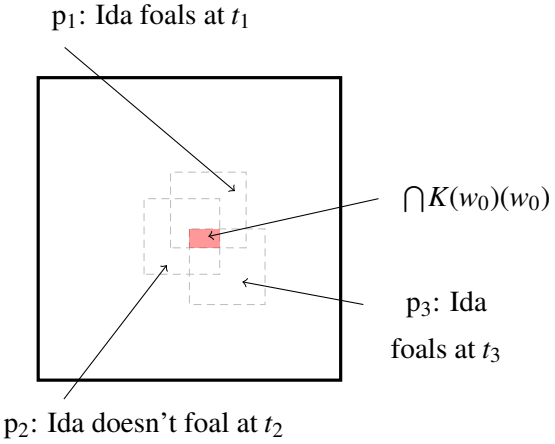
(234) a. $[\![\textit{The barn will collapse}]\!]^{g,w,t}$ = defined only if
the barn collapses at g(i) is not an issue in $S_{K(w)(t)}$
I.e. only if $S_{K(w)(t)} \neq S_{K(w)(t)}$[barn-collapse-at- $g(i)$]

b. If defined, $[\![\textit{The barn will collapse}]\!]^{g,w,t}$ = 1 iff
the-barn-collapse($g(i)$)(s$\langle w, \bigcap K(w_0)(t_0)\rangle$)= 1.

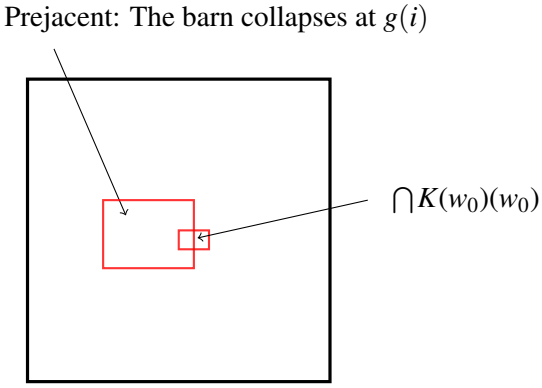
In scenario (229), the modal base $\bigcap K_{met}(w_0)(t_0)$ corresponds to the proposition $p_1 \cap p_2 \cap p_3$. It is indicated as the red square in (235-a). The relation between the partition induced by $\bigcap K_{met}(w_0)(t_0)$ and the partition induced by the prejacent *the-barn-collapse at g(i)* (where g(i) is some time following t_0) is illustrated in (235-b).

(235)

a. $S_{K(w_0)(t_0)}$



b. $S_{K(w_0)(t_0)}$[barn-collapse(g(1))]



According to (234), the sentence *the barn will$_{met}$ collapse* is defined as long as $g(i)$ is assigned a time after speech time and is true iff the actual world satisfies the prejacent proposition (i.e. iff it is among those worlds in $\bigcap K(w_0)(t_0)$ that settle *whether the barn collapses at g(i)* positively). Since on this analysis *will p* makes a non-maximal claim with respect to the worlds in the modal base, *will p* can be true even if p is not settled by the metaphysical modal base $\bigcap K(w_0)(t_0)$. Truth of *will p* only requires that the world of utterance is among the equivalence class where p is true after all (this is compatible with $\bigcap K(w_0)(t_0)$ being a homogeneous p-space). And since p has to be true for *will p* to be true, this analysis predicts modal strength for *will*.

Table 6.2 summarizes the felicity patterns of *will p* in three types of scenarios. If the metaphysical kernel settles p directly (leftmost column), then *will p* cannot be used (i.e. it cannot get a temporal reading). If *will p* were compatible with direct settledness of p by a metaphysical kernel, then *will p* would not be future-oriented obligatorily. Due to the indirectness requirement, *will p* can only get a non-future-oriented reading if the kernel of the modal base does not fully specify past or present states of affairs (e.g. *epistemic* modality). If the metaphysical kernel does not directly settle the prejacent proposition, *will p* can be used (middle and rightmost column). Again, as in the case of epistemic modality above

(Table 6.1), I do not wish to commit myself to the status of bare assertion of p in contexts of metaphysical non-(direct-)settledness of p or to the status of *must p* in the context of metaphysical non-settledness of p. This is indicated by '$\sim$'. Note that Table 6.2 is not perfectly congruent to the table showing epistemic uses of *will* and *must* above (Table 6.1). While epistemic *will p* is ruled out from contexts of inferred full knowledge (i.e. if K_{ep} does not directly settle p but $\bigcap K_{ep} \subseteq p$; middle column in Table 6.1), metaphysical *will p* can be used even if the modal base homogeneously satisfies the prejacent proposition (i.e. if K_{met} does not directly settle p but $\bigcap K_{met} \subseteq p$; middle column in Table 6.2), like in the evil-butcher case. I attribute this to the fact that, for independent reasons, metaphysical *must* is not readily acceptable in cases like the evil-butcher example and hence does not present a competitor to metaphysical *will* in such cases (indicated by '($\checkmark$/??)'). This lose end is discussed in a bit more detail below in Section 7.2.

	K_{met} **directly settles** p	$\bigcap K_{met} \subseteq p$ and K_{met} does not directly settle p	$\bigcap K_{met} \not\subseteq p$ and K_{met} does not directly settle p
bare p	$\checkmark$	$\sim$	$\sim$
$must_{met}$ p	$\times$	($\checkmark$/??)	$\sim$
$will_{met}$ p	$\times$	$\checkmark$	$\checkmark$

Table 6.2: Compatibility of epistemic *will p* vs. epistemic *must p* and bare p with contexts of different levels of certainty.

6.3 Summary

The analysis set forth in this chapter is characterized by the following properties.

(236) **The meanings of English *will* and German *werden* on both readings**

a. …can be fully captured by a single lexical entry involving modal semantics (no extra temporal ingredients needed)

b. …are non-quantificational

c. …assert their prejacent (if unembedded), since they are *strong*

The account predicts that speakers who make an unembedded *will*-claim are committed to the truth of the prejacent proposition. This is because the choice function picks from a modal base the modal anchor world, whenever it is itself an element of that modal base, as defined in (237) (repeated from (60)).

(237) A function s: $\mathscr{W} \times (\mathscr{W} \to \mathscr{P}(\mathscr{W})) \to \mathscr{W}$ is a selection function iff:

a. if $MB(w)$ is non-empty, then $s(w,MB(w)) \in \mathrm{MB}(w)$, and

b. if $w \in MB(w)$, then $s(w,MB(w)) = w$

(adapted from Cariani and Santorio 2018; Cariani 2021)

Since epistemic and metaphysical accessibility relations are reflexive and since epistemic and temporal readings of *will/werden* are derived from epistemic and metaphysical modal bases, a proposition p ends up being *asserted* whenever it functions as the prejacent of (unembedded) *will/werden*.

The analysis correctly predicts that temporal *will/werden* is compatible with full knowledge of the prejacent proposition (see 7.2 for an idea why epistemic *will/werden* are not) and why assertion of *will/werden p* does not seem to commit the speaker to epistemic or metaphysical necessity (unlike *must*).

Given the cross-linguistic prevalence of alternating futures, a unified account is very much needed. With the exception of Werner (2006), existing approaches to alternating futures unanimously assume additional temporal ingredients in order to derive obligatory future-orientation of temporal readings of alternating futures. But any account becomes less unified through that assumption. Since the effect of forward-shifting is only obligatory with temporal, but not with epistemic readings, those accounts that assume such additional temporal ingredients somehow have to suspend obligatory forward-orientation if the reading is epistemic (or, depending on the implementation, they have to suspend compatibility with present-orientation if the reading is temporal). Like the account by Werner (2006) my account derives forward-orientation of temporal readings without any additional temporal ingredients and is hence a true unified analysis of the alternating future. But while Werner's derivation of forward-orientation depends on the diversity requirement and thus on the weakness of *will*, my account preserves modal strength of *will* and *werden*: following von Fintel and Gillies (2010), my proposal defines non-settledness relative to a privileged part of the modal base (the kernel), in a way that does not lead to a weak semantics of *will/werden*.

My proposal can be viewed as an elaboration of the account by Cariani and Santorio (2018) (and the updated version in Cariani 2021), as I have adopted the at-issue meaning they propose for temporal *will* (they do not propose any not at-issue components). I have supplemented this account by a definedness condition stating that some privileged part of the modal base (the kernel) must not directly settle the prejacent proposition. With this condition, I have simply adopted the presupposition von Fintel and Gillies (2010) assume for epistemic *must* and epistemic modals in general, which I have adapted to fit also metaphysical readings of *will* (and *werden*). This additional component comes along with two improvements of the choice function analysis. First, the requirement of epistemic indirectness accounts for the fact that epistemic *will p* is not equivalent to bare assertion of *p*. Because the at-issue contribution of unembedded *will* is, in the end, vacuous, the analysis by Cariani and Santorio does not explain this observed non-equivalence without such additional assumptions. Second, the not at-issue requirement that the metaphysical kernel must not directly settle the prejacent proposition allows to drop any additional temporal component in the lexical entry of *will*. In the form implemented by Cariani and Santorio, the choice function analysis depends –in addition to the modal choice function– on a proper temporal component in the lexical entry of *will* in order to account for obligatory future-orientation of temporal readings. If the modal component can be exploited to derive obligatory future-orientation on its own, positing additional temporal semantics is superfluous. I have shown that it is possible indeed. Moreover, the assumption of additional forward-orienting semantics is dubious because it over-generates future-oriented readings. Future-orientation is only obligatory if the modal base is metaphysical, but not if the modal background is epistemic. Deriving future-orientation with the aid of temporal semantics proper would –depending on the implementation– require strategies to either rule out obligatory forward-orientation selectively in the case of epistemic modality or to make it obligatory in the case of metaphysical modality. If we

find obligatory future-orientation *exactly* in those contexts where the modal flavor is (according to our theory) metaphysical, then, if possible, the analysis should derive this property is a *direct effect* of the modal background being metaphysical. On my account, future-orientation is expected to be obligatory *exactly* when the modal background is metaphysical.

Viewed in different way, my analysis can hence also be seen as an elaboration of the account by Werner (2006), who, too, derives obligatory future-orientation on a purely modal strategy. Assuming the same two kinds of modal backgrounds for *will*, epistemic and metaphysical, he observes that Condoravdi's diversity principle already derives obligatory future-orientation whenever the modal background is metaphysical. As I have discussed above, this elegant solution is incompatible with a strong analysis of *will*. The assumption that modal bases have kernels allows for a more elaborate notion of 'non-settledness'; i.e. one that is compatible with modal strength. Combined with a choice function analysis, the kernel-relative requirement of indirectness improves on the account by Werner, as it correctly predicts the *strong* behavior of *will* and *werden*.

In essence, the proposal set forth in this thesis combines (i) the method of deriving epistemic and temporal readings from epistemic and metaphysical modal flavors by Condoravdi (2002), (ii) the strong and quasi-vacuous choice function semantics proposed by Cariani and Santorio (2018) and (iii) the kernel-relative indirectness requirement by von Fintel and Gillies (2010) with (iv) a purely modal strategy of deriving obligatory future-orientation similar to the one suggested by Werner (2006). Table 6.3 summarizes the most important features of those existing accounts of alternating futures that have been most important to this thesis and compares it to those of my own analysis.

	Condoravdi	**Werner**	**Cariani & Santorio**	**My account**
Modal bases	metaphysical & epistemic	metaphysical & epistemic	metaphysical & epistemic	metaphysical & epistemic
At-issue meaning	$\forall$-modal	$\forall$-modal	choice function	choice function
Obligatory fut.-orientation	additional temporal semantics	diversity principle	additional temporal semantics	requirement of non-settled kernel
Modal strength	weak	weak	strong	strong

Table 6.3: Existing analyses that are closest to my own account

Chapter 7

Discussion and outlook

7.1 Compatibility of assertion of *p* and uncertainty of *p*

I have proposed that epistemic readings of *will p* –even though they assert *p*– signal (due to the contrast to epistemic *must*) that *p* is not strictly *inferred* from what is known and, hence, that the speaker is not fully certain of *p*. This is why epistemic readings are felicitous in contexts where certainty is rather high, but non-maximal and infelicitous where certainty is maximal. In essence, I assume that their communicative profile can be described with (238).

(238) ***epistemic will p***

at-issue:	*p*
not at-issue:	presupposition that *p* is not known directly, implicature that *p* is not inferred either
signals:	the speaker is not fully certain of *p*

This makes my proposal incompatible with theories that take full certainty (i.e. strong belief) or even knowledge as a norm of assertion. Weaker theories of assertion better fit with a meaning profile like (238) and I think that the data I presented in this thesis should be viewed as supporting those accounts. For example, Mandelkern and Dorst (to appear) suggest (tentatively) the condition in (239).[1]

[1] At the heart of the proposal by Mandelkern and Dorst (to appear) is the observation that assertion of *p* can be felicitous even if the speaker's credence in *p* is significantly below 1, even below 0.5. The most extreme example to this effect involves a guessing scenario in the context of a quiz show, (i).

(i) **Scenario:** *Game show*

Host: In which year did the Seven Years' War start?
Guest: I don't know. I know it was in the 1700s, but I don't know more than that.
Host: Okay, well you're out of lifelines, so you'll just have to guess.
Guest: Ok, hm. The war started in 1760. (adapted from Mandelkern and Dorst to appear, p. 7)

In such a context, the assertion that *the war started in 1760* is acceptable, even though the guest is clearly not certain of their answer. However, assertions like those in (ii) are never ok, not even in contexts that otherwise tolerate assertion of *p* in spite of non-maximal certainty of *p*. The sentences in (ii) conjoin a proposition *p* with a proposition expressing subjective uncertainty of *p* (so-called *Moore sentences*, which are closely related to Wittgenstein sentences discussed in my section 4.2.2).

(ii) [Same scenario as in (i)]

a. #The war started in 1760, but I don't know whether the war started in 1760.

(239) In performing the speech act of asserting *p*, act as if you are absolutely certain of *p*. [Applied sentence by sentence, JM] (Mandelkern and Dorst to appear, p.20)

But even (239) is not readily compatible with my claim that there exist items that have the communicative profile in (238). In particular, it does not make clear whether (239) should apply only to at-issue content or whether not at-issue content is subject to this restriction too. The sentences in (240) suggest that a more fine-grained view of (239) is needed. That (238) should indeed apply to the level of at-issue content only is implicit in the update system proposed by Murray (2014). Her discussion features, among other things, reportative marking in the evidential system of Cheyenne. According to Murray (2014), evidentials in Cheyenne contribute (non-modal) not at-issue content and take as their argument at-issue content. (240) asserts the at-issue that Sandy won and the reportative marking contributes that the speaker heard that Sandy won. In Cheyenne, the reportative signal makes such a strong hedge, that it completely dissolves the speaker's commitment to the at-issue content. This way this sentence can be continued with a directive-marked at-issue assertion that Sandy did in fact not win. According to Murray, English parentheticals expressing reportative meaning as in (241) should be analyzed in parallel.

(240) É-hó'tȧheva-**sèstse** Sandy naa oha é-sáa-hó'tȧhévá-he-**∅**. (adapted from Murray 2014, p.6)
3-win-RPT.3SG Sanddy and CNTR 3-neg-win-MOD_A-DIR
'Sandy won, they say, but (I was there and) she didn't.

a. **at-issue$_1$:** Sandy won
not at-issue$_1$: That Sandy won is second hand information for the speaker.

b. **at-issue$_2$:** Sandy did not win.
not at-issue$_2$: The speaker has direct evidence that Sandy did not win.

(241) Floyd won the race, they say, but I was there and he didn't.

a. **at-issue$_1$:** Floyd won the race.
not at-issue$_1$: That Floyd won the race is second hand information for the speaker.

b. **at-issue$_2$:** The speaker was there and Floyd did not win.

Those cases do not completely parallel the kind of conflict expressed by the proposed meaning profile of *will*, because their not at-issue content is reportative, not uncertainty. But (242) shows that parentheticals expressing that the at-issue content is based on a conjecture, as in (242), are assertible too. (It is not important for current purpose whether they cancel speaker commitment or not.)

(242) a. The war started –remember I'm guessing– in 1760.

b. Der Krieg hat –vermuteterweise– 1760 begonnen.
the war has –supposedly– 1760 begun
'The war started in 1760 –supposedly.'

This shows that a meaning profile like (238) is justified from a theoretical perspective. The exact update

b. #I have no idea when the war started, but the war started in 1760.
c. #The war started in 1760, but I'm not sure that it started in 1760

potential of *will/werden* has to be analyzed by future work. It will have to determine how obligatory speaker commitment to p paired with a signal of uncertainty of p affects the update of the context. I suspect that a structured update system like the one proposed by Murray (2014) might be suited to describe the update potential of items like *will*.

7.2 A loose end: pragmatic competition with epistemic vs. metaphysical *must*

In this subsection I want to sketch out the basics of what I believe is a plausible way to tie up a lose end of my proposal. Recall that I accounted for the unacceptability of epistemic *will* in contexts of epistemic settledness by assuming that *will* pragmatically competes with epistemic *must*: the former is semantically compatible with epistemic non-settledness, while the latter is not. I then suggested that the assertion of epistemic *will p* is interpreted as sending the signal that the epistemic modal base does not settle the prejacent proposition (i.e. non-maximal certainty) because the speaker did not choose to make the stronger claim *must p* (even though both assertions are *strong*, i.e. both semantically entail p).[2]

I still maintain that this is a reasonable explanation. However, by the same reasoning, it is expected that due to the existence of metaphysical uses of *must* (which I have argued for in section 5.2), temporal *will p* signals metaphysical uncertainty. If this were true, temporal *will* should be odd in contexts of metaphysical settledness just as much epistemic *will* is odd in epistemic contexts of epistemic settledness. But this is not what we find. Temporal *will* has been shown to be acceptable in contexts of metaphysical certainty, for instance in the *evil-butcher*-example in (229). This contrast between temporal and epistemic *will* is again highlighted in Table 7.1.

	$\boldsymbol{K_{ep}}$ **directly settles** $\boldsymbol{p}$	$\bigcap \boldsymbol{K_{ep}} \subseteq \boldsymbol{p}$ and K_{ep} does not directly settle p	$\bigcap \boldsymbol{K_{ep}} \not\subseteq \boldsymbol{p}$ and K_{ep} does not directly settle p
$must_{ep}\ p$	×	✓	∼
$will_{ep}\ p$	×	×	✓
	$\boldsymbol{K_{met}}$ **directly settles** $\boldsymbol{p}$	$\bigcap \boldsymbol{K_{met}} \subseteq \boldsymbol{p}$ and K_{met} does not directly settle p	$\bigcap \boldsymbol{K_{met}} \not\subseteq \boldsymbol{p}$ and K_{met} does not directly settle p
$must_{met}\ p$	×	✓	∼
$will_{met}\ p$	×	✓	✓

Table 7.1: Compatibility with epistemic vs. metaphysical settledness of *will*.

Here, I want to speculate very briefly about a possible reason for this pattern. In a nutshell, the observation is that metaphysical *must* does not seem to compete with metaphysical *will* in the same way as epistemic *must* competes with epistemic *will*.

[2] I should note here, however, that there was one consultant who insisted that epistemic readings of *will* were absolutely felicitous in contexts of full certainty and that they would not signal uncertainty in such contexts. Maybe, future research can explain why there are those inconsistencies in the judgments.

Consider again the context from (227) ('evil butcher'), repeated in (243). In such a context it can be known with absolute certainty that the proposition that *Ida has foaled at g(i)* (where $g(i)$ is a future time) is true in *any* world metaphysically accessible at the time of utterance. The claim that *'Ida has foaled holds' at some relevant future time* (8pm, as the example goes) can be expressed by a sentence where *Ida has foaled at g(i)* is the prejacent of metaphysical *will*, as in (243-a). By contrast, the same sentence is not straightforwardly acceptable if *will* is replaced by *must* as in (243-b).

(243) A: The evil butcher comes again at 8pm. If Ida has not foaled by 8pm, he will take her.
B: [Pointing at Ida, who started to foal. It is 1pm.]
a Ida will$_{\text{met}}$ have foaled (by 8pm). She is saved!
b ??Ida must$_{\text{met}}$ have foaled (by 8pm). She is saved!

I believe that the reason why (243-b) is effectively unacceptable is that the metaphysical kernel settles the prejacent proposition *Ida has foaled at g(i)* in a way that is *too* direct for *must*. Consider again example (181) from Section 5.2 (repeated in (244)) where the use of metaphysical *must* is felicitous.

(244) [**Metaphysically settled context:** *a child contemplating falling objects with its parent*.]
A: Why will the mug fall to the ground when I push it over the edge of the table?
B: Well, if you push it too far, there is nothing between the mug and the floor. Due to gravity, it {**must**$_{\text{met}}$/**has to**$_{\text{met}}$} fall to the ground./It **cannot**$_{\text{met}}$ stay up in the air.

In this example, the use of metaphysical *must* seems to be justified only because one participant signals that they do not treat the proposition *the mug will fall to the ground* to be entailed by the proposition *the mug is pushed over the edge of the table*. This also seems to be true of the evil-butcher case: the *must* claim in (243) turns acceptable if it is not common ground that *Ida has foaled by g(i)* $> t_0$ is entailed by *Ida foals now*. Of course, such examples are pragmatically very absurd, as they involve a speaker who seems to be ignorant about the most basic metaphysical properties of time. Nevertheless, if we accept for the sake of the example the existence of a common ground that is implausible in such a way, then it can be observed that the *must*-sentence from (243-b) becomes felicitous in (245).

(245) A: I can see that Ida is foaling now (at 1pm), of course. But why are you so certain that she will have foaled when the butcher comes at 8pm?
B: Are you insane? From the fact that she foals now, it *follows* that she also will have foaled when the butcher will come at 8pm. If she is foaling now, she **must**$_{\text{met}}$ have foaled at 8pm.

Therefore, I propose that metaphysical *must* is felicitous only if the prejacent proposition does not directly follow from (and is not contradicted by) one single proposition in the metaphysical kernel. That is, I suggest that the definedness condition of metaphysical *must* is correctly described by von Fintel and Gillies' Implementation 1 in (206) restated below as (246).

(246) **Epistemic *must*: Implementation 1 of definedness**

a. $[\![must\ P]\!]^w$ is defined only if
$\neg\exists X \in K(w).\ [X \subseteq P \text{ or } [X \cap P = 0]]$.

b. If defined, $[\![must\ p]\!]^w = 1$ iff $\bigcap K(w) \subseteq P$. (adapted from von Fintel and Gillies, p.374)

Still, the question *why* metaphysical *must* should use this stricter definedness condition rather than the more permissive implementation in terms of subject matters has to remained unanswered in this thesis.[3]

7.3 Outlook

7.3.1 English Futurates

My account may present a starting point for a novel way to distinguish the *will*-future from futurates. It has often been noted (Copley 2002, 2008; Kaufmann 2005; Kaufmann et al. 2006) that English sentences with future-orientation but morphological present marking are only felicitous if they describe a property of the world that is in some sense settled. Propositions that describe non-planable events, such as winning a game or managing to escape are not felicitous in such constructions.

(247) a. ??Rapid wins against Austria Wien tomorrow.
b. Rapid will win against Austria Wien tomorrow.
c. ??Lui manages to escape prison tomorrow.
d. Lui will manage to escape prison tomorrow.

On the other hand, there are certain cases where the *will*-future sounds very strange while the corresponding futurate does not.[4]

(248) a. Tomorrow is my birthday.
b. ?Tomorrow will be my birthday.
c. New Year is on Jan 1.
d. ?New Year will be on Jan 1.

The kernel-relative approach of metaphysical modality developed above provides an explanation for this observation if we assume that the metaphysical kernel $K_{\text{met}}(w)(t)$ contains, in addition to all the propositions that yield truth for any $t' \leq t$ in w, *stative* propositions, like those in (249-a). This is well compatible with the definition of historical equivalence in (219) above, stating that two worlds w and w' are historically equivalent iff the same properties hold at non-future times in w and w'. What a

[3] I suspect, though, that epistemic and metaphysical modality is not treated to be equally relevant in ordinary conversation. In particular, I suspect that while information addressing the extent to which some proposition is epistemically certain is pragmatically relevant (one should only assert a proposition p if one has good epistemic reasons for the truth of p), the same does not necessarily hold of the metaphysical domain: it seems as if the pragmatics of assertion does not strictly discriminate by relevance such propositions that are metaphysically necessarily true from such propositions that are true *simpliciter* (but not directly settled by the metaphysical kernel). In the epistemic domain, on the other hand, the extra information that the proposition is epistemically necessary is relevant and treated as superior to the assertion that *p is true but not necessarily epistemically settled.*

[4] I thank Daniel Büring, who pointed this out to me.

metaphysical kernel does not contain are tensed propositions as in (249-b), which are straightforwardly excluded from metaphysical kernels by the definition of historical equivalence in (219).

(249) a. **Propositions permitted in metaphysical kernels:**
   (i) Lui's birthday is on Oct 20;
   (ii) New Year is on Jan 1.

   b. **Propositions not permitted in metaphysical kernels:**
   (i) Rapid wins against Austria Wien at *t'* (where *t'* is in the day after *t*),
   (ii) Lui manages to escape prison at *t'* (where *t'* is in the day after *t*).

We should then view bare versus modalized assertions as reflecting the fundamental distinction between propositions that are represented in a modal kernel and those that are not. If this is true, my tildes in Table 6.2 should be changed into '×'s. If this idea can also be extended to the epistemic domain (Table 6.1), we must say something about why bare assertion of *p* is possible in contexts where *p* is only inferred. I suspect that this might be so because if *p* is a watertight inferences –especially if it is made overtly, as in the ball-box example– *p* might be easily accommodated as direct knowledge. The appearance that bare assertion of *p* does not require that *p* is known directly would then only be an illusion. If this can be shown convincingly, an analysis of the indirectness requirement epistemic modals in terms of a *conversational* implicature (not a lexical presupposition) would become possible again.

In any case, the contrast between the propositions in (249-a) and those in (249-b) intuitively comes down to a difference in stativity: The sentences in (249-a) are stative propositions which are not instantiated by a single event happening at a certain time. They seem to predicate the property in question over a possible world only but not of a world-time pair. The sentences in (249-b) are eventive propositions that locate in time an event satisfying the description expressed by the verb. Of course, a principled account along these lines would also explain *why* birthdays and holidays but not wins or escapes are conceptualized as stative propositions. Unfortunately, an investigation of the question why certain properties of the world tend to be described or conceptualized by stative eventualities while others tend to be described by eventive ones is beyond the scope of my thesis.

7.3.2 Relation to German discourse particle *wohl*

I am certain that the discussion of *will/werden* and German discourse particles would benefit from a comparison of *wohl* and *werden/will* (and *must*, for that matter). The semantics of *wohl* that has been suggested by Eckardt (2020) and in particular that by Göbel (2018) is very similar to my analysis of epistemic readings of *will/werden*. Göbel proposes that *wohl* is a non-modal CI-item (à la Potts (2005)) which states that the at-issue content in its scope is inferred (though he does not give a definition of inference, or of how inferences relate to direct or indirect forms of knowledge. In the account by Eckardt (2020), a modal analysis, this part is worked out more explicitly). To illustrate the similarity between Göbel's account of *wohl* and my treatment of epistemic *will* consider (250) vis-à-vis (251). (Note that both Göbel and Eckardt take *wohl* to delete speaker commitment, which is why they assume that *wohl* reduces the illocutionary force in the declarative sentence it appears in.)

(250) Marlijn ist **wohl** in Köln. (adapted from Göbel 2018, p.83-4)
M. is WOHL in Cologne
'Marlijn is in Cologne, I guess.'

at-issue: Marlijn is in Cologne (with reduced illocutionary force)

CI: That Marlijn is in Cologne is inferred by the speaker.

(**illocutionary force:** Lower than bare assertion of *p*. No full commitment to at issue content.)

(251) Marlijn **will** be in Cologne (right now).

at-issue: Marlijn is in Cologne.

presupposed: That Marlijn is in Cologne is not directly represented in the epistemic kernel (and hence conjectured (but not inferred, versus *must*)).

While the meaning profiles described by (251) and (250) are certainly not equivalent, the difference between *wohl*, *will/werden* and *must/müssen* has to be worked out more clearly. The contrast between those items becomes evident in an example that Göbel gives for *wohl*, where it modifies a proposition that is known *directly* (through a trustworthy source), (252). The sentences in (253) show that *must, müssen, will* and *werden* are infelicitous in this type of context.

(252) [**Context:** Pascal and Mordecai, bored during the soccer break, are playing a guessing game.]

Mordecai: Guess how much Tianjin Quanjian is offering Aubameyang.

Pascal: 20 million?

Mordecai: You are wrong, it's 34 million!

Pascal: Hm, da lag ich { **wohl** / offenbar / wahrscheinlich / möglicherweise } falsch.
well there lay I WOHL obviously probably maybe wrong
'Well, I was WOHL wrong.' ≈ 'Well, looks like I was wrong.'

(from Göbel 2018, p.78; format adapted)

(253) **Context:** *Same context as in (252).*

a. ??Hm, I will have been wrong then.

b. ??Hm, I must have been wrong then.

c. ??Hm, da werde ich mich geirrt haben.
hm, there will I REFL erred have

d. ??Hm, da muss ich mich geirrt haben.
hm, there must I REFL erred have

Indirectness as broadly defined as in von Fintel and Gillies (2010) (and in my thesis) predicts the unacceptability of the sentences in (253): the prejacent proposition in (253) *I have been wrong* is directly settled by the epistemic kernel and as a result epistemic modals are infelicitous. However, if this is the whole story, then there is the question in which sense *wohl* can be said to signal that an inference has taken place in (252). So either the account by Göbel (2018) has to be modified, or we need a yet more structured formal representation of *what is known* and the different ways a proposition can follow from it. In sum, I think it is fair to say that the existing analyses of *wohl* and *werden/must* are still too similar to predict this contrast.

If my analysis is on the right track and the at-issue content of *will* and *werden* is quasi-vacuous and its not at-issue content is presuppositional, epistemic *will/werden* makes an excellent test case for the contrast to *wohl* and other items that have been claimed to contribute only not at-issue content (e.g. conjectural evidentials like the one discussed by Murray (2010)). In particular, it would be exciting to see, whether we find a systematic difference between not at-issue items that contribute conjectural content/indirectness as a conventional implicature (e.g. *wohl* on Göbel's treatment) and not at-issue items that contribute the same or a similar meaning through a presupposition (e.g. *will/werden* on my account).

Furthermore, German *werden* often co-occurs with *wohl*. In such cases, it is especially difficult to pin down the contribution made by each individual item, as, again, they seem to contribute a similar content.

(254) Lui wird wohl gerade die Schweine füttern.
Lui will WOHL right.now the pigs feed.
'Lui will WOHL be feeding the pigs right now.' ≈ 'Lui will be feeding the pigs, I guess.'

Another German discourse particle that naturally co-occurs in prototypical *werden*-examples and is often added by native speakers if they are asked to engage with *werden* is *schon*.

(255) **Context:** *Quiz game*

Wenn du meinst, dann nimm Antwort C. Wird schon stimmen.
if you mean, then take answer C. Will SCHON be.right

'If you think so, go ahead and take answer C. It'll be right, I suppose.'

Interestingly, *must* is incompatible with *schon*, while *werden* is not. I am not aware of any rigorous comparison of those items, but I am confident that future work would gain from such an endeavor.[5]

7.3.3 Ninan sentences

Frank Sode (p.c.) pointed out to me that *will/werden* is among those kinds of modals M that allow for disjunctions of the following type: Mp *or* $M\neg p$. The modals *ought* and *must*, by contrast, are not felicitous in such constructions. According to him, those examples have been mentioned by in a talk by Dilip Ninan (2018) (I was never able to get a hold of any written discussion of those examples). This is illustrated in (256), where *will* gets a temporal reading.

(256) **Context: A coin is about to be thrown.**

a. The coin will land heads or it will land tails.
b. The coin might land heads or it might land tails.
c. #The coin should land heads or it should land tails.
d. #The coin must land heads or it must land tails.

I do not attempt to make any conjecture about why those modals behave that way. I note, however, that (256) speaks strongly against a necessity analysis of *will* (as argued in Section 5.2). Intuitively,

[5] I thank Valerie Wurm, who brought this case to my attention.

the modals in (256-c) and (256-d) lead to unacceptability because they express likelyhood/normality (or some related meaning) and necessity respectively (the modal flavor of those modals is irrelevant for their acceptability). If *will* were to express necessity or likelihood too, its acceptability in (256) would be surprising. If, instead, the at-issue meaning of *will/werden* is (quasi-)vacuous, the fact that it allows for constructions of that type is predicted, as witnessed by the example in (257), which shows that disjunction of bare p and $\neg p$ is felicitous.

(257) **Context:** *A coin has been thrown and the speaker does not know which side it landed.*
The coin has fallen heads or it has fallen tails.

Interestingly, *will* only occurs in Ninan sentences if it has a temporal reading, but they strike me as infelicitous if the reading is epistemic, as illustrated by (258).

(258) **Context:** *A coin has been thrown and the speaker does not know which side it landed.*

a. The coin might have landed heads or it might have landed tails
b. ??The coin will have landed heads or it will have landed tails.

Intuitively, this is because *will* (by virtue of being asserted, as I have claimed) signals confidence/subjective likelihood with respect to the prejacent, which results in a contradiction if applied to both p and $\neg p$. Future work will have to show why (258-b) appears to be a contradiction, even though one would not expect it to be contradictory judging solely from the semantics of *will*. I suspect, that a system like Mandelkern's (2019) 'Bounded Modality' offers the tools to tackle that question, but an exploration of that possibility is beyond the scope of my thesis.

7.3.4 Other implementations

I have argued that *will* is not a necessity modal and have adopted the at-issue meaning proposed by Cariani and Santorio (2018). If *will* is unembedded and takes as its second semantic argument a realistic modal base, the prejacent proposition is always evaluated at the matrix world. I repeat the suggested entry in (259) (see (237) for the formal definition of the choice function semantics).

(259) ***will/werden***

a. $[\![\textit{will/werden}_{\textit{met/ep}}\ p]\!]^{c,g,w,t}$ is defined only if p is not an issue in $S_{K_{\text{met/ep}}(w)(t)}$.
I.e. only if $S_{k_{\text{met/ep}}(w)(t)}[P] \neq S_{K_{\text{met/ep}}(w)(t)}$.
b. If defined, $[\![\textit{will/werden}_{\textit{met/ep}}\ p]\!]^{c,g,w,t} = 1$ iff $p(s\langle w, \bigcap K_{met/ep}(w)(t)\rangle)$

This makes the at-issue content of *will* quasi-vacuous. It is assumed that conventional implicatures do not contribute at-issue content either (Potts (2005)). Therefore, an analysis that captures the contribution by (259-a) as CI-content lends itself. According to this idea, the lexical entry for *will/werden* could look like (260) (where the type specifies its meaning as CI-content, as provided by the system in Potts (2005)).

(260) $[\![\textit{will/werden}_{\textit{met/ep}}\ p]\!]^{w,t,c} = \lambda p.\ \lambda t.\ \lambda w. S_{k_{\text{met/ep}}(w)(t)}[P] \neq S_{K_{\text{met/ep}}(w)(t)}$.
Type: $\langle\langle s^a, t^a\rangle,\rangle\ \langle z^a\langle s^a, t^c\rangle\rangle\rangle$

In this thesis, however, I remain agnostic as to whether there is any merit in analyzing *will* as a CI-item. I note, though, that the indirectness associated with *werden* (I do not have the relevant data on *will*) can be plugged by an attitude verb, as in (261), while an epithet like '–the idiot–' is always speaker-oriented, as in (262).

(261) Lui ist auf Urlaub. Aber Lia glaubt, dass der Lui gerade die Schweine füttern wird.
Lui is on vacation. But Lia believes that Lui right.now the pigs feed will
'Lui is on vacation. But Lia believes that Lui will be feeding the pigs right now.'

(262) I don't think that Lui is an idiot. #But Lia believes that Lui –the idiot– left open the gate to the pigsty.

Another possibility, which I have already raised in Section 5.1 and which concerns the at-issue content of *will/werden*, is that it denotes a plurality of worlds. This idea is motivated by the fact that *will* and *werden* behave like neg-raising predicates (see Section 5.1). On that implementation, *will/werden* would parallel Križ's (2015) analysis of neg-raising attitude verbs and would denote a plurality of metaphysically or epistemically accessible worlds, as in (263).[6]

(263) $[\![\textit{will/werden}]\!]^{w,t,g} = \iota w'.w' \in MB_{met/ep}(w)(t)$

It would be interesting to see how a plurality of worlds implementation could explain the contrast to universal quantification over worlds (*must*). The parallel in the nominal domain is represented by the contrast between plural definites like *the pigs* and universally quantified pluralities like *all pigs*. As for similarities, first note that *will* but not *must* is scopeless (see Section 5.1), which is paralleled by the behavior of definite descriptions and universally quantified plurals respectively. Second, there is the fact that definite plurals in the nominal domain are in some sense weaker than universally quantified expressions: definite plurals typically allow for non-maximality, i.e. for exceptions, while universally quantified expressions do not.

(264) **Context:** *Almost the whole audience is smiling. Prof. Smith is known to never smile anyway.*

a. The professors were smiling.

b. #All the professors were smiling. (adapted from Križ 2015, p.71-2)

The position of this thesis is that speaker commitment to the prejacent of *will/werden* is obligatory. However, I am uncertain whether speaker commitment to the prejacent proposition would be predicted, if *will/werden* would denote a plurality of worlds. Although the data in Sections 5.2 and 5.3 showed that *will* seems to be acceptable if only a non-maximality part of the modal base satisfies the prejacent, it is not acceptable if the *actual* world fails to satisfy the prejacent. Intuitively, the difference between pluralities of individuals and pluralities of worlds (if they exist in natural language, see Schmitt (2021) for the view that they do not) is that (at least in the case of realistic modal bases) the real world seems to be a privileged element of the modal base. Therefore, it seems that a plurality of worlds analysis of *will/werden* should implement, next to non-maximality, some ingredient that guarantees centering around the actual world. An exploration of this idea has to be left to future work.

[6] I thank Viola Schmitt, who pointed me to this idea.

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Abstract

English *will* and German *werden* give rise to two separate readings: one where they induce future-orientation (their 'temporal reading') and one which is similar(!) to the interpretation of epistemic *must/müssen* and which does not lead to future-orientation (their 'epistemic reading'). They are exemplified in (i) –(ii) respectively. Expression that give rise to those readings I will refer to as 'alternating futures' (AFs).

(i) **Temporal reading**
(Do you know when Lia will come?)
a. Yes, she **will** come tomorrow.
b. Ja, sie **wird** morgen kommen.
yes, she will tomorrow come

(ii) **Epistemic reading**
(Where is Ava?)
a. Ava **will** be in the stable.
b. Ava **wird** im Stall sein.
Ava will in.the stable be

Since AFs are cross-linguistically common, a unified analysis of both of their readings is called for.
In Chapter 2, I discuss existing analyses of AFs, a majority of which treats AFs as necessity modals. With the exception of the choice function analysis by Cariani and Santorio (2018) and the purely temporal analysis by Kissine (2008), existing analyses unanimously assume a modally *weak* semantics for AFs. Except Werner (2006), existing modal accounts assume, in addition to a modal component, a temporal component in the lexical entry of AFs. In Chapter 3, I discuss the rudimentary meaning profile of *will* and *werden* as well as their differences. In Chapter 4, I argue that *will* and *werden* are *strong* modals (they entail their prejacent proposition). Metaphysical and epistemic settledness of the prejacent proposition *p* is compatible with a temporal reading of *will/werden p*. Furthermore, a speaker asserting (unembedded) *will/werden p* (on any reading) is committed to the truth of *p*. Those facts support a strong analysis of *will* and *werden*. Chapter 5 establishes that *will* and *werden* lack equivalence to *must* and *müssen*. First, *will* and *werden* but not *must* and *müssen* do not interact (non-trivially) with negation. Second, epistemic readings of AFs in English and German are compatible with epistemic unsettledness and their metaphysical (i.e. temporal) readings are compatible with metaphysical non-settledness. In Chapter 6, I propose to treat the at-issue content of *will* and *werden* as quasi-vacuous and follow the choice function implementation by Cariani and Santorio (2018). Obligatory future-orientation of temporal readings and the epistemic flavor of epistemic readings are accounted for by their presuppositional content. Following von Fintel and Gillies' (2010) implementation of the indirectness signal of *must*, I propose that *will/werden* is only defined if its prejacent is not directly settled by a privileged part of their modal base (their 'kernel'). If applied to epistemic and metaphysical kernels respectively, this constraint explains the epistemic modal flavor of epistemic readings and obligatory future-orientation of temporal readings. Chapter 7 addresses a loose end of my proposal and raises potential topics for future work on alternating futures.

Deutschsprachige Zusammenfassung

Der englische Ausdruck *will* und der deutsche Ausdruck *werden* haben je zwei unterschiedliche Lesarten: eine 'temporale Lesart', in der sie Futur-Orientierung ausdrücken und eine 'epistemische Lesart', in welcher sie ähnlich(!) zu der Bedeutung von epistemischen *must* und *müssen* interpretiert werden, siehe (i)–(ii). Ausdrücke, welche diese Arten der Interpretation haben nenne ich 'alternating futures' (AFs).

(i) **Temporal reading**
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(ii) **Epistemic reading**
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Da AFs sprachübergreifend häufig auftreten, ist eine einheitliche Analyse beider Lesarten geboten. In Kapitel 2 diskutiere ich existierende Analysen von AF-Ausdrücken. Ein Großteil der bestehenden Analysen behandelt AFs als Notwendigkeitsmodale. Mit der Ausnahme von der Choice Function Analyse von Cariani und Santorio (2018) und der rein temporalen Analyse von Kissine (2008), nehmen existierende Analysen einheitlich eine modal *schwache* Semantik für AFs an. Abgesehen von Werner (2006), nehmen bestehende Vorschläge neben modalen Komponenten stets auch rein temporale Bestandteile im lexikalischen Eintrag von AFs an. In Kapitel 3 diskutiere ich die rudimentären Eigenschaften von *will* und *werden*, sowie auch deren Unterschiede. In Kapitel 4 argumentiere ich dafür, *will* und *werden* als modal *starke* Ausdrücke zu analysieren. Dafür spricht, dass die temporale Lesart von *will/werden p* kompatibel mit Kontexten metaphysischer und epistemischer Gesichertheit ('settledness') von "p" ist, sowie die Tatsache, dass die Assertion von *will/werden p* die Sprecher*in auf die Wahrheit von *p* verpflichtet. Kapitel 5 zeigt, dass die Bedeutung von *will/werden* nicht völlig equivalent zu jener von *must/müssen* ist. Dies zeigt sich daran, dass erstere, im Gegensatz zu letzteren, nicht mit Negation interagieren. Weiters sind epistemische und metaphysische (d.h. temporale) Lesarten von *will/werden* jeweils kompatibel mit Kontexten epistemischer und metaphysischer Nicht-Gesichertheit. Kapitel 6 enthält den Vorschlag meiner Arbeit, demzufolge der at-issue Gehalt von *will/werden*, welchen ich als quasi-leer behandle, mit der von Cariani und Santorio vorgeschlagenen Choice Function Semantik erfasst werden kann. Die obligatorische Futur-Orientierung der temporalen Lesart und die epistemische Bedeutung der epistemischen Lesart werden durch präsuppositionalen Gehalt abgeleitet. Ich folge dem Vorschlag von von Fintel und Gillies (2010), die das 'Indirektheits-Signal' von epistemischen modalen auf eine Definiertheitsbedingung zurückführen, und schlage vor, dass *will/werden* nur dann definiert ist, wenn ein gewisser Teil der Modalgrundlage (der 'kernel') nicht direkt klärt (settled), ob der Präjazent wahr oder falsch ist. Jeweils angewendet auf epistemische und metaphysische Kernels, erklärt diese Einschränkung das epistemische 'modal flavor' der epistemischen Lesarten und die obligatorische Futur-Orientierung temporaler Lesarten von *will* und *werden*. In Kapitel 7 weise ich auf einen potentiell problematischen Aspekt meiner Analyse hin und rege mögliche Themen für zukünftige Arbeiten zu AF-Ausdrücken an.