Selection Function Semantics for *Will*

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Abstract

We develop a new semantics for the English auxiliary *will* that exploits a Stalnaker-style, single-world selection function. Unlike existing theories, the resulting analysis succeeds in satisfying three *desiderata*: it accounts for the modal character of *will*, it predicts its peculiar lack of scope interactions, and it vindicates intuitive judgments about the probabilities of *will*-claims.

We develop a new semantics for the English auxiliary *will* that exploits selection functions, similarly to Stalnaker's [24] semantics for conditionals. The semantic is motivated by three constraint, which we state in §1. In §2, we show that no existing account satisfies all three constraints. We state our analysis in §3. In §4 and §5, respectively, we show how this analysis accommodates indeterminacy about the future and intuitive judgments about the probability of *will*-claims. We close, in §6, by discussing the assertability of *will*-claims.

1   Three constraints

A plausible semantics for *will* must satisfy three constraints.

Constraint 1: The modal character of *will*. There is evidence that *will* is a modal rather than a tense. By this we mean that *will* manipulates a world parameter, similarly to modal auxiliaries like *must* or *might*. We understand the modal analysis as compatible with the claim that *will* also manipulates a time parameter; the salient contrast is with a view on which *will* manipulates exclusively a time parameter. The literature has provided three pieces of evidence for the modal view. Taken together, they seem to us compelling.

Shared morphology with *would*. It is widely accepted [1, 5, 13] that *will* shares morphology with the modal *would*. In particular, *will* and *would* have in common a modal morpheme, often represented as 'WOLL': *will* is PRESENT + WOLL; *would* is PAST + WOLL. The assumption of common morphology helps explain some semantic facts. For example, it explains why we can replace *will* with *would* in indirect reports of past utterances of *will*-sentences. If, on Tuesday, Harriet says "I will come to work tomorrow", then on Wednesday we would report Harriet's utterance by saying "Harriet said she would come to work today".

Epistemic readings of *will*. *will* has uses where it performs no temporal shift, but rather flags that the speaker is making a prediction on the basis of evidence [22]:

(1)   John will be in London by now.

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will in (1) doesn't perform temporal shift: as is made clear by the modifier *by now*, the prejacent of (1) has its reference time in the present. Moreover, in (1), *will* works as a marker of evidentiality. To see this, notice that (1) is infelicitous if uttered by someone who is looking directly at John, even if both are indeed in London. These facts are hard to explain on a purely temporal view, but easily accommodated by a modal view.

Modal subordination. As Peter Klecha [14] has argued, *will* allows for modal subordination. Roughly, this means that *will*-sentences can inherit domain restrictions from previous elements of the discourse.

(2)   If the supplies arrive tomorrow, it will be late in the day. They will contain three boxes of cereal.

(3)   The supplies might arrive tomorrow. It will be late in the day.

This makes these sentences pattern with modals, and unlike tenses.

(4)   a.   If the supplies arrive tomorrow, it might (/must) be late in the day. They might (/must) contain three boxes of cereal.
       b. #If the supplies arrived yesterday, it was late in the day. They contained three boxes of cereals.

The availability of modal subordination may be explained (as we do below) by treating *will* as a modal, and postulating that modals can stand in anaphoric relations to each other. By contrast, the pattern in the data seems hard to account for on a temporal analysis.

Constraint 2: Scopelessness. *will* displays no significant scope interactions with other lexical items: i.e., changes in the relative syntactic scope of *will* and other items don't affect truth conditions. Here we focus on negation, but the point generalizes. For a basic illustration, notice that (5-a) and (5-b) are truth conditionally equivalent.

(5)   a.   It will not rain.
       b.   It is not the case that it will rain.

The phenomenon persists in *will*'s interactions with items that lexicalize negation, like *doubt* (≈*believe that not*) and *fail* (≈*not pass*), as the equivalence of (6-a) and (6-b) shows.

(6)   a.   I doubt that Sam will pass his logic exam.
       b.   I believe that Sam will fail his logic exam.

The lack of scope interactions with negation yields a logical constraint, which for the moment we state by appealing to an intuitive notion of logical truth:

> **Will Excluded Middle** (preliminary take): ⌜*will* A ∨ *will not* A⌝ is a logical truth

Constraint 3: The reasonableness of future uncertainty. Speakers often have nonextreme credences in propositions expressed by *will*-claims. Moreover, this uncertainty seems sometimes rational. Consider an example:

> **Sports Fan:** Cynthia comes to work each day wearing a Warriors cap or a Giants cap, depending on the outcome of a fair coin toss. You are certain that for each of the two caps, it is an open possibility that Cynthia wears that cap tomorrow.

In this scenario, it seems permissible for you to assign credence .5 to an utterance of (7).

(7)   Cynthia will wear a Warriors cap.

This fact seems obvious, but (as we point out in the next section) it is hard to accommodate on existing modal accounts.

2   Existing analyses

In the the philosophical literature, *will* is usually analyzed as a tense (often in combination with a supervaluational treatment of the world parameter; see [25], [26], [3]). Obviously, these analyses violate Constraint 1, and hence fail to account for the data motivating a modal analysis. For reasons of space, we don't discuss accounts of this sort in this paper. Our goal is developing a modal account that meets in full Constraints 2 and 3.

In the linguistics literature, *will* is usually (though not invariably; see e.g. [27]) analyzed as a modal. Following Kratzer [15, 16], we take the semantic value of *will* to be relativized to a modal base and an ordering source, which throughout this section we denote via, respectively, the metavariables 'f' and 'g'. The modal base is function from the world of evaluation to a set of worlds (the domain of quantification of the modal); the ordering source is a function from the world of evaluation to a pre-order $\preceq_w$ which is defined on the domain. (For simplicity, we'll allow ourselves to be sloppy at times, talking of the modal base simply as a set of worlds, and of the ordering source simply as a partial ordering on that set.) In this framework, all existing modal analyses share a schematic form. Under the limit assumption, this form is:

(8) $[\![\textit{will } \mathsf{A}]\!]^{w,f,g} = 1$ iff $\forall w' \in \text{BEST}_{g(w)}(f(w))$, $[\![\mathsf{A}]\!]^{w'} = 1$

where the set of 'best' worlds is the set of worlds ranked as maximal by the ordering source:

(9) $\text{BEST}_{g(w)}(f(w)) = \{w' \in f(w) : \forall w'' \in f(w), w' \preceq_{g(w)} w''\}$

Together, (8) and (9) specify the schematic form of modal analyses. These analyses generally agree in taking the modal base of *will* to include at least all possible worlds that count as 'open possibilities' at the time of utterance. The relevant notion of openness is metaphysical, and connects to the intuition that future events, unlike past events, are not settled. For current purposes, we understand openness in this way (following [2]):[1]

> **Openness.** At least some contingent facts about the future are not settled at the present moment in time.

While modal analyses generally agree about the modal base of *will*, they differ widely in their treatment of the ordering source. The ordering is understood as capturing a notion of likelihood (e.g., [13]), normality (e.g., [6]), or match the speaker's knowledge (e.g., [10]). The choice between these options has significant empirical consequences. We set it aside because the basic problem concerns the schematic form that they all share. Any theory that implements the schematic analysis in (8) and assumes that the domain of the universal quantifier is larger than a singleton fails to satisfy at least one of our constraints, and in particular Constraint 3.

A first, potential difficulty concerns Constraint 2. By treating *will* as a universal quantifier, we predict that *will* (on a par with other universal modals, like *must* and *have to*) has nontrivial scope interactions with negation. This problem is well-known in the literature. The standard solution is Copley's [6]. Building on work by von Fintel on generics [7], she adds a presupposition

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[1]This notion of openness is conveniently neutral on philosophical views about determinism and bivalence.

to the meaning of *will*: *will* presupposes that its domain of quantification is uniform with respect to the prejacent—either all worlds satisfy it, or none does.[2]

(10) $[\![will\ \mathsf{A}]\!]^{w,f,g}$ is defined iff: either $\forall w' \in \textsc{best}_{g(w)}(f(w))$, $[\![\mathsf{A}]\!]^{w'} = 1$,
         or $\forall w' \in \textsc{best}_{g(w)}(f(w))$, $[\![\mathsf{A}]\!]^{w'} = 0$;
         if defined, it is true iff $\forall w' \in \textsc{best}_{g(w)}(f(w))$, $[\![\mathsf{A}]\!]^{w'} = 1$

This analysis validates **Will Excluded Middle**, at least on a notion of entailment that makes appropriate reference to presupposition (such as, e.g., von Fintel's Strawson Entailment [8]).

Building a uniformity presupposition in the lexical entry of *will* satisfies Constraint 2—we get the correct predictions about *will*'s compositional interactions with negation. But, crucially, (10) still fails to satisfy Constraint 3. To see this, consider an example.

> **Coin.** I'm about to toss a coin. The outcome of the coin toss is genuinely open. Moreover, you and I are both aware of this.

Suppose that I say:

(11)   The coin will land tails.

What credence should you assign to (11)?[3] The natural answer is '1/2'. Even if you have doubts about this specific answer, it is clear that the correct answer is not 'zero', or 'near-zero'. We take this to provide both a descriptive data point—the degree of belief that most speakers of English assign to the content expressed by (11) is substantially higher than zero—and a normative one—the appropriate degree of belief in the content of (11) as uttered in the Coin scenario is also substantially higher than zero. Yet, modal theories that conform to (8), whether or not they incorporate a uniformity presupposition, are committed to this answer.

To see why, notice that, on all the available glosses for the ordering source, the set of best worlds that (11) quantifies over includes both heads- and tails-worlds.[4] Speakers are in a position to know this, hence they should know that (11) is false—since (11) requires that *all* worlds quantified over are tails-worlds. As a result, theories conforming to (8) predict that speakers should assign zero, or in any case very low credence to it. Moreover, they predict that this credence assignment should count as the only rational one. These predictions seem incorrect.

Notice that the uniformity presupposition doesn't help here. The effect of the presupposition is to make (11) undefined in our scenario. It is unclear what credence, if any, one should assign to utterances made in these circumstances. But it seems both that speakers don't assign them positive credences, and that it would be irrational to do so. For a comparison, consider (12).

(12)   The King of France is bald.

It seems irrational to assign positive credence to that proposition, while also being certain that France is not a monarchy. And in fact, ordinary speakers have no temptation to do so.

Summing up: all existing modal theories violate Constraint 3. In the next section, we state a new semantics for *will* that satisfies all three constraints. The key move is dropping the idea that *will* is a universal modal. In fact, we deny that *will* has quantificational force at all.

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[2]Copley's implementation differs in a number of details that don't make a difference for current purposes.

[3]We assume that it makes sense to talk about the credence attaching to an utterance, and that this credence derives from the credence attaching to the proposition expressed by the utterance.

[4]If you think that this assumption is incorrect for this specific example, just switch examples. There will be analogous cases on any view on which the domain of quantification of *will* is larger than a singleton.

3   Selection function semantics for *will*

1. Overview.   Our semantics exploits an extended analogy with Stalnaker's [24] semantics for conditionals. We assume that *will* denotes a selection function, i.e. a function that maps a pair of a world w and a set of worlds S to a 'selected' world w'. Intuitively, the world selected represents the way things will actually be; this world is selected out of the set of worlds that are compatible with history up to the time of utterance. Before proceeding, a word about notation: we use sans-serif letters ('A', 'B', etc.) as metalinguistic variables over sentences; and boldface letters ('$\mathbf{A}$', '$\mathbf{B}$', etc.) as metalinguistic variables over sets of worlds.

2. Selection function semantics.   Let's start by defining selection functions.

> A function $s : W \times \mathcal{P}(W) \mapsto W$ is a *selection function* iff
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> i. **Inclusion**: if $\mathbf{A}$ is non-empty, $s(w, \mathbf{A}) \in \mathbf{A}$, and
> ii. **Centering**: if $w \in \mathbf{A}$, then $s(w, \mathbf{A}) = w$.

Informally, a selection function is a function s that maps a world w and a proposition $\mathbf{A}$ to a world w' and that satisfies Inclusion and Centering. Inclusion says that the world selected must verify the input proposition (provided that the input proposition is non-empty). Centering says that, if the input world verifies the input proposition, then s selects the input world itself.[5]

We treat *will* as a sentential operator, i.e. an operator that takes a full clause as argument. (This is a simplification, but a harmless one.)   We relativize interpretation to a context c (generally suppressed to avoid clutter), a world of evaluation w, an assignment g, and a selection function s. In addition to its prejacent, *will* takes a modal-base-type argument. We assume that modal bases are the semantic values of covert object language pronouns; we represent the latter as 'f_i', and the set of worlds individuated by a modal base and a world of evaluation w as '$\mathbf{F}_{i,w}$'. For shorthand, we often represent modal bases just as subscripts of modals. Hence we write '$will_f$' as a shorthand of '$will\ [f]$'.

At this point, we are ready to state the meaning of *will*. The schematic truth conditions of ⌜$will_f$ A⌝ are in (13), and the lexical entry for *will* in (14):

(13) $[\![will_f\ \mathsf{A}]\!]^{w,s,g} = 1$ iff $[\![\mathsf{A}]\!]^{s(w,g(f)),s,g} = 1$

(14) $[\![will]\!]^{w,s,g} = \lambda F_{\langle s,st\rangle}.\ \lambda p_{\langle s,t\rangle}.\ p(s(w, F(w))) = 1$

Informally, ⌜$will_f$ A⌝ is true (relative to w, s, g) just in case A is true relative to the world v that is selected by s when the input is the world of evaluation and *will*'s modal base (and s and g, which stay unshifted). Notice that we are leaving temporal shift entirely out of the meaning of *will*. We do this for simplicity. Introducing temporal shift would be easy,[6] but would be a distraction from our main innovation, which concerns the way in which *will* manipulates the world of evaluation parameter.

3.   Modal base and historical alternatives.   Before stating truth conditions, we need to specify what set of worlds is determined by the modal base of *will*. We said that current modal accounts, building on an assumption of Openness, identify the modal base with the set of possible worlds that are open possibilities at the time of utterance. Our proposal is similar, but

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[5]We leave it open whether further conditions apply to selection functions, as in Stalnaker's original theory, or whether (i) and (ii) are the only conditions in place.

[6]For example, following Kaufmann [13], we could let *will* extend forward the time interval at which the prejacent is evaluated.

not quite analogous. We assume that, as a default, the modal base of *will* at world w and time t is the set of **historical alternatives** of w at t. Here is how we define historical alternatives:

> Two worlds w and v are historical alternatives at t iff w and v match perfectly in their history (i.e., iff they match perfectly in matters of particular fact) up to t.

The notion of perfect match in matters of particular fact is borrowed from David Lewis [17]. Two worlds that perfectly match in matters of particular fact up to a certain point in time are duplicates—indiscernible copies of each other—up to that point. Two observations: first, historical alternatives form an equivalence class; second, since each world is a historical alternative of itself, the world of evaluation is always a member of the modal base when *will* is unembedded. Notice that we are not assuming that the modal base of *will* is invariably historical. We leave it open that (as it happens for, e.g., *have to* and *may*) *will* may also have a modal base of different flavor (more about this shortly).

We can now state the truth conditions of a sample sentence:

(15) $[\![$It will$_{f_i}$ rain$]\!]^{w,s,g}$ is true at w iff it rains at $s(w, [g(f_i)](w))$

Notice a consequence of our theory. Given our assumptions about the modal base, we know that the set $[g(f_i)](w)$ includes w, i.e. the world of evaluation itself. Moreover, given the Centering condition, we know that the selection function will select w itself, i.e. $s(w, [g(f_i)](w)) = w$. Hence the truth conditions in (15) simplify to:

(16) $[\![$It will$_{f_i}$ rain$]\!]^{w,s,g}$ is true at w iff it rains at w

More generally: in combination with our background assumptions, our semantics makes unembedded occurrences of *will* semantically vacuous with respect to the modal parameter.

(17) $[\![will_f \; \mathsf{A}]\!]^{w,s,g} = 1$ iff $[\![\mathsf{A}]\!]^{w,s,g} = 1$

Thus, when *will* occurs unembedded, our semantics effectively collapses on a simple nonmodal semantics which treated *will* as a mere tense. Nevertheless, as we show in the next paragraphs, our semantics differs from the nonmodal analysis in important respects.

4. Predictions.   Our theory provides the tools to predict all the data presented in section 1, at least in outline. For reasons of space, we can't give a full account of all these predictions, which are discussed in more detail in [4]. Here we give a brief survey of how the theory meets Constraints 1 and 2 (immediately below) and 3 (in section 5).

Shared morphology with *would*.   On a Stalnakerian semantics for *would*, the *will/would* connection is vindicated in a simple and elegant way: *will* and *would* realize the very same modal morpheme. The connection is less straightforward on an analysis on which *would* works as a universal quantifier; but let us notice that a selection semantics is anyway better equipped to account for the connection than any nonmodal theory.

Epistemic readings of *will*.   We noticed that *will* can have epistemic readings:

(1)   John will be in London by now.

Above, we suggested that the modal base of *will* defaults to a set of historical alternatives of the world of evaluation. But we don't assume that this is the only kind of modal base available for *will*. Rather, we allow that *will* may take an epistemic modal base. This alone doesn't account for the epistemic readings of *will*, but (presumably, in combination with an account of the evidential features of epistemic modals) is a first step towards such an account.

Modal subordination. Consider again our example of modal subordination involving *will*:

(2)   If the supplies arrive tomorrow, it will be late in the day. They will contain three boxes of cereal.

Our analysis can predict the relevant interpretation of (2), if combined with appropriate assumptions of *if*-clauses and a general account of modal subordination. As for the former: we assume (following Kratzer [16]) that *if*-clauses work as semantics restrictors of modal bases. As for the latter: we assume that modal subordination is generated by anaphoric connections between modal base pronouns (for an account in this style, see [9]). Against this background, all we need to do is assume that the modal bases of the two occurrences of *will* are coindexed:

(18)   If the supplies arrive tomorrow, it will$_{f_3}$ be late in the day. They will$_{f_3}$ contain three boxes of cereal.

Scopelessness. Let us start by defining a notion of validity.

> **Validity***: $\mathsf{A}_1, ..., \mathsf{A}_n \vDash \mathsf{B}$ iff, for any triple $\langle w, s, g \rangle$ such that $[\![\mathsf{A}_1]\!]^{w,s,g} = 1$, ..., $[\![\mathsf{A}_n]\!]^{w,s,g} = 1$, $[\![\mathsf{B}]\!]^{w,s,g} = 1$

We can now formulate **Will Excluded Middle** in a precise way:

> **Will Excluded Middle** (precise take): $\ulcorner$*will* A $\vee$ *will not* $\mathsf{A}$$\urcorner$ is logically true*.

(As usual, we take a sentence to be logically true* iff the inference from the empty set of premises to it is valid*.) It's easy to see that **Will Excluded Middle** holds.

> PROOF: let $\langle w, s, g \rangle$ be an arbitrary point of evaluation. We have that $\ulcorner$*will*$_f$ A $\vee$ *will*$_f$ *not* $\mathsf{A}$$\urcorner$ is true at $\langle w, s, g \rangle$ iff either **A** is true at $s(w, \mathbf{F}_w)$ or false at $s(w, \mathbf{F}_w)$. But the right-hand side of the biconditional is true for any choice of w, s, and $\mathbf{F}_w$. Hence, $\ulcorner$*will*$_f$ A $\vee$ *will*$_f$ *not* $\mathsf{A}$$\urcorner$ is true at $\langle w, s, g \rangle$. Since $\langle w, s, g \rangle$ was arbitrary, $\ulcorner$*will*$_f$ A $\vee$ *will*$_f$ *not* $\mathsf{A}$$\urcorner$ is true at any point of evaluation.

Validity* is a very strong kind of validity (it captures preservation of truth at a point of evaluation). Hence the fact that **Will Excluded Middle** holds in the form we state it immediately entails that sentences of the form $\ulcorner$*will* A $\vee$ *will not* $\mathsf{A}$$\urcorner$ are valid on a number of weaker notions of validity, including validity in the Kaplanian sense (i.e., preservation of truth at a context). See the full discussion in [4, §7] for further important logical consequences of our semantics.

4   Indeterminacy

Our semantics for *will* assumes that, at the time of utterance, there is a unique, fully specified way things will actually be. This assumption is controversial. Several theorists object that we have no right to assume that there is a fully specified way things will be. On the one hand, it might be that the future is open and that there is no fact of the matter about what world is actual [25, 3]. On the other, even if the future is not open, it is unclear that semantics can legitimately presuppose metaphysical claims about Openness [18, 19, 20].

Even if one agrees with these concerns, we don't think that the compositional semantics for *will* needs to be changed. Openness should be accommodated not by changing the lexical entry of *will*, but rather by allowing that there is indeterminacy in the value of contextual parameters that *will* appeals to. In particular, our denotation for *will* assumes that there is a single world of evaluation. We can preserve this assumption, but allow that it may be indeterminate which world this is. Let us show how this idea can be implemented at the technical level.

We start by defining a notion of truth at a context.[7] We do this in the standard contextualist fashion deriving from Kaplan's [12]. Take contexts to be fully specific situations that include (at least) a world, a time, and a speaker. (Crucially, we refrain from assuming that a fully specific situation in this sense corresponds to a concrete situation of utterance; more on this in a moment.) We define truth at a context by fixing the values of index parameters to the coordinates of the context. Formally:

> **Truth at a Context.** A is true as uttered at c iff $[\![A]\!]^{w_c, s_c, g_c} = 1$

It follows that, given a context, every *will*-claim has a determinate truth value. At the same time, if Openness is correct, it may be indeterminate which context corresponds to the actual situation of utterance, since it is unsettled which world the utterance takes place at.

One consequence of implementing Openness in this way is that both the supporter and the opponent of Openness can make use of our formalism. The disagreement over Openness is moved out of the semantic apparatus entirely. While we don't assume that semantics has to be neutral between different metaphysical options, we regard it as a welcome feature of our theory that theorists in both metaphysical camps can help themselves to it.

5   Probability of *will*-claims

Recall our Constraint 3. Ordinary agents are uncertain about the future. On one natural way to understand this uncertainty, this means that ordinary agents have nonextreme degrees of belief in the propositions expressed by *will*-claims. Moreover, at least in some cases, it seems that this uncertainty is rationally permissible, if not rationally required. Now we are equipped to show how our theory meets this constraint.

Recall our Sports Fan scenario: every day, Cynthia tosses a fair coin and, on the basis of the outcome, decides whether to wear a Giants hat or a Warriors hat. Consider an agent who assigns credence 1/2 to each of the two possibilities. Against this background, what we want to show is that this agent also has credence 1/2 in the proposition expressed by (7).

(7)   Cynthia will wear a Warriors cap.

To extract a verdict from our system, we need to specify (a) what agents' credences attach to, and (b) how we individuate the propositions expressed by *will*-claims.

As for the first point: we simply assume that credences are defined over sets of worlds. In particular, we assume that an agent's credences at a given time may be modeled by a probability function μ satisfying the usual constraints. For example, let μ model an agent's credences at the current point in time. Let $\mu(\mathbf{A}) = 1/2$, where $\mathbf{A}$ is the set of worlds where Cynthia wears a Warriors cap. Our task is to check that $\mu(\mathbf{PROP}_W) = 1/2$, where $\mathbf{PROP}_W$ is the proposition expressed by an utterance of (7).

As for the second point: we simply identify the proposition expressed by the utterance of a *will*-sentence at a given context with the set of worlds such that the utterance is true as evaluated at those worlds. Formally:

> **Content of A at** c: $\|A\|_c = \{w : [\![A]\!]^{w, s_c, g_c} = 1\}$

In what follows, we suppress reference to the context to avoid clutter.

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[7]Here we adopt a specific account of how indeterminacy affects the semantics, i.e. the one defended by [2] (see also [11]). Barnes & Cameron's view is part of a family of views that draw inspiration from supervaluatism but retain a bivalent semantics; the inspiration for accounts of this sort comes from [21].

It's easy to see that our semantics yields exactly the verdict we want. ‖Cynthia will wear a Warriors cap‖ is just the set of worlds in which Cynthia wears a warriors cap. On the assumption that the credence that our agent assigns to Warriors-cap-worlds is 1/2, she will also assign credence 1/2 to the proposition expressed by (7). More generally:

Transparency: For any prejacent A, $\|will_f \; \mathsf{A}\| = \|\mathsf{A}\|$.[8]

6   Assertion of *will*-claims

We close by noting an open problem for our semantics. If the future is genuinely open, then, for at least some future claims, it is not settled that those claims are true and it is not settled that they are false. Yet some of these claims seem okay to assert (and others not). For example:

(19)   The 2022 World Cup will take place in Qatar.

(19) seems assertable (unlike its negation). Yet, if Openness is true, presumably there are open possibilities where the 2022 World Cup takes place elsewhere, or doesn't take place at all.

This is a problem for all views of the future, not just ours. Nevertheless, we want to explore how it can be solved within our analysis. We briefly present two strategies. None of them succeeds as it stands, but perhaps one of them can be developed into a viable solution.

Strategy 1 allows that the modal base may be restricted to a subset of the historical alternatives to the world of evaluation. Depending on how it is sharpened, this proposal suffers from two potential problems. First, it might overgenerate. If we allow that the modal base might be restricted in this way, we risk predicting that an utterance of "The coin will land tails" concerning a genuinely open coin toss is perfectly appropriate—provided that the speaker intends to leave heads-worlds out of the modal base. This seems wrong. One might try to fix this by limiting the worlds one may leave out to low-probability or far-off worlds. Even with this patch, the proposal suffers from a second problem, i.e. it makes some wrong truth value predictions. Suppose that you utter (19) leaving out of the modal base non-Qatar-worlds, but that a chain of fluky events brings it about that the World Cup takes place in Iceland instead. In this case, your utterance is predicted to be true; but this seems incorrect.

Strategy 2 consists in weakening the link between assertability and truth. Following Stalnaker's account of assertion [23], think of assertion as a proposal to narrow down a set of worlds that we regard as live epistemic possibilities (roughly, what Stalnaker calls 'context set'). In general, the purpose of narrowing down the context set is locating the actual world with greater precision. But, if Openness is correct, there is no such thing as the actual world—rather, there are a number of equally viable candidates, and it unsettled which of them counts as the actual world. In this situation, making a *will*-claim may be seen as akin to placing a bet that the actual world will be in a subset of these candidates (the odds related to this bet may be given by the probability attaching to the relevant claim). Of course, this strategy needs to be developed in a rigorous fashion to be viable. In addition, since it doesn't connect the assertability of *will*-claims to any element that is syntactically localized in the modal *will*, it incurs another burden: it should explain why present tense sentences with a future reference time (like "The 2022 World Cup takes place in Qatar") are not assertable in the same range of circumstances as the corresponding *will*-claims.

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[8] PROOF: $v \in \|will_f \; \mathsf{A}\|$ iff $[\![will_f \; \mathsf{A}]\!]^{v,s,g} = 1$ iff $[\![\mathsf{A}]\!]^{s(v,\mathbf{F}_v),s,g[f \to \mathbf{F}]} = 1$ iff $v \in \|\mathsf{A}\|$. The first equivalence follows from our definition of content; the second from the truth-conditions of *will*, the third from $s(v, \mathbf{F}_v) = v$, which in turn follows from centering and $v \in \mathbf{F}_v$.

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