Circumstantial Indirectness: Future Orientation of Modals Revised

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Abstract

Circumstantially interpreted modals are obligatorily future oriented. Standard accounts of this correlation rely on a condition demanding that the modal base must be *diverse* with respect to the prejacent proposition (e.g. Condoravdi 2002; Rullmann and Matthewson 2018; Williamson 2021). I present evidence against this account by showing that circumstantial *will* is veridical and compatible with full certainty of the prejacent. I develop an account on which future orientation of circumstantial modals results from an 'indirectness presupposition' that has been independently motivated for the epistemic domain (von Fintel and Gillies 2010).

1 Introduction

This paper is concerned with the interaction between the interpretation of a modal auxiliary (its 'flavor') and the temporal interpretation of its embedded proposition (its 'prejacent'). Following Condoravdi (2002) I will call the time of evaluation of a modal its *temporal perspective* and the time of evaluation of the prejacent its *temporal orientation*. The central empirical puzzle of this paper is that circumstantial[1] modality obligatorily gives rise to future temporal orientation relative to the modal perspective. More precisely:

(1) **Puzzle:** For any modal $\mathcal{M}$ with temporal perspective t and temporal orientation t', if $\mathcal{M}$ is interpreted circumstantially, then $t < t'$.

Most existing accounts of this correlation involve DIVERSITY, a condition requiring that the modal base of a modal must be *diverse*, i.e. non-homogeneous, with respect to the prejacent. However, DIVERSITY is at odds with the *veridical* semantic profile of circumstantial (i.e. 'temporal') *will* which is commonly considered a modal auxiliary. A case in point are sentences like (2), which seem to be incompatible with DIVERSITY.

(2) In 1 hour, 60 minutes **will** have passed.

The present paper derives obligatory future orientation of circumstantial modals via an independently motivated mechanism of modal indirectness going back to von Fintel and Gillies (2010) which is compatible with full prejacent certainty and veridicality of the modal.

Section 2, recaps the temporal interpretation of modal auxiliaries and briefly describes the standard account of future orientation of modals. In Section 3, I present three pieces of data involving English circumstantial *will*, which will prove to be incompatible with the standard accounts, which rely on DIVERSITY. Section 4 contains my analysis of future orientation of modals. Section 5 concludes the paper.

[1]Note that this paper is specifically concerned with the *metaphysical* (or 'non-priority'(Thomas 2014)) subkind of circumstantial modality. I.e. circumstantial modality in its most basic form, in which it does not involve any ordering. Circumstantial modality seems to be future oriented quite generally, however (see Skibra 2020; Rullmann and Matthewson 2018).

2 Circumstantial Modality and Temporal Interpretation

Modal flavor is known to correlate with temporal orientation: circumstantial modals are invariably future oriented, while epistemic modals can be past or present oriented.[2] The English auxiliary *will*, which according to the vast majority of accounts is a modal auxiliary (Cariani and Santorio 2018; Condoravdi 2002; Copley 2002; Giannakidou and Mari 2018; Kaufmann 2005; Werner 2006 among others) brings out very clearly the questions regarding the nature of this correlation. A major argument in favor of a modal analysis of *will* is the existence of epistemic readings of *will* as exhibited by the sentence in (3) (see Klecha 2014 for further arguments). The temporal interpretation of *will* exhibited in (4), i.e. the reading usually glossed as a *future tense* in traditional grammars, has been claimed to correspond to the circumstantial reading of *will*.

(3) (*QUD: Where is Meg hiding?*) (epistemic)
She**'ll** be hiding in the attic.

(4) (*QUD: Who will win tomorrow?*) (circumstantial)
The Hens **will** win against the Boars (tomorrow).

Modal analyses of *will* capture the difference between the two readings in (3) and (4) in terms of a shift of the modal base: *will* takes an epistemic modal base in (3) and a circumstantial modal base in (4). This assumption alone leaves unexplained why *will*, and circumstantial modals in general, induce future orientation.[3] Existing accounts resort to a definedness condition demanding DIVERSITY of the modal base with respect to the prejacent proposition, as defined in (5). Together with a branching future conception of circumstantial modality, DIVERSITY assures that the evaluation time of the prejacent follows the evaluation time of the modal (Werner 2006; Rullmann and Matthewson 2018).[4]

(5) **Diversity condition:** (adapted from Rullmann and Matthewson 2018, p.300)
For any modal $\mathcal{M}$, prejacent p_j of type $\langle s,t\rangle$ with temporal orientation j, world w, time t and assignment g:
$[\![\mathcal{M}(MB)(p_j)]\!]^{w,t,g}$ is defined only if: $\exists w', w''[w', w'' \in MB(w,t)$ & $p_j(w')=1$ & $p_j(w'')=0]$.

A future-branching modal space is modeled as the set of worlds that are identical up to a certain time t and may diverge from each other after t. The relation of historic equivalence relative to a time is defined in possible world semantics as in (6). A circumstantial modal base then corresponds to the set specified in (7) (see Condoravdi 2002; Kaufmann 2005).

(6) **Historic Equivalence**
For all $t \in T$, $\simeq_t$ is an equivalence relation on $W \times W$ such that:
for any w,w' $\in$ W and t,t' $\in$ T, if $w \simeq_t w'$, and $t' < t$, then $w \simeq_{t'} w'$

(7) **Circumstantial Modal Bases**
$MB_{circ}(w)(t) = \{w' \mid w \simeq_t w'\}$.

Future orientation then results from DIVERSITY whenever the modal base is circumstantial: since all the worlds in a circumstantial modal base $MB_{circ}(w)(t)$ are identical to w up to t,

[2] The literature does not provide a definite answer to the question whether epistemic modals can be future oriented too. See Williamson (2021) for the view that they can and Klecha (2016) for the view that they can not.

[3] Positing an additional future-orienting temporal component either in the lexical entries of the modal or in a separate head in its scope (e.g. Cariani and Santorio 2018; Condoravdi 2002; Cariani 2021; Copley 2002; Giannakidou and Mari 2018; Rullmann and Matthewson 2018; Williamson 2021) simply shifts the question to why this temporal component does not induce future orientation with non-circumstantial flavors.

[4] The accounts by Klecha (2016) and Skibra (2020) are notable exceptions to DIVERSITY-approaches. The former account hard wires temporal orientation into the denotation of the respective modal base. The latter pursues an analysis in terms of causation. A comparison with my account is beyond the scope of this paper.

circumstantial modal bases can satisfy DIVERSITY only relative to a time following t.

3 Against Diversity: novel data from temporal *will*

If circumstantial *will* induces future orientation due to DIVERSITY, *will* should be incompatible with full certainty of the prejacent proposition, i.e. it should be infelicitous to assert circumstantial *will p* if all circumstantially accessible worlds support p. This prediction is disproved by examples in which the prejacent of *will* expresses a logical relation between two standardized measures of time, as in (8).

(8) In one hour, 60 minutes **will** have passed.

According to DIVERSITY, (8) should be felicitous only if the circumstantial modal space can be divided into one set of worlds w such that 60 minutes will have passed after one hour in w and one set of worlds w' such that 60 minutes *won't* have passed after one hour in w'. This goes against our basic intuitions regarding (8) and even seems impossible to model using a world-time frame. (8) is therefore a clear counterexample to the claim that *will* depends on DIVERSITY.

Second, *will* is compatible with a prejacent that is logically inferred from a known fact.

(9) **Context:** Al won an Olympic medal last year.
   a. [Al:] I have already won one Olympic medal. And I hope to win one more this year.
   b. [Bo:] In any case, at the end of your life you **will** have won at least one Olympic medal. So that's already very impressive.

In the context of (9), the proposition that *Al has won one gold medal* is true at the time of the utterance. It follows that for *any* world circumstantially accessible at the time of utterance the proposition *Al has won one Olympic medal* is true at any future time. The circumstantial modal base in (9) is hence non-diverse with respect to the prejacent of (9) as it homogenously supports the truth of the prejacent. Yet the *will*-sentence used by Bo in (9-b) is felicitous.

The third argument comes from the behavior of *will* regarding speaker commitment to the prejacent proposition. The scenario in (10) demonstrates that a speaker asserting *will p* commits herself to the truth of p.[5]

(10) a. [A:] The ship **will** arrive tomorrow. (based on von Fintel and Gillies 2010)
   b. [two days later, B:] See the ship did not arrive. You were wrong.
   c. [A:] #I was not wrong. Look, I only said 'the ship *will* arrive tomorrow'.

A's pointing to her use of *will* does not help her attempt to escape B's accusation of having asserted something false. This shows that through the assertion of *will p*, the prejacent p necessarily ends up being asserted as well. Since a modal operator can only assert its prejacent if it is veridical, I conclude that *will* is veridical, as defined in (11).

(11) **Veridicality**
A modal operator $\mathcal{M}$ is veridical iff $[\![\mathcal{M}(p)]\!]^w \rightarrow [\![p]\!]^w$. Else it is non-veridical.

Veridicality and DIVERSITY are incompatible. If the modal base of a universally quantifying modal satisfies DIVERSITY, then the evaluation world of the modal cannot be guaranteed to be

[5] Interestingly, even though *will p* seems to make a weaker statement than *must p* (Cariani and Santorio 2018; Mihoc et al. 2019), both variants come with obligatory speaker commitment to the prejacent, even in the case of epistemic *will* (Majdič 2022).

in the domain of quantification anymore, resulting in non-veridicality.[6] A 'centered' selection function analysis of *will* (Cariani and Santorio 2018; Cariani 2021), on which unembedded *will* essentially passes down its evaluation world to the prejacent, is incompatible with DIVERSITY too.[7] DIVERSITY as a general principle predicts that circumstantial *will p* must *always* signal that *p* is circumstantially uncertain. But due to its lexical semantics, *will p* can only ever be truthfully uttered, if *p* is true in the world of evaluation and hence is predicted to signal the exclusion of $\neg p$ worlds. Therefore, without any additional assumptions, veridicality of a modal is incompatible with a general requirement of DIVERSITY.

To conclude, temporal *will* does not behave as expected from a modal conforming to DIVERSITY. I have shown that temporal *will* is compatible with full circumstantial certainty of the prejacent and that it behaves like a veridical modal with regards to speaker commitment. I conclude that *will* is not subject to DIVERSITY. It follows that DIVERSITY cannot be the source of future orientation of circumstantial *will*. This leads me to reject DIVERSITY as the source of future orientation for *any* circumstantial modal.

4 Proposal: Indirectness as a source of future orientation

I propose an account that derives future orientation of circumstantial modals without resorting to DIVERSITY. Following von Fintel and Gillies (2010), I assume that a modal base is derived from a *kernel*. Intuitively, a circumstantial kernel is the set of propositions for which the past and present is wholly relevant. My account derives future orientation via an indirectness condition demanding that the prejacent must not be an issue in the partition induced by the kernel.

4.1 Setting the stage

I assume that the maximal projection of the prejacent branches into a node denoting a predicate of times (type $\langle i,t\rangle$) and a node denoting a semantically vacuous temporal pronoun Vac_i (type i). The modal combines with the prejacent via intensional function application (von Fintel and Heim 2021).

(12) a. $[_{\text{ModP}}$ *will/might* $[_{\text{PrejacentP}}$ [$\boldsymbol{Vac_i}$] [$\boldsymbol{\lambda t.p(t)}$]]]
b. $[\![\boldsymbol{Vac_i}]\!]^{g}$ = g(i) if g(i) is a time and undefined otherwise

I follow von Fintel and Gillies in assuming that the modal base of a modal is derived from a set of propositions K (for 'kernel) by intersecting all the propositions in K, i.e. $MB = \bigcap K$.

Which set of propositions corresponds to the kernel K_{circ} of a circumstantial modal base? Intuitively speaking, the set of historically equivalent worlds share a set of propositions p such that *what has already happened* in w at t is wholly relevant for p. To model this set, I first define the set of atomic sentences that are true in w at some time before or at t:

(13) **Atomic sentences about the past**
For any sentence ϕ, $\phi \in [\![HIST^{atom}_{t_0}]\!]^{w,g}$ iff:
a. ϕ is of the form $\boldsymbol{p(k_1,\ldots k_{n-1},t_i)}$ where $\boldsymbol{p}$ is a predicate of n-arity, $\boldsymbol{k_1 \ldots k_{n-1}}$ are terms, $\boldsymbol{t_i}$ is a time constant with index i st. $g(i) \leq g(0)$
b. and $[\![\phi]\!]^{w,g}$=1.

[6] It is quite clear that *will* is not a necessity modal (see Cariani and Santorio 2018; Cariani 2021). For further data that can be interpreted as arguments against a necessity analysis see Mihoc et al. 2019.

[7] Cariani and Santorio (2018) assume that *will* denotes a selection function *s*: $\mathcal{W}\times(\ \mathcal{W} \to \mathcal{P}(\mathcal{W})\ ) \to \mathcal{W}$ such that (a) if $MB(w)$ is non-empty, then $s(w,MB(w)) \in$ MB(w) ('success') and (b) if $w \in MB(w)$, then $s(w,MB(w)) = w$ ('centering').

The set of all atomic sentences true up to t indeed affords a complete description of the history up to t. Still $HIST^{atom}$ is not suitable as a circumstantial kernel. $HIST^{atom}$ only contains *atomic* sentences. But, given non-atomic prejacents, we will need the set of *all* sentences that are entirely about the past – atomic and non-atomic. I propose that a circumstantial kernel $K^{circ}_{t_0}$ corresponds to the set of sentences ϕ of the form $p(t_i)$ such that t_i is not preceded by t_0 and such that ϕ is entailed by an element in $HIST^{atom}_{t_0}$. (See example (18) for an illustration).

(14) **Circumstantial Kernels**
For any sentence ϕ, $\phi \in [\![K^{circ}_{t_0}]\!]^{w,g}$ iff:
a. $\exists\ \psi\ [\psi \in [\![HIST^{atom}_{t_0}]\!]^{w,g}\ \ \&\ \ \psi \rightarrow \phi]$
b. ϕ is of the form $\boldsymbol{p(t_i)}$ where $\boldsymbol{p}$ is any formula and $\boldsymbol{t_i}$ is a time such that $t_i \leq t_0$

From a circumstantial kernel K^{circ} the set of historically equivalent worlds is then derived by intersecting all the propositions in K^{circ} (i.e. $MB^{circ} = \bigcap K^{circ}$).[8]

4.2 Future orientation through indirectness

To account for the epistemic indirectness signaled by epistemic *must*, von Fintel and Gillies (2010) propose, in one of two suggested implementations, that epistemic modals have the presupposition in (15).[9] This presupposition demands that the prejacent proposition must not be an *issue* in the *subject matter* induced by the propositions in the kernel. I assume that a modal takes as its arguments a proposition p, a temporal pronoun t_i and a modal base $\bigcap K_{ti}$, whose time argument is co-indexed with the matrix time t_i.

(15) **Indirectness**
$[\![Mod(p)(\bigcap K_{t_i})(t_i)]\!]^{w,g}$ is defined only if p is not an issue in $S_{K_{t_i}}$
(where $S_{K_{t_i}}$ is the subject matter induced by K_{t_i})

The subject matter, determined by a proposition p can be captured as an equivalence relation between two worlds w, v such that w and v are in the same equivalence class if and only if p has the same truth value in w and v. This partitions logical space into two cells: one cell of worlds in which p is true and one in which p is false, see (16).

(16) A subject matter S is an equivalence relation on W such that
a. $S[P] = \{\langle w, v\rangle \in S : w \in P \text{ iff } v \in P\}$
b. P is an issue in S iff $S[P] = S$ (von Fintel and Gillies 2010, p.377)

The subject matter induced by a set of propositions K is then the set of partitions along the boundaries of the equivalence classes of each of the propositions in K, as defined in (17).

(17) Let $K = \{P_1 \dots P_n\}$, then: $S_K = S[P_1] \dots [P_n]$ (adapted from ibid.)

Adopting the presupposition in (15) for circumstantial modals allows us to derive future orientation without the problematic assumption of DIVERSITY: K^{circ}_t corresponds to the set of all propositions that are entirely about the past (of w relative to t). The presupposition in (17) demands that the prejacent must not be an issue in the partition induced by K^{circ}_t. Since *any* proposition entirely about the past is settled by this partition, it follows that the prejacent of a circumstantial modal must be future oriented.

To illustrate, let's recall the *Olympic medal* example in (9). In such a scenario, the circumstantial kernel would contain (minimally) the sentences in (18-b).

[8] Note that I will switch freely between the term 'kernel' (and the symbol K) as standing for a set of sentences and standing for the corresponding set of propositions, which contains for each sentence ϕ in K the intension of ϕ.

[9] My proposal represents additional evidence in favor of von Fintel and Gillies' (2010) *Implementation 2*.

(18) Let $\boldsymbol{t_1}, \boldsymbol{t_2}, \boldsymbol{t_3}, \boldsymbol{t_4}$ denote time constants such that $g(1) < g < (2) < g(3) < g(4) < g(5)$ are times ordered by temporal precedence ($<$) as indicated. Then:

a. $HIST^{atom}_{\boldsymbol{g(3)}} = \{\boldsymbol{Al\text{-}wins\text{-}medal}(\boldsymbol{t_1}), \ldots\}$

b. $K^{circ}_{\boldsymbol{g(3)}} = \{\boldsymbol{Al\text{-}wins\text{-}medal}(\boldsymbol{t_1}), \boldsymbol{PERF_i}(\boldsymbol{Al\text{-}wins\text{-}medal}(t_i))(\boldsymbol{t_2}), \boldsymbol{PERF_i}(\boldsymbol{Al\text{-}wins\text{-}medal}(t_i))(\boldsymbol{t_3}), \ldots\}$[10]

The circumstantial kernel $K^{circ}_{\boldsymbol{g(3)}}$ contains the sentences listed in (18-b). In accordance with (14), each of the sentences in $K^{circ}_{\boldsymbol{g(3)}}$ is entailed by an element in $HIST^{atom}_{\boldsymbol{g(3)}}$ and has as its temporal argument a time that is not later than $g(4)$. But crucially, the kernel $K^{circ}_{\boldsymbol{g(3)}}$ does not contain the sentence $[\boldsymbol{PERF_i}(\boldsymbol{Al\text{-}wins\text{-}medal}(t_i))(\boldsymbol{t_4})]$ because its time argument follows the time $g(3)$ relative to which the circumstantial kernel is evaluated. Consider now the sentence in (19) with the LF in (19-a), whose prejacent corresponds to the sentence in (19-b).

(19) Al will$_{\text{circ}}$ have won one medal.

a. LF: [... [$_{\text{Mod}}$ *will*] [$_{\text{PrejacentP}}$ [$\boldsymbol{Vac_k}$] $[\boldsymbol{\lambda t}.\ \boldsymbol{PERF_i}(\boldsymbol{Al\text{-}wins\text{-}medal}(t_i))(\boldsymbol{t})]]]$

b. PrejacentP $\rightsquigarrow \boldsymbol{PERF_i}(\boldsymbol{Al\text{-}wins\text{-}medal}(t_i))(\boldsymbol{Vac_k})$

Since $\boldsymbol{Vac_k}$ is defined as long as $g(k)$ is any time, the prejacent $[\boldsymbol{PERF_i}(\boldsymbol{Al\text{-}wins\text{-}medal}(t_i))(\boldsymbol{Vac_k})]$ does not contain any information with regards to its temporal orientation. It is the modal, which by demanding that its prejacent must not be an issue in its kernel, forces future orientation. For example, if $\boldsymbol{Vac_k}$ is mapped to the time denoted in (18) by $\boldsymbol{t_2}$, then (19) is undefined, since the sentence $[\boldsymbol{PERF_i}(\boldsymbol{Al\text{-}wins\text{-}medal}\ (t_i))(\boldsymbol{t_2})]$ is an element in $K^{circ}_{t_{g(3)}}$. Since any circumstantial kernel $K^{circ}_{t_n}$ contains all the sentences that are entirely about the past, a prejacent is an issue in $S_{K^{circ}_{t_n}}$ on *any* assignment g that maps $\boldsymbol{Vac_k}$ to a non-future time. The indirectness presupposition in (15) hence can never be satisfied whenever the temporal pronoun $\boldsymbol{Vac_k}$ is mapped to a non-future time. This is captured in (20).

(20) a. $[\![\boldsymbol{MODAL}(\bigcap \boldsymbol{K^{circ}_{t_n}})(\boldsymbol{PERF_i}(\boldsymbol{Al\text{-}wins\text{-}medal}\ (t_i))(\boldsymbol{Vac_k}))]\!]^{w,g}$ is defined only if $[\![\boldsymbol{PERF_i}(\boldsymbol{Al\text{-}wins\text{-}medal}\ (t_i))(\boldsymbol{Vac_k})]\!]^g_c$ is not an issue in $S_{K^{circ}_{t_n}}$ (by (15))

b. $[\![\boldsymbol{MODAL}(\bigcap \boldsymbol{K^{circ}_{t_n}})(\boldsymbol{PERF_i}(\boldsymbol{Al\text{-}wins\text{-}medal}\ (t_i))(\boldsymbol{Vac_k}))]\!]^{w,g}$ is defined only on assignments g such that $g(n) < g(k)$ (by (12-b) and (14))

This predicts that the temporal orientation of the prejacent lies in the future whenever the modal flavor of the modal is circumstantial, as desired.

5 Conclusion

I have suggested a novel account of the cross-linguistically observed correlation between future orientation and circumstantial modal flavor. I have shown that DIVERSITY-accounts of future orientation are incompatible with three pieces of data on English circumstantial *will* that have been hitherto ignored in the literature. I have proposed a novel definition of a circumstantial kernel on which future orientation of circumstantial modals can be modeled as a resulting from an independently motivated indirectness presupposition (von Fintel and Gillies 2010). The account predicts that any modal induces future orientation whenever its modal base is circumstantial.

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[10] For the meaning of $\boldsymbol{PERF}$ we could simply assume that $[\![\boldsymbol{PERF_i}(\phi)(\boldsymbol{t_k})]\!]^g = 1$ iff ϕ is a sentence of the form $p(t_i)$ and $g(i)$ is any time such that $g(i) < g(k)$. But any other commonly assumed denotation would do.

References

Cariani, Fabrizio (2021). *The modal future: A theory of future-directed thought and talk*. Cambridge University Press.

Cariani, Fabrizio and Paolo Santorio (2018). "Will done Better: Selection Semantics, Future Credence, and Indeterminacy". In: *Mind* 127.505, pp. 129–165. DOI: 10.1093/mind/fzw004. URL: https://academic.oup.com/mind/article/127/505/129/3053474 (visited on 02/21/2021).

Condoravdi, Cleo (2002). "Temporal interpretation of modals: Modals for the present and for the past". In: *The construction of meaning*. Ed. by David Beaver, Stefan Kaufmann, Brady Clark, and Luis Casiillas. CSLI Publications Stanford, CA, pp. 59–88.

Copley, Bridget (2002). "The Semantics of the Future". PhD thesis. Cambridge, MA: Massachusetts Institute of Technology.

Giannakidou, Anastasia and Alda Mari (2018). "A unified analysis of the future as epistemic modality: The view from Greek and Italian". In: *Natural Language & Linguistic Theory* 36.1, pp. 85–129. DOI: 10.1007/s11049-017-9366-z. URL: http://link.springer.com/10.1007/s11049-017-9366-z (visited on 06/16/2020).

Kaufmann, Stefan (2005). "Conditional Truth and Future Reference". In: *Journal of Semantics* 22.3, pp. 231–280. DOI: 10.1093/jos/ffh025. URL: http://academic.oup.com/jos/article/22/3/231/1672017/Conditional-Truth-and-Future-Reference (visited on 06/18/2020).

Klecha, Peter (2014). "Diagnosing Modality in Predictive Expressions". In: *Journal of Semantics* 31.3, pp. 443–455. DOI: 10.1093/jos/fft011. URL: https://academic.oup.com/jos/article-lookup/doi/10.1093/jos/fft011 (visited on 06/19/2020).

— (2016). "Modality and embedded temporal operators". In: *Semantics and Pragmatics* 9, pp. 9–1.

Majdič, Jakob (2022). "Temporal and epistemic readings of English "will" and German "werden"". MA thesis. University of Vienna. URL: https://phaidra.univie.ac.at/detail/o:1544849 (visited on 11/07/2024).

Mihoc, Teodora, Diti Bhadra, and Anamaria Falaus (2019). "Epistemic modals, deduction, and factivity: new insights from the epistemic future". In: *Semantics and Linguistic Theory*. Vol. 29, pp. 351–370.

Rullmann, Hotze and Lisa Matthewson (2018). "Towards a theory of modal-temporal interaction". In: *Language* 94.2, pp. 281–331. DOI: 10.1353/lan.2018.0018. URL: https://muse.jhu.edu/article/697182 (visited on 03/14/2024).

Skibra, Daniel (2020). "Future Orientation on an Event-Relative Semantics for Modals". In: *NELS 49: Proceedings of the Forty-Ninth Annual Meeting of the North East Linguistic Society*. Ed. by Maggie Baird. Vol. 3. Amherst, MA: GLSA, Dept. of Linguistics, pp. 149–162.

Thomas, Guillaume (2014). "Circumstantial modality and the diversity condition". In: *Proceedings of Sinn und Bedeutung*. Vol. 18, pp. 433–450.

von Fintel, Kai and Anthony S. Gillies (2010). "Must . . . stay . . . strong!" In: *Natural Language Semantics* 18.4, pp. 351–383. DOI: 10.1007/s11050-010-9058-2. URL: http://link.springer.com/10.1007/s11050-010-9058-2 (visited on 06/16/2020).

von Fintel, Kai and Irene Heim (2021). *Intensional semantics. Updated Version 2021*. Unpublished manuscript, MIT.

Werner, Tom (2006). "Future and non-future modal sentences". In: *Natural Language Semantics* 14.3, pp. 235–255. DOI: 10.1007/s11050-006-9001-8. URL: http://link.springer.com/10.1007/s11050-006-9001-8 (visited on 06/16/2020).

Williamson, Gregor (2021). "Worlds of the Future: Modality & Future Licensing at the Syntax-Semantics Interface". PhD thesis. UCL (University College London).