

Circumstantial modality and the diversity condition*

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Abstract. Condoravdi (2002) observed that the perfect cannot scope below metaphysical modals. She argued that this is a consequence of a constraint on the use of modal operators, the diversity condition (see also Werner, 2003). Recently, Abusch (2012) challenged Condoravdi's analysis by identifying instances of circumstantial modals that cannot scope over the perfect but that cannot be analysed as metaphysical modals either. In this paper, I show that the diversity condition can be exploited to derive the ban on low perfects with non priority circumstantial modals (Portner, 2009), and I explain why priority circumstantial modals are not subject to this constraint.

Keywords: Metaphysical modality, circumstantial modality, diversity condition.

1. Condoravdi's analysis and Abusch's critique

1.1. The diversity condition

In this subsection I will review Condoravdi's (2002) observations about the temporal orientation of modals, and her account of the absence of perfects in the scope of metaphysical modals. Following Kratzer (1977, 1981, 1991), modals are analysed with respect to conversational backgrounds, i.e. functions which map a world of evaluation to a set of propositions. A modal base is a type of conversational background that defines the domain of quantification of a modal operator, namely the intersection of the propositions in the modal base. A second type of conversational background, an ordering source, may be used to impose an order on this set of worlds.

When discussing the temporal interpretation of modal statements, i.e. statements consisting of a proposition embedded under a modal operator, it is useful to distinguish the temporal perspective of the modal from its temporal orientation. The temporal perspective of the modal statement is the time with respect to which the modal base is defined. In (1), it is the time at which the obligation holds, namely the time of utterance. The temporal perspective of a modal may be analysed as a parameter of its modal base, which is then analysed as a function from worlds to times to sets of propositions. The temporal orientation of a modal statement is the time of evaluation of its prejacent. In (1), the temporal orientation lies in the future of the temporal perspective.

(1) John must pay his rent tomorrow.

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Condoravdi (2002) made a series of observations that relate the availability of epistemic versus metaphysical interpretations of modal operators, to the relations between the temporal perspective and orientation of these operators. Her observations concern polysemous modals, such as *might* in sentence (2). This sentence is ambiguous. It has two interpretations which are selected by appropriate continuations in (3) and (4). In (3), the modal *might* is interpreted epistemically. (3) is an assertion that John's having won the game is compatible with the speaker's information state at the time of utterance. In (4), the modal *might* is interpreted metaphysically. (4) is an assertion that John's winning the game was a possible continuation of the world of evaluation at some time in the past of the time of utterance.

- (2) John might have won the game.
- (3) John might have won the game, but it is also possible that he lost it.
- (4) John might have won the game, but in the end he didn't.

Following Condoravdi (2002) and Thomason (1970), we say that a world w' is metaphysically accessible from w at a time t iff w and w' have the same history up to t . The historical equivalence relation between worlds defined in (5) allows us to define metaphysical modal bases:

- (5) *Historical equivalence relation*
The historical equivalence relation is that relation which holds between two worlds w and w' at a time t iff the histories of w and w' are identical up to t . It is written $w \approx_t w'$.
- (6) *Metaphysical modal base*
A metaphysical modal base is a function from a world w to a time t to the singleton set containing the characteristic function of the set of worlds w' that are historically equivalent to w at t , i.e. $\lambda w.\lambda t.\{p : p = \lambda w'.w \approx_t w'\}$

Condoravdi (2002) first observes that the temporal orientation of polysemous (epistemic and metaphysical) modal auxiliaries depends on the aktionsart of their complement: they have a present orientation (i.e. the temporal orientation is identical to the temporal perspective) with stative predicates and progressive predicates but they have a future orientation (i.e. the temporal orientation lies in the future of the temporal perspective) with non-progressive eventive predicates. Importantly, they never have a past orientation. Let us call this phenomenon the *non-past orientation* of epistemic and metaphysical modals.

- (7) Anna might be sick.
- (8) Anna might win the game.

Secondly, she observes that a perfect aspect cannot scope below a metaphysical modal operator. Examples (9) to (11) show that the perfect can scope below a modal operator. (9) shows that while *already* has a sortal restriction against non-perfect eventive predicates, this restriction does not apply to perfect forms. Condoravdi takes this as an indication that *already* scopes over the perfect in (9). By the same reasoning, the contrast between (10) and (11) indicates that the perfect has scope below *already* in (10), and therefore that it has scope below the modal operator. Finally, (12) shows that *still* is in complementary distribution with the perfect in a minimal clausal domain.

- (9) He *(has) already returned.
 (10) He might have already returned.
 (11) He might (*already) return.
 (12) He has (*still) won.

These diagnostics allow Condoravdi to correlate the scope of the perfect with the epistemic or metaphysical interpretation of polysemous modal auxiliaries. The acceptability of the continuations in (13) and (14) shows that the modal auxiliary is interpreted epistemically in the former but not in the latter, i.e. *might* is interpreted metaphysically in (14) but not in (13). The use of *already* and *still* indicates that the perfect has scope below *might* in (13), while it has wide scope in (14). In sum, the metaphysical interpretation of *might* and other polysemous modals is unattested when the perfect scopes below the modal operator. Let us call this the ban on low perfects (with metaphysical modals).

- (13) Anna might have won already, # but in the end she didn't.
 (14) At that point, Anna might still have won, ✓ but in the end she didn't.

Condoravdi (2002) explains the non-past orientation of epistemic and metaphysical modals by building a non-past temporal operator in the denotation of modal auxiliaries, and she derives the ban on low perfects by resorting to a constraint on the use of modal bases, the diversity condition (a similar analysis was proposed independently by Werner, 2003). Both aspects of Condoravdi's analysis have been criticized (see e.g. Abusch, 2012; Matthewson, 2012). In this paper, I will only be concerned with her analysis of the ban on low perfects. She argues that this restriction is due to the following diversity condition (which differs in minor respects from Condoravdi's original formulation):

- (15) *Diversity condition*
 A context c with context set CS , can assign a modal base M to a modal operator with a temporal perspective t and a prejacent P only if there is a world w in CS and there are

worlds w', w'' in $\bigcap M(w)(t)$ such that $P(w')(t) = 1$ and $P(w'')(t) = 0$.

When the perfect is in the scope of a modal operator interpreted metaphysically, the diversity condition is violated. Consider for instance sentence (16-a) with the logical form in (16-b). Assume the semantic derivation in (17). If M is a metaphysical modal base, the prejacent of the modal operator is true in every world in $\bigcap M(w)(t_c)$, since by definition every world in $\bigcap M(w)(t_c)$ is identical up to t_c and the truth of the prejacent only depends on facts that precede t_c .

- (16) a. Anna might have won.
 b. [PRES [might [PERF [Anna win]]]]
- (17) a. $\llbracket \text{Anna win} \rrbracket^c = \lambda t. \lambda w. \mathbf{win}(w)(t)(\mathbf{Anna})$
 b. $\llbracket \text{PERF} \rrbracket^c = \lambda P. \lambda t. \exists t' [t' < t \wedge P(w)(t')]$
 c. $\llbracket \text{might} \rrbracket^c = \lambda P. \lambda t. \lambda w. \exists w' [w' \in \bigcap M(w)(t) \wedge P(w')(t)]$
 d. $\llbracket \text{PRES} \rrbracket^c = t_c$
 e. $\llbracket (16\text{-b}) \rrbracket^c = \lambda w. \exists w' [w' \in \bigcap M(w)(t) \wedge \exists t' [t' < t_c \wedge \mathbf{win}(w')(t')(\mathbf{Anna})]]$

1.2. Abusch's rejection of metaphysical modality

Abusch (2012) argues that some uses of *might* and *could* to which Condoravdi would assign a metaphysical modal base should rather be analysed with a non-metaphysical circumstantial modal base. This result challenges Condoravdi's account of the ban on low perfects with the non-epistemic interpretation of these modals (cf. Matthewson, 2012), since her account relies on a characteristic property of metaphysical modality, namely that the domain of quantification consists of worlds that are identical up to the temporal perspective of the modal.

I will only discuss one of Abusch's (2012) arguments, which I think is representative of her general line of reasoning. Consider example (18) in the context given in (19).

- (18) In week 11 of the football season, mathematically, Buffalo could still have reached the playoffs.
- (19) In evaluating sentences like these, one pays attention only to the history of play in w_0 up to the reference time t_1 , the league schedule in w_0 , and the league regulations in w_0 . Other facts about w_0 are stipulated to be irrelevant. Suppose for instance that in week 11, all of the Buffalo players had broken legs, so that it was impossible for Buffalo to win any more games [...] Facts such as these are irrelevant to assessing the truth of (18).
 (Abusch, 2012, renumbered)

The issue with this example is that if the modal base of *could* was metaphysical, every fact of the world of evaluation that precedes week 11 of the football season should hold in the metaphysical alternatives, and therefore the players would have broken legs in all alternatives, preventing them to play any further game and reach the playoffs. That such facts are not taken into account when evaluating the truth of (18) suggests that the modal base is not metaphysical but only circumstantial: only certain facts of the world of evaluation matter, namely those that are described by the adverb *mathematically*, i.e. facts such as the number of games that had been played and won by Buffalo at the time of evaluation, and the schedule of the rest of the season at that time. The same point can be made with ambiguous modals like *might*:

(20) At that point, Buffalo might still have reached the playoffs.

What are the consequences of Abusch's observation for Condoravdi's account of the ban on low perfects? The unattested non-epistemic interpretation of *might* in (21) is supposed to be blocked by the diversity condition. If the modal base is metaphysical, then every world in its intersection is identical to the evaluation world up to the temporal perspective of the modal. Since the truth of the prejacent depends on facts that precede the temporal perspective of the modal, the prejacent is homogeneously true or false in the intersection of the modal base. The issue if the modal base is circumstantial but not metaphysical is that the history of the worlds in the intersection of the modal base may differ from that of the evaluation world even before the temporal perspective. Therefore, without any further restriction on the modal base, there may be two worlds in its intersection that assign a different truth value to the prejacent, in which case the diversity condition would be satisfied.

(21) Buffalo might have reached the playoffs already.

The objective of this paper is to convince the reader that there are indeed restrictions on circumstantial modal bases that prevent such a situation from arising, i.e. that Abusch's observation, even if it is correct, does not jeopardize Condoravdi's (2002) account on the ban on low perfects with would-be metaphysical modals.

2. The diversity condition without metaphysical modality

2.1. Pure circumstantial modals

In order to rule out infelicitous uses of polysemous modals with a past orientation as a violation of the diversity condition, it is sufficient to make sure that these modals are subject to the following conditions:

1. The modal base is a set of propositions that describe certain facts of the evaluation world at the temporal perspective.
2. If the prejacent describes an event that does not follow the temporal perspective, the modal base entails the prejacent or its negation.

Assigning a metaphysical modal base to these modals is one way to ensure the satisfaction of these conditions. But what if the modal base is circumstantial and not metaphysical? Circumstantial modal bases are sets of propositions that describe relevant facts of the world of evaluation. Therefore, we must ensure that whenever the prejacent of a modal that is subject to the ban on low perfects describes an event that precedes the temporal perspective, that event should count as a relevant fact described by the modal base. In this section I will argue that this is the case with pure circumstantial modals.

I call pure circumstantial modals these circumstantial modal operators that are not relative to a preference inducing ordering source, such as the law, some agent's desires or goals, etc. In other words, they are a subset of circumstantial modals that complement the set of what Portner (2009) calls *priority modals*, i.e. deontic, bouletic and teleological modals. I will assume that they have an empty or a stereotypical ordering source. (22) and (23) are examples of pure circumstantial modals.

- (22) Hydrangeas can grow here.
 (23) At that point, Mary may still have won the game.

I define circumstantial modal bases as in (24). This definition is incomplete, insofar as it does not state what facts or propositions that describe facts are, and it does not state what the criterion of relevance c is. I try to complete this definition in what follows.

(24) *Circumstantial modal base*

A circumstantial modal base is a function from a world w to a time t to the set of propositions that describe facts of w at t that are relevant according to some criterion c .

I wish to show that whenever the prejacent of a pure circumstantial modal describes an event that does not follow the temporal perspective of the modal, the prejacent is part of the circumstantial modal base. To do so, I will use three auxiliary assumptions. The first of these is that there is no future fact. More precisely, I define propositions that describe facts as in (25). Note that I do not define facts themselves. I hope that I can evade this notoriously complicated philosophical problem (see Casati and Varzi, 2010; Mulligan and Correia, 2013, and references therein) and that the definition in (25) will be precise enough to support a reasonably predictive theory of circumstantial modal bases.¹

(25) *Descriptions of facts*

A proposition ϕ describes a fact f at a time t if and only if there is some event e such that for every world w , $\phi(w)$ is true iff e happens in w and the runtime of e does not follow t .

The second assumption specifies the relevance criterion used in the computation of modal bases of pure circumstantial modals:

(26) *Relevant facts for pure circumstantial modals*

The facts that are described by the modal base of a pure circumstantial modal operator O are all the facts f such that knowing whether f obtains is relevant to assessing the truth of the prejacent of O .

(26) states that propositions that describe facts but that are not relevant to assessing the truth of the prejacent are not included in the modal base of pure circumstantial modals. The infelicity of (27) supports this claim, where the adverbial clause conveys that the fact that I was born in 1981 is described by some proposition in the circumstantial modal base.

(27) #Given the fact that I was born in 1981, hydrangeas can grow here.

(26) also states that *all* proposition that describe facts and that are relevant to assessing the truth of the prejacent are included in the modal base of pure circumstantial modals. This claim is supported by Nauze's (2008) observation that the (pure) circumstantial statement (28-a) is infelicitous in the

¹Here I assume that an event can exist in different worlds. If the reader does not share this philosophical belief, she may reformulate (25) using counterparts of events.

context described in (29), contrary to the epistemic statement (28-b). This shows that if it is necessary for the prejacent to be true that a certain fact f obtain, the omission of f 's description from the modal base (in this case due to incomplete knowledge) makes a pure circumstantial statement infelicitous.

- (28) a. Hydrangeas can grow here.
 b. There might be hydrangeas growing here.
- (29) Suppose this time the climate in this faraway country is very much like home (temperate) but I do not know about the soil (at home the soil is alkaline, but on this piece of land I do not know whether it is alkaline or acid). As a matter of fact, I know that pilgrims had hydrangea seeds with them when they discovered this piece of land. Suppose finally that I know that hydrangeas need a temperate climate and an alkaline soil to grow. In this situation, sentence (28-b) is true. It is possible that the soil is alkaline, that the pilgrims planted some hydrangeas and thus that they still grow in the region. However, sentence (28-a) is not true in the present situation (as would follow in the standard framework); it is not false either but it is undecided awaiting for further knowledge about the soil's pH.
 (Nauze, 2008, renumbered)

Finally, the third and last assumption is that knowing whether a proposition ϕ is true is always relevant to assessing the truth of ϕ . I think that this assumption is trivial and does not require independent support.

- (30) *Principle of self-relevance*
 Knowing whether ϕ is true is relevant to assessing the truth of ϕ .

As a consequence of these three assumptions, a pure circumstantial modal whose prejacent describes an eventuality that is ongoing at or precedes its temporal perspective violates the diversity condition. Consider for instance (31). The temporal perspective of the modal is the utterance time. Assume that *might* is interpreted as a circumstantial modal – we want to explain why the sentence is infelicitous under this interpretation. Since the prejacent of the modal is the proposition ϕ that there is an event of Anna winning the game that precedes the utterance time, either this proposition or its negation is a member of the modal base, by principles (26) and (30). Indeed, if there was an event of Anna winning the game in the world of evaluation before the time of utterance, then ϕ is in the modal base, which entails that there was such an event before the time of utterance in every circumstantial alternative. On the other hand, if there was no event of Anna winning the game in the world of evaluation before the time of utterance, then the negation of ϕ is in the modal base, which entails that there is no such event in any circumstantial alternative. In both cases, the diversity condition is violated, since the prejacent is either homogeneously true or homogeneously false across the circumstantial alternatives.

- (31) Anna might have already won the game.

The same reasoning can be applied to other types of pure circumstantial modals, such as ability modals. In French, *pouvoir* can be interpreted as an ability modal, e.g. (32), or as an epistemic modal. However, when a perfect auxiliary scopes below *pouvoir*, the ability interpretation is unavailable, as illustrated in (33) which only has an epistemic reading. Note that the ability interpretation resurfaces when the perfect has wide scope, as in (34) (in addition, (34) triggers an actuality inference, see Bhatt, 1999; Hacquard, 2006; Homer, 2010).

- (32) Michel peut soulever 100 kg d'un seul bras.
'Michel can lift 100 kg with one arm.'
- (33) Michel peut avoir soulevé 100 kg d'un seul bras.
'Michel might have lifted 100 kg with one arm.'
- (34) Michel a pu soulever 100 kg d'un seul bras.
'Michel could lift 100 kg with one arm.'

2.2. Other circumstantial modals

Not all circumstantial modals are subject to the ban on low perfects. In particular, the perfect may scope below certain priority modals, i.e. circumstantial modals that are relative to a preference inducing ordering source, such as deontic modals, bouletic modals or teleological modals (Portner, 2009). Here, I will only discuss deontic and teleological modals.

Teleological modals are not subject to the ban on low perfects, as illustrated in (35) and (36).

- (35) To become a virtuoso violinist, you must have started to practice early in your life.
- (36) To become a virtuoso violinist, you should have started to practice early in your life.

On the other hand, the perfect may scope below some deontic modals but not all of them. As observed by Ninan (2008), while *ought to* is felicitous with a past orientation in (37), *must* can only be interpreted epistemically in (38).

- (37) Sam ought to have gone to confession.
- (38) Sam must have gone to confession.

In the previous subsection, I proposed an account of the ban on low perfects that relies on the assumption that the modal base of a pure circumstantial modal includes all propositions that describe facts and that are relevant to assessing the truth of the prejacent. In this subsection, I will argue that teleological and deontic modals are not subject to the ban on low perfects because their modal base is not subject to this requirement.

2.2.1. Teleological modals

Teleological modals describe what is possible or necessary given certain goals. These modal statements are circumstantial insofar as their truth depends on certain facts about the world of evaluation, and not just on the goals to be achieved. Consider for instance (39), from Sæbø (2001) via von Fintel and Iatridou (2005). Whether it is necessary for the addressee to take the A train or not does not only depend on the goal to go to Harlem that the assertion ascribes to her, it also depends on certain facts about the current location of the addressee, the situation of public transportation systems, etc.

(39) To go to Harlem, you ought to take the A train.

von Stechow (2004) and von Fintel and Iatridou (2005) argue that the purpose clause in such modals describe a designated goal which is added to the circumstantial modal base, in the spirit of Kratzer's (1981) analysis of conditionals. This extended modal base is ordered by the set of goals of the addressee.

The relation between the prejacent and the modal base in teleological modals is intuitively quite different from what we observed in pure circumstantial modals. The modal base of pure circumstantial modals describe facts that condition the realization of an eventuality described by the prejacent. As a consequence, it is possible to justify a possibility statement with this flavour by pointing out that the prejacent is actually true, as illustrated in (40). By contrast, the prejacent of a teleological modal describes means to reaching certain goals, and the circumstantial modal base describe facts that are relevant to determine which means can be used to reach these goals. Consequently, whether the prejacent is actually true is irrelevant to a teleological statement, as demonstrated by the oddity of the continuation in (41), if it is intended as a justification of the preceding modal statement.

(40) Of course hydrangeas can grow here. Hydrangeas DO grow here!

(41) Of course you can take the A train to go to Harlem. #You ARE on the A train!

I propose that the circumstantial modal base of teleological modals is subject to the following constraint. Consequently, the principle of self-relevance does not force the inclusion of a prejacent with a past orientation in the modal base, which explains why a teleological modal may have a perfect operator in its scope without violating the diversity condition.

(42) *Relevant facts for teleological modals*

The facts that are described by the modal base of a teleological modal with designated goal g are only facts f such that knowing whether f obtains is relevant to determining which means are available to reach g .

2.2.2. Deontic modals

Deontic modals describe what is possible or necessary given certain rules or moral principles. Their prejacent describes a state of affairs that is presented as (not) permissible or (not) mandatory, given the facts described in the modal base and the rules described in the ordering source.

(43) John must be fined.

As with teleological modals, knowing whether the prejacent is actually true or false is not helpful to assess the truth of the modal statement. This is illustrated in (44), where the continuation is odd, if it is intended as a justification of the modal statement.

(44) Of course John may eat a piece of cake. #He is eating one right now!

I propose that the modal base of deontic modals is subject to the following constraint. Here again, the principle of self-relevance will not force the inclusion of a prejacent with a past orientation in the modal base.

(45) *Relevant facts for deontic modals*

The facts that are described by the modal base of a deontic modal with ordering source g are only facts f such that knowing whether f obtains is relevant to determining whether the prejacent is inconsistent with or a consequence of the rules described in g .

This assumption explains why the perfect may scope below the deontic modal in (46), but it leaves the absence of deontic interpretation of (47) unexplained.

- (46) Sam ought to have gone to confession.
 (47) Sam must have gone to confession.

According to Ninan (2008), it is performativity that explains the lack of past orientation of *must*-type deontic modals. Performative deontic modals are interpreted as directive speech acts on top of their modal assertive meaning, as illustrated in (48). When the temporal perspective of the modal is the time of utterance, the perfect cannot scope below the modal because it doesn't make sense to ask an agent to realize a past action.

- (48) Sam must go to confession.
Assertion: Among the set of circumstantially accessible worlds, those that are optimally lawful are all worlds in which Sam goes to confession.
Directive speech act: the speaker places a requirement on the addressee to ensure that Sam goes to confession.

An interesting prediction of this analysis is that the ban on low perfects with performative deontic modals should disappear when the prejacent describes a future eventuality, which may be the case if the temporal perspective of the modal is in the future. In such a case, the past orientation of the prejacent would not be incompatible with the directive speech act, since the prejacent could still describe a state of affairs that lies in the future of the time of utterance. This prediction is borne out, as demonstrated by the availability of a deontic interpretation in (49), from Portner (2009).

- (49) Mary must have left by the time I get back.

Unfortunately, this analysis does not account for the persistence of the ban on low perfects with non-performative deontic uses of *must*. This issue is illustrated in (50) from Ninan (2008).

- (50) #If Sam must have gone to confession, he did something wrong.

This casts serious doubts on Ninan's analysis. One way out of this problem is to assume that *must* actually has a metaphysical modal base. This would derive the ban on low perfects as a straightforward consequence of the diversity condition. However, in the absence of independent evidence to support this hypothesis, it is hardly explanatory.

3. The diversity condition and the non-past orientation of pure circumstantial modals

Kratzer (2011) and Matthewson (2012) argue that the future orientation of circumstantial modals is due to the use of a (covert) prospective aspect in their complement, rather than built in the lexical entry of these modals. Cross-linguistic support for this analysis comes from Gitksan, a language where the prospective aspect is overt and obligatory with circumstantial modals (Matthewson, 2012).

In order to discuss this analysis, it will be useful to adopt the following lexical entries. Modal operators are defined with respect to a modal base M and an ordering source O , where $Best(M)(O)(w)(t)$ is the set of worlds in $\bigcap M(w)(t)$ that are best ranked with respect to the ordering induced by $O(w)(t)$.

$$(51) \quad \llbracket \text{might} \rrbracket^c = \lambda P. \lambda t. \lambda w. \exists w' [w' \in Best(M)(O)(w)(t) \wedge P(t)(w')]$$

$$(52) \quad \llbracket \text{PFV} \rrbracket^c = \lambda P. \lambda t. \lambda w. \exists e [P(e)(w) \wedge \tau(e) \subseteq t]$$

$$(53) \quad \llbracket \text{PERF} \rrbracket^c = \lambda P. \lambda t. \lambda w. \exists t' [t' < t \wedge P(t')(w)]$$

$$(54) \quad \llbracket \text{PROSP} \rrbracket^c = \lambda P. \lambda t. \lambda w. \exists t' [t' > t \wedge P(t')(w)]$$

$$(55) \quad \llbracket \text{PRES} \rrbracket^c = t_c$$

$$(56) \quad \llbracket \text{PAST} \rrbracket^c = \lambda P. \lambda w. \exists t [t < t_c \wedge P(t)(w)]$$

The following examples illustrate the prospective analysis of the future orientation of modals.

- (57) a. It might rain.
 b. PRES > might > PROSP > PFV
 c. $\lambda w. \exists w' [w' \in Best(M)(B)(w)(t_c) \wedge \exists t' [t' > t_c \wedge \exists e [\text{rain}(w')(e) \wedge \tau(e) \subseteq t']]]$

According to this analysis, the past and future orientations of modals are symmetric, the latter being obtained when the prospective aspect is inserted below a modal operator. Consequently, the correct generalization about the temporal orientation of circumstantial modals is that pure circumstantial modals have an obligatory future interpretation, while epistemic modals and priority circumstantial modals may be interpreted with a past, present or future orientation, the latter being illustrated in (58), (59) and (60) respectively.

(58) Sam ought to have been to confession.

- (59) a. Sam ought to be at church.
 b. Sam ought to be sleeping.

(60) Sam ought to go to church.

In this section, I would like to argue that these generalizations follow from the diversity condition and additional assumptions about grammatical aspect. Let us assume that viewpoint aspect (perfective *vs* imperfective) is obligatory with eventive VPs and illicit with stative VPs. Let us also assume that perfect and prospective aspects are optional. Finally, let us assume that eventive VPs without progressive *-ing* morphology are perfective. There are three combinations to consider with each viewpoint aspect. I will examine each combination in turn, with a present temporal perspective.

- (61) *Aspect combinations in the complements of modals*
- a. MODAL > IMP/PFV
 - b. MODAL > PERF > IMP/PFV
 - c. MODAL > PROSP > IMP/PFV

Present perspective, perfective viewpoint A pure circumstantial modal interpretation of the first combination is ruled out by the diversity condition. Furthermore, assuming that t_c is an instant and that events are not instantaneous, the first combination in (61) results in a contradiction, see Taylor (1977); Dowty (1979) and also Kratzer (2011). This means that an epistemic interpretation of the modal is not available either, nor is the combination attested with a priority modal, as illustrated in (63).

- (62) a. It might rain.
 b. PRES > might > PFV *pure circumstantial, *epistemic
 c. $\lambda w. \exists w' [w' \in Best(M)(O)(w)(t_c) \wedge \exists e[\mathbf{rain}(w')(e) \wedge \tau(e) \subseteq t_c]]$
- (63) a. Sam ought to leave.
 b. PRES > ought > PFV *deontic
 c. $\lambda w. \forall w' [w' \in Best(M)(O)(w)(t_c) \rightarrow \exists e[\mathbf{leave}(w')(e)(s) \wedge \tau(e) \subseteq t_c]]$

A pure circumstantial interpretation of the second combination is ruled out by the diversity condition. However, an epistemic interpretation is available in (65), and the combination is also attested with priority modals, as illustrated in (65).

- (64) a. It might have rained.
 b. PRES > might > PERF > PFV *pure circumstantial, \checkmark epistemic
 c. $\lambda w. \exists w' [w' \in Best(M)(O)(w)(t_c) \wedge \exists t' [t' < t_c \wedge \exists e[\mathbf{rain}(w')(e) \wedge \tau(e) \subseteq t']]]$
- (65) a. Sam ought to have left.

- b. PRES > ought > PERF > PFV ✓deontic
 c. $\lambda w.\forall w'[w' \in Best(M)(O)(w)(t_c) \rightarrow \exists t'[t' < t_c \wedge \exists e[\mathbf{leave}(w')(e)(\mathbf{s}) \wedge \tau(e) \subseteq t']]]$

Pure circumstantial modals are only compatible with the third combination, which explains the future orientation of non-progressive eventive pure circumstantial modals. Epistemic and priority interpretations are available with this combination too.

- (66) a. It might rain (tomorrow).
 b. PRES > might > PROSP > PFV ✓pure circumstantial, ✓epistemic
 c. $\lambda w.\exists w'[w' \in Best(M)(O)(w)(t_c) \wedge \exists t'[t' > t_c \wedge \exists e[\mathbf{rain}(w')(e) \wedge \tau(e) \subseteq t']]]$
- (67) a. Sam ought to leave (tomorrow).
 b. PRES > ought > PROSP > PFV ✓deontic
 c. $\lambda w.\forall w'[w' \in Best(M)(O)(w)(t_c) \rightarrow \exists t'[t' > t_c \wedge \exists e[\mathbf{leave}(w')(e)(\mathbf{s}) \wedge \tau(e) \subseteq t']]]$

Present perspective, imperfective viewpoint A pure circumstantial interpretation of the first combination violates the diversity condition, however it is not contradictory because of the imperfective aspect. Consequently, while a pure circumstantial interpretation is ruled out, epistemic and priority interpretations are available.

- (68) a. It might be raining.
 b. PRES > might > IMP *pure circumstantial, ✓epistemic
 c. $\lambda w.\exists w'[w' \in Best(M)(O)(w)(t_c) \wedge \exists e[\mathbf{rain}(w')(e) \wedge \tau(e) \supseteq t_c]]$
- (69) a. Sam ought to be sleeping.
 b. PRES > ought > IMP ✓deontic
 c. $\lambda w.\forall w'[w' \in Best(M)(O)(w)(t_c) \rightarrow \exists e[\mathbf{sleep}(w')(e)(\mathbf{s}) \wedge \tau(e) \supseteq t_c]]$

A pure circumstantial interpretation of the second combination is again ruled out by the diversity condition. Epistemic and priority interpretations are attested.

- (70) a. It might have been raining.
 b. PRES > might > PERF > IMP *pure circumstantial, ✓epistemic
 c. $\lambda w.\exists w'[w' \in Best(M)(O)(w)(t_c) \wedge \exists t'[t' < t_c \wedge \exists e[\mathbf{rain}(w')(e) \wedge \tau(e) \supseteq t']]]$
- (71) a. Sam ought to have been sleeping.
 b. PRES > ought > PERF > IMP ✓deontic
 c. $\lambda w.\forall w'[w' \in Best(M)(O)(w)(t_c) \rightarrow \exists t'[t' < t_c \wedge \exists e[\mathbf{sleep}(w')(e)(\mathbf{s}) \wedge \tau(e) \supseteq t']]]$

Finally, prospective imperfective combinations license all three interpretations:

- (72) a. It might be raining (when Anna arrives tomorrow).
 b. PRES > might > PROSP > IMP ✓ pure circumstantial, ✓ epistemic
 c. $\lambda w. \exists w' [w' \in Best(M)(O)(w)(t_c) \wedge \exists t' [t' > t_c \wedge \exists e [\mathbf{rain}(w')(e) \wedge \tau(e) \supseteq t']]]$
- (73) a. Sam ought to be sleeping (when Anna arrives tomorrow).
 b. PRES > ought > PROSP > IMP ✓ deontic
 c. $\lambda w. \forall w' [w' \in Best(M)(O)(w)(t_c) \rightarrow \exists t' [t' > t_c \wedge \exists e [\mathbf{sleep}(w')(e)(\mathbf{s}) \wedge \tau(e) \supseteq t']]]$

In sum, if we assume that the past and future orientations of modals are obtained by inserting a perfect and prospective aspect (respectively) in the scope of the modal, the extension of the diversity condition to pure circumstantial modals (as opposed to just metaphysical modals) allows us to derive their future orientation, without blocking the past and present orientation of epistemic and priority modals.

A complication with past ability modals The diversity condition should apply to modal operators independently of their temporal perspective. In particular, it should prevent the use of pure circumstantial modal bases with modal operators whose prejacent has a past or a present orientation, no matter whether the temporal perspective of the operator is in the present or in the past. In this respect, the availability of a pure circumstantial interpretation (namely, an ability interpretation) of sentences like (74) is surprising:

- (74) Michel a pu soulever 100 kg d'un seul bras.
 'Michel could lift 100 kg with one arm.'

The modal auxiliaries *pu* and *could* in (74) have a past perspective. The fact that their prejacent has a present orientation should block the ability interpretation, since it violates the diversity condition. Indeed, insofar as the prejacent describes an event that is ongoing at the temporal perspective, it describes a fact of the world of evaluation, and therefore it should be included in the circumstantial modal base. Nevertheless, (74) is acceptable.

Note that (74) also triggers an actuality inference (see Bhatt, 1999; Hacquard, 2006; Homer, 2010): (74) entails that Michel did lift 100kg with one arm. Interestingly, Kratzer (2011) proposes that actuality entailments of past ability statements are due to the fact that the event described by the prejacent is part of the circumstances that are described in the modal base. But these are precisely the conditions under which the diversity condition is violated!

Kratzer's proposal suggests that actuality entailments may be a way to redeem violations of the diversity condition. However, it raises the question why actuality entailments do not arise with

other flavours of pure circumstantial modality, as in (75).

- (75) Hier matin, il a pu pleuvoir. *Only epistemic*
 ‘It might have rained yesterday morning.’

I leave these questions for further research.

4. Conclusion

I have argued that the ban on low perfects with metaphysical modals applies to all pure circumstantial modals, and I have proposed that the difference between pure circumstantial modals and priority modals in this respect is due to the fact that the modal bases of these modals are subject to different constraints. One component of this proposal is the claim that the composition of the modal base of a circumstantial modal depends on the meaning of its prejacent. This is not a new idea: it is a version of Hacquard’s (2006) claim that circumstantial modal bases are anchored in the event argument of the prejacent VP. What may be more original is the proposal that the way the meaning of the prejacent is exploited in the computation of the modal base varies across classes of circumstantial modals. In Hacquard’s terms, one may say that there exist different functions that map VP events to circumstantial modal bases, and different flavours of circumstantial modality exploit different such functions.

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