# On the (In)dependence of Tense and Modality[1]

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**Abstract:** A compositional analysis is provided of temporal perspective and orientation (Condoravdi 2002) of modals in Dutch, English, Gitksan (Tsimshianic) and St'át'imcets (Lillooet Salish). Modals interact freely with the tense-aspect architecture in each language. Temporal perspective is determined by an operator scoping over the modal, usually tense, while temporal orientation is determined by aspectual operators below it (and further restricted by the Diversity Condition). In contrast to much of the literature, it is shown that epistemic modals allow past temporal perspective. Modal-temporal interactions behave in predictable ways in Dutch, Gitksan and St'át'imcets, whereas the English system is more idiosyncratic and partly lexicalized.

## 1 Introduction
## 1.1 Main claims of this paper

Modals like *can* or *must* are standardly assumed to contribute quantification over possible worlds (Kratzer 1981). The different possible flavours of the modal (epistemic, deontic, etc.) result from conversational backgrounds, which narrow down the set of worlds the modal quantifies over. Since the truth value of a modal assertion depends both on the world of evaluation and the time of utterance, conversational backgrounds are frequently modeled as functions from world-time pairs to sets of propositions.

One important issue is what restricts conversational backgrounds – that is, what determines whether a modal in a context can be interpreted, say, epistemically or deontically. In Kratzer's original analysis (1981, 1991), conversational backgrounds are restricted by adverbial phrases (like *given what we know* or *given the law*), the context of use, and the modal's lexical entry. Subsequent research has proposed that conversational backgrounds can be restricted by the syntactic position of the modal (Hacquard 2006, Kratzer 2012). In this paper we address the question of the extent to which conversational backgrounds are restricted by the temporal properties of the clause the modal finds itself in. Our discussion is based on data from four languages from three families: English, Dutch, Gitksan (Tsimshianic) and St'át'imcets (Salish).

We make two proposals about the relation between conversational backgrounds and temporal properties. First, we argue that a modal's flavour does not depend on the time at which the conversational background is calculated (Condoravdi's 2002 'temporal perspective'). In contrast to a large body of literature (discussed below), we propose that all modals, including epistemic ones, can have a past temporal perspective. We thus argue, in line with a minority of authors including von Fintel and Gillies (2008), that examples like (1) are felicitous.

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(1)    *Context: Yesterday, my friend John's team was playing a game. I didn't know if they won or not because I was busy during the game. I bought a bottle of champagne just in case. Unfortunately, I found out when I got home that John's team had lost. My spouse asked me why I had bought the champagne. I replied:*
Because John's team might have won the game.

Here the speaker is talking about a past epistemic state: at the utterance time she knows that John's team did not win the game, but at some point in the past she considered it possible that they had won. The modal base is epistemic, but the temporal perspective is past. Our proposal that there are no grammatical restrictions on the possible combinations of modal flavour and temporal perspective is supported by Dutch, which overtly encodes temporal perspective on modals (via tense marking), and in which temporal perspective is predictably determined by the tense morphology, regardless of modal flavour. It is also supported by Gitskan and St'át'imcets, which overtly encode modal flavour (via lexically distinct epistemic vs. non-epistemic modals; Rullmann et al. 2008, Peterson 2010, Matthewson 2013). In the appropriate contexts, all flavours of modals allow for past temporal perspectives in these languages.

Although modal flavour is not restricted by temporal perspective (henceforth TP), we argue that there *is* a restriction on the combination of modal flavour and the modal's 'temporal orientation' (TO; the relative ordering of the TP and the time of the possible or necessary event). In particular, as has been observed by Condoravdi (2002) and others, we find that in the four languages we investigate, modals with a circumstantial modal base are restricted to future TO. Epistemic modals, on the other hand, are free to have any TO (past, present or future). For example, in (1) the TO is past, because the (non-actual) event of winning precedes the time at which the epistemic modal base is calculated.

These proposals lead us to predict the set of possible modal flavour/TP/TO combinations in Table 1, as the null hypothesis for all languages.

Table 1: Predicted modal flavour/TP/TO combinations

|  | PAST TP | PRESENT TP |
|---|---|---|
| PAST TO | epistemic | epistemic |
| PRESENT TO | epistemic | epistemic |
| FUTURE TO | epistemic, circumstantial | epistemic, circumstantial |

This contrasts with Condoravdi's (2002) more restricted set of predicted possible combinations, according to which epistemic modals do not allow past TPs, and therefore for example 'there are no modals with a past perspective and a past [or present] orientation' (Condoravdi 2002:5).

In terms of how TP and TO are compositionally derived, we argue for a potentially universal basic architecture, according to which temporal operators above a modal provide the modal's TP, while temporal operators below the modal provide the TO. In languages like Dutch, the higher temporal operators are typically tenses, and the lower temporal operators are morphologically aspects; this may however not always be the case cross-linguistically (Chen et al. to appear, among others).

The paper is structured as follows. In the remainder of the introduction we provide background on Condoravdi's influential analysis of English possibility modals, the languages we discuss, and our methodology. Section 2 argues that a modal's TP is provided by a higher temporal operator, often a tense. We show that this is the case for any flavour of modal; our main empirical

argument for this is that epistemic modals with past TP exist in Dutch, English, Gitksan and St'át'imcets. In section 3 we argue that a lower temporal operator, often an aspect, restricts TO. Again we show that our architecture and semantic proposals are supported in the four languages. In section 4 we present a formal analysis for Dutch, Gitksan and St'át'imcets. Section 5 addresses the lexical complexities of the English modal auxiliary system, including the differing behaviour of individual modals in sequence of tense and free indirect discourse environments. In section 6 we compare our analysis to previous ones, and section 7 concludes.

## 1.2    Background on modal-temporal interactions

Condoravdi (2002) was the first to provide a worked-out analysis of the temporal properties of English *might (have),* which has laid the groundwork for most of the subsequent research in this area. Condoravdi observes that *might have* is ambiguous between two readings (see also Huddleston & Pullum 2002:203-204, Ippolito 2003). On one reading, *might have* expresses present epistemic uncertainty about a past event. On this interpretation, (2) says that it is consistent with the present epistemic state of the speaker (or some other salient agent) that John won the game at some time preceding the utterance time.

(2)    John might have won the game (but I'm not sure if he did).

Another reading, exemplified in (3), says that at some past time it was metaphysically possible for the world to develop in such a way that John would win the game.

(3)    John might have won the game (if he hadn't been feeling sick that day).

These two readings display distinct modal flavours, as well as distinct temporal profiles. For the epistemic reading in (2), the TP is the utterance time, and the TO is past, because John's potential winning precedes the utterance time. For the metaphysical reading in (3), the TP is past and the TO is future: the sentence is about the different ways in which history could have unfolded after some past time point. The attested combinations of conversational background and temporal properties are summarized in Table 2. Notice that these are a small subset of the logically possible combinations.

Table 2: Two readings of *might have* (Condoravdi (002)

| CONVERSATIONAL BACKGROUND | TEMPORAL PERSPECTIVE | TEMPORAL ORIENTATION |
|---|---|---|
| epistemic | present | past |
| metaphysical | past | future |

Condoravdi and others have argued that the observed correlations between conversational background and temporal properties for *might have* are non-accidental. The claimed restriction of the epistemic interpretation of *might have* to present TP is due to a general stipulation that epistemic modals cannot scope under either past tense or the perfect auxiliary. This is often argued to follow from a syntactic hierarchy whereby epistemic modals scope higher than non-epistemic ones (Brennan 1993, Cinque 1999, among many others). With respect to TO, the fact that metaphysical modality is necessarily future-oriented follows from Condoravdi's Diversity Condition (or from Werner's 2003, 2006 Disparity Principle); see discussion in section 3.1 below.

## 1.3    Languages discussed and methodology

Apart from English and Dutch, the two languages we discuss are Gitksan and St'át'imcets. 'Gitksan' is the term used to cover that part of the Nass-Gitksan dialect continuum which is spoken along the upper drainage of the Skeena River in northwestern interior British Columbia, Canada. Gitksan currently has fewer than 400 speakers (First Peoples' Cultural Council 2014). Our data come from speakers of three dialects: Barbara Sennott, from Ansbayaxw (Kispiox;), Vincent Gogag, from Git-anyaaw (Kitwancool), and Hector Hill, from Gijigyukwhla (Gitsegukla).

St'át'imcets (a.k.a. Lillooet) is a Northern Interior Salish language spoken in the southwest interior of British Columbia. The language currently has fewer than 100 first-language speakers. Data come from fieldwork with speakers of both the Upper St'át'imcets dialect (Carl Alexander, the late Beverley Frank, the late Gertrude Ned, and the late Rose Agnes Whitley) and the Lower St'át'imcets dialect (Laura Thevarge).

For Gitksan and St'át'imcets, our data and generalizations are based on fieldwork with individual speakers. Fieldwork methodologies used include translation tasks (in both directions), acceptability judgment tasks (in which the consultant evaluates a target language utterance in a particular discourse context), and storyboard tasks (in which targeted contexts are provided to the consultant by a series of pictures, in response to which the consultant tells a story). See Matthewson (2004) and Burton and Matthewson (2015) for further details.

For English and Dutch, our data sources are introspective native-speaker judgements by the authors, examples reported in the linguistic literature, attested examples gathered through informal corpus searches, and a small informal questionnaire study.

## 2    Modals with any conversational background can have any temporal perspective

In this section we argue that, in principle, modals with any type of conversational background can have either past or present temporal perspective. Since the most controversial aspect of this claim concerns epistemic modals, we devote the section mainly to demonstrating that epistemic modals with past TP (henceforth, past epistemics) exist. Our findings will weaken one of the main arguments behind the claim that epistemic modals always scope over tense (Hacquard 2011, among others). We begin with a brief overview of the debate about past epistemic modality. We then present evidence from Dutch, Gitksan and St'át'imcets for past epistemic readings, and finally we turn to English, whose lexical and morphological idiosyncrasies make it possibly the least ideal language in which to study the question (e.g., Stowell 2004).

### 2.1    The debate about epistemic modals with past temporal perspective

The existence of past epistemic readings has been a subject of lively debate. The question is whether sentences like (4)a-c can make an assertion about what was epistemically possible or necessary at some past time.

(4)    a.  Jack's wife **couldn't** be rich.                              (Stowell 2004:625)
       b.  There **had to** be a hundred people there.                    (Stowell 2004:626)
       c.  There **might have** been ice cream in the freezer.     (von Fintel and Gillies 2008:87)

The existence of past epistemic readings has frequently been denied in the literature, for a variety of

languages (Groenendijk and Stokhof 1975, Cinque 1999, Drubig 2001, Condoravdi 2002, Stowell 2004, Hacquard 2006, 2011, Borgonovo and Cummins 2007, Demirdache and Uribe-Etxebarria 2008, Laca 2008). A typical example comes from Hacquard (2011:30), who writes about English that 'with an epistemic interpretation, the modal's time of evaluation seems unable to get backshifted.' At least some authors frame the issue in terms of the relative scope of modals and tense: the claim is that (in English or universally) epistemic modals must scope over tense (Cinque 1999, Stowell 2004, Hacquard 2006, 2011). This is often accompanied by the observation that non-epistemic modals (a.k.a. root or circumstantial modals) *can* scope under tense, something which we take to be uncontroversial.

Although the view that epistemic modals always scope over tense is widespread, some scholars have argued against it. Von Fintel and Gillies (2008:87) give the example in (5), noting that 'It is possible for [the speaker] to have said something true, even though at the time of utterance she knows ... there is no ice cream in the freezer' (see also Portner 2009, Abusch 2012 for discussion). Other authors have argued for past epistemic readings on the basis of data from languages other than English, including Eide (2003, 2005) for Norwegian, and Homer (2010) and Martin (2011) for French.

(5)     *Context: Sophie is looking for some ice cream and checks the freezer. There is none in there. Asked why she opened the freezer, she replies:*
        There might have been ice-cream in the freezer.

Several researchers acknowledge that epistemic modals can (appear to) have past TP, but try to explain away these readings in various ways. In section 6, we argue that such attempts are ultimately unsuccessful.

## 2.2    Dutch

In Dutch, modals carry tense inflection, and in that sense they are just like any other verb. We assume therefore that tense scopes over the modal, and we predict that the modal's TP will be determined by its tense marking, which is exactly what we find. As in English, Dutch modals can have a range of different flavours, but here we will focus on epistemic readings. Our examples involve the universal modal *moeten* ('must, have to') and the existential modal *kunnen* ('can, could, may, might'), both of which readily accept epistemic interpretations, as well as non-epistemic ones. (See Foolen and de Hoop 2009 for discussion of various factors determining the modal flavour of *moeten* and *kunnen*.)

When an epistemic modal is in the simple present tense, as in (6), the TP is present as well.[2]

(6)     De        sleutels **moet-en**   / **kunn-en**        (wel)   (eens)   in    de    la      ligg-en
        the       keys     **must.PRS-PL** / **can.PRS-PL**  (PRT)   (PRT)    in    the   drawer  lie-INF
        'The keys must / might be in the drawer.'                            PRESENT TP, PRESENT TO

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[2] Glosses not in the Leipzig Glossing Rules: I/II = series I/II pronoun, AUT = autonomous intransitivizer, CIRC = circumstantial modal, CN = common noun connective, CNTR = contrastive, COUNTER = counter to expectations, DEON = deontic modal, DIR = directive transitivizer, EPIS = epistemic modal, EXIS = assertion of existence, NECESS = necessity modal, PN = proper noun connective, POS = possibility modal, PROSP = prospective, PRT = particle, REDUP = reduplication.

In (6), the *moeten* version contains the optional discourse particle *wel,* and the *kunnen* version contains *wel eens;* these particles often accompany epistemic modals in Dutch. They disambiguate the modal towards an epistemic interpretation and tend to make the sentences more colloquial, but an epistemic interpretation is also possible without them. (6) asserts that at the speech time it is epistemically necessary/possible that the keys are in the drawer at that time. The TP is present because the modal is inflected for present tense. (For discussion of TO, see section 3.)

Instead of with the simple modal verb *kunnen* as in (6)b, epistemic possibility with present TP can also be expressed by means of the double modal form *zou/zouden kunnen*, as in (7): [3]

(7) | De | sleutels | **zoud-en** | in | de | la | **kunn-en** | ligg-en
| | the | keys | **shall.PST-PL** | in | the | drawer | **can-INF** | lie-INF
| | | 'The keys may/might be in the drawer.' | | | | PRESENT TP, PRESENT TO

*Zou/zouden kunnen* contains the past-tense form of the modal verb *zullen* 'shall, will' plus the infinitival form of *kunnen.* It is a "weakened" form of *kunnen,* analogous to the use of subjunctive modals in other (Indo-European) languages (cf. von Fintel and Iatridou 2008). *Zou/zouden kunnen* should perhaps be treated as a single lexicalized present subjunctive form of *kunnen.* [4] For some of the examples below, some speakers may prefer the variant with *zou/zouden kunnen* and/or with the discourse particles *wel (eens)* in order to get an epistemic interpretation, but for the sake of simplicity, we will generally provide the form with just the plain modal.

Now let's turn to epistemic modals with *past* TP. The past-tense counterparts of (6)a,b are given in (8):

(8) | De sleutels | **moest-en** | / | **kond-en** | in | de | la | ligg-en
| | the keys | **must.PST-PL** | / | **can.PST-PL** | in | the | drawer | lie-INF
| | | 'The keys {had to be} / {might have been} in the drawer.' | | | | PAST TP, PRESENT TO

As pointed out by Boogaart (2007), *moest(en)* and *kon/konden* can have an epistemic interpretation, reflecting the epistemic state of some agent – most likely (but not necessarily) the speaker – at a past time. [5] On this reading, the sentence asserts that at a time t (where t is a time preceding the utterance time that is salient in context), it was epistemically necessary or possible that the keys were in the drawer at t.

When sentences like (8) are presented in isolation without support from context, such past epistemic readings may be hard to perceive. But here are two discourse contexts in which they are entirely natural:

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[3] For unknown reasons, the analogous form *zou/zouden moeten* can only express weak deontic necessity, and cannot be epistemic.

[4] This "weak possibility" interpretation can also be expressed by means of the simple past form *kon/konden* (Boogaart 2007):

(i) | De | sleutels | **kond-en** | wel eens | in | de | la | ligg-en
| | the | keys | **can.PST-PL** | PRT PRT | in | the | drawer | lie-INF
| | | 'The keys may/might be in the drawer.' | | | | PRESENT TP, PRESENT TO

Here the past tense expresses 'modal remoteness' (Huddleston and Pullum 2002) or 'non-reality' (Geerts et al. 1984: 466-472).

[5] Boogaart (2007) claims that this is restricted to free indirect discourse; see section 6 for discussion.

(9)  **Discourse context for a past epistemic reading of** (8) **with *moesten***
'Yesterday, when I wanted to go to work, I couldn't find my keys anywhere. I tried to remember where I might have left them the previous night. I felt in the pocket of my pants, looked in my nightstand, and even searched the waste basket, but all in vain. Suddenly I knew. <u>They had to be in the kitchen drawer</u>.'

(10)  **Discourse context for a past epistemic reading of** (8) **with *konden***
'When I arrived at work yesterday, I discovered that I didn't have my keys on me. I called my wife and asked if I had left them somewhere at home by any chance. She asked me where she should look. I tried to remember where I might have left them the previous evening. <u>They might have been in the kitchen drawer</u>, so I asked her to look there.'

In addition to the simple past form *kon/konden,* Dutch has another way of expressing past epistemic possibility, namely with the pluperfect form *had/hadden kunnen*, as in (11):

(11)  | De | sleutels **hadd-en** | in | de | la | **kunn-en** | ligg-en |
      |---|---|---|---|---|---|---|
      | the | keys **have.PST-PL** | in | the | drawer **can-INF** | lie-INF |
'The keys might have been in the drawer.'

As van Gerrevink and de Hoop (2011) point out, in Dutch the pluperfect form of a modal (of any flavour) implies the falsity of its prejacent. Thus, (11) implies that the keys were not actually in the drawer. This is not a coincidence, of course. In Dutch, much as in English, the pluperfect serves a dual function: in addition to its purely temporal interpretation as the past tense of a perfect, it is used for expressing past counterfactuality, for example in conditionals (cf. Iatridou 2000, Ippolito 2003). In the latter role it has the same function that in many other Indo-European languages is fullfilled by the past subjunctive. What is important for our purposes is that a "past subjunctive" possibility modal like in (11) does not have to be circumstantial (or metaphysical), but can also be epistemic. On the latter reading, the pluperfect *hadden kunnen* is very close in meaning to the simple past *konden* (cf. (8)).The only difference is that with the pluperfect, the event is viewed in hindsight; at the utterance time, the speaker knows that the prejacent was false (i.e., the keys were not in the drawer). It is probably for this reason that in a context like that of von Fintel and Gillies's 'ice-cream' example (5), the pluperfect form *had kunnen liggen* is strongly preferred over the simple past form *kon liggen*.[6] These complexities will not be part of our formal analysis. Our main goal here is simply to show that past epistemic readings are possible in Dutch.

In this section we have seen that, in accordance with one of the main empirical claims of this paper, Dutch modals can have past epistemic interpretations. Past TP is morphologically marked either by past tense on the modal (*kon/konden*), or by the counterfactual pluperfect form *(had/hadden kunnen)*.

## 2.3  Gitksan and St'át'imcets

We now turn to two languages which provide a different kind of evidence for modals with past epistemic readings: Gitksan and St'át'imcets. Both these languages have lexically dedicated epistemic

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[6] The *present* perfect of a modal cannot express epistemic modality in Dutch (Boogaart 2007, van Gerrevink and de Hoop 2011).

modals, so there can be no doubt that the relevant examples are epistemic. However, the languages do not have explicit marking for tense, so we have to rely on context to make sure the temporal perspective is past.

Gitksan lexically distinguishes epistemic from circumstantial modals (Peterson 2010, Matthewson 2013). An epistemic example with present TP is shown in (12), and circumstantial modals with present TP are given in (13)-(14).

(12)  *Context: You hear pattering, and you're not entirely sure what it is.*
   yugw=**imaa**=hl          wis
   IPFV=**EPIS**=CN          rain
   'It might be raining.'                                    (Gitksan; Matthewson 2013:358)

(13)  **da'a<u>kh</u>lxw**-i=hl          maa'y   dim     lim<u>x</u>s-t
   **CIRC.POS-**TR=CN          berries   PROSP   grow.PL-3SG.II
   'Berries could grow here.'                            (Gitksan; Matthewson 2013:370)

(14)  **sgi**           dim     (ap)            ha'w-s          Lisa
   **CIRC.NECESS**   PROSP   (VERUM)         go.home-PN      Lisa
   'Lisa should/must go home.'                           (Gitksan; Matthewson 2013:380)

Past tense is not overtly marked in Gitksan. Nevertheless, both epistemic and circumstantial modals can freely be interpreted with a past TP. This is demonstrated for epistemic modality in (15)-(16).

(15)  *Context: Stacey bought food to feed Pat's pet, but she didn't know what kind of pet he had, so she bought all the wrong kinds of food. Later she finds out Pat's pet is a snake. Pat asks 'Why did you buy a carrot?' Stacey replies:*
   yugw=**imaa**=hl          ga<u>x</u>-t
   IPFV=**EPIS**=CN          rabbit-3.II
   'He might have been a rabbit.'    (Gitksan; 'Feeding Fluffy', <u>www.totemfieldstoryboards.org</u>)

(16)  *Context: When you looked out your window earlier today, water was falling, so it looked like it was raining. But you found out later it was the gutters leaking.*
   yugw=**imaa**=hl          wis     da'awhl
   IPFV=**EPIS**=CN          rain    then
   'It might have been raining earlier.'                 (Gitksan; Matthewson 2013:363)

Given the contexts, both examples are clear cases of epistemic modality with past TP. The TO in these cases happens to be present – the time of the prejacent event overlaps with the TP. We will see examples in section 3.3 with different temporal orientations.

Circumstantial modals with past TPs are illustrated in (17)-(18).

(17)  *Context: You are talking about some land you used to have. I ask you 'What was the soil like? Could berries have grown there?'*
   **da'a<u>kh</u>lxw**-i=hl          maa'y=hl          dim     lim<u>x</u>s-t
   **CIRC.POS-**TR=CN          berries=CN          PROSP   grow.PL-3.II
   'Berries could have grown.'                           (Gitksan; Matthewson 2013:375)

(18)  *Context: Lisa's son was all alone / he needed to see her.*
      **sgi**            dim=t        sga-'wa=s         Lisa=hl    hlguuhlxwim    gat-t
      **CIRC.NECESS**    PROSP=3.I    across-get.to=PN Lisa=CN    child          man-3.II
      'Lisa should have met her son.'                              (Gitksan; Matthewson 2013:380)

These data show that all types of Gitksan modals allow both past and present TPs. This supports our proposal that past TP is not restricted to modals with certain flavours. In section 3.3 we will analyze the past TP readings as involving the modals scoping under a non-future tense morpheme.

Just like Gitksan, St'át'imcets also lexically distinguishes epistemic from circumstantial modality (Matthewson et al. 2007, Rullmann et al. 2008, Davis et al. 2009), and does not obligatorily encode past tense (van Eijk 1997, Matthewson 2006, Davis 2010). Epistemic and circumstantial modals with present TPs are illustrated in (19)-(20).

(19)  wá7=**k'a**    qelh-n-ás              nilh kw=s=ts'áqw-an'-em         lh=kalál=as
      IPFV=**EPIS**  put.away-DIR-3ERG      FOC DET=NMLZ=eat-DIR-1PL.ERG    COMP=soon=3SBJV
      'Maybe she put it away and we ate it later.'              (St'át'imcets; Matthewson 2005:58)

(20)  lán=lhkacw=**ka**      áts'x-en         ti=kwtámts-sw=a
      already=2SG.SBJ=**CIRC** see-DIR        DET=husband-2SG.POSS=EXIS
      'You must / can / may see your husband now.' (St'át'imcets; Rullmann et al. 2008:329-330)

(21)-(22) show that both epistemic and circumstantial modals allow past TP. In (21), it is not compatible with the speaker's epistemic state at the utterance time that the Canucks were winning.

(21)  *Context: The Canucks were playing last night. You weren't watching the game, but you heard your son sounding excited from the other room, where he was watching. You thought the Canucks were winning, and you called up your friend and said: 'Good sports news!' But after the game, you found out that the Canucks had actually lost, and your son was excited about something his friend was telling him on his cellphone. Today, your friend asks you why you had told him there was good sports news when the Canucks had actually lost. You say:*
      wá7=**k'a**    t'cum    i=Canucks=a
      IPFV=**EPIS**  win      PL.DET=Canucks=EXIS
      'The Canucks might have been winning.'                              (St'át'imcets)

(22)  *Context: I don't remember if we ate the rabbits or not …*
      t'u7    wá7=**ka**    n-scwákwekw=a        ts'áqw-an'-em    nilh    s=pápt-s=a
      just    IPFV=**CIRC** 1SG.POSS-heart=EXIS  eat-DIR-1PL.ERG  FOC     NMLZ=always=3POSS=EXIS
              wa7    tecw-ecw=wít             lh=as                kwís-alt    i=sqweyíts=a
              IPFV   increase-REDUP=3PL COMP=(IPFV)3SBJV    fall-child   DET.PL=rabbit=EXIS
      'But I think we had to eat the rabbits because they were always having babies.'
                                                      (St'át'imcets; Matthewson 2005:98-99)

The data in this section have shown that epistemic (as well as circumstantial) modals can have past TPs in Gitksan and St'át'imcets, languages in which epistemic modality is lexically distinct from other types of modality. Similar facts obtain in a range of other languages including Blackfoot, Atayal and Mandarin; see Chen et al. (to appear) for further discussion.

## 2.4    English

We now turn to English, a language where modal auxiliaries carry only residual, lexically idiosyncratic inflectional morphology. The semi-modals, however (*have to*, *be allowed to*, or *be able to*), inflect for tense in a well-behaved way, and their TP is determined by their overt tense inflection, just as in Dutch. We will focus on *have to*, which can have an epistemic interpretation (unlike *be allowed to* or *be able to*).

Stowell (2004) claims that the simple past tense of *have to* cannot have an epistemic reading in (23) (repeated from (4)b):

(23)    There **had to** be a hundred people there.                    (Stowell 2004:626)

We disagree with this judgment;[7] we think (23) can have a reading where it describes a past epistemic state. To back up our claim, we collected cases of past epistemic *had to* from the Corpus of Contemporary American English (http://corpus.byu.edu/coca/). Representative examples are given in (24)-(26). In each case, the TP of the epistemic modal seems to be clearly located at the past narrative reference time.[8]

(24)    And here in the bathroom off the hall they found Clorox bottles. Looked like someone tried to wash away evidence. This **had to** be more than just an injured dog.
                    (COCA 2011-01-21; The Man Who Talked to Dogs; Dateline NBC)

(25)    Petra went to the left through the crowd, her eyes searching for any signs of trouble. They were so close. This **had to** be it. Here they would uncover the information they needed. She was sure of it.                    (COCA 2011; *The Silenced: A Novel;* Battles, Brett, New York: Dell)

(26)    A dim chemical light flickered on as we entered, revealing metal boxes of C-6 stacked to the ceiling. There **had to** be over a tonne of the stuff.
        (COCA 2010; Teaching the Pig to Sing; Levine, David D., *Analog Science Fiction & Fact* 130(5):71-80)

Let us now consider *might have*. In COCA, we found many instances of *might have* with a past epistemic reading,  two of which are given in (27)-(28). We include a case from a novel in (29).

(27)    I wasn't worried about the guards. They knew we were neighbors. I mean, we **might have** been borrowing a cup of sugar, right?
        (COCA 2010; The Robots' Girl; Cooper, Brenda; *Analog Science Fiction & Fact* 130(4):90-103)

(28)    It was dark. He did not know he was in a new land. Through the window he could see stars trembling in the clear black night. It **might have** been the sky over Valparaso.
        (COCA 2010; *In the Company of Angels: A Novel;* Kennedy, Thomas E., New York: Bloomsbury)

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[7] Stowell (p.c.) has since changed his opinion of this and similar examples.

[8] It might be argued that these examples are somehow special because they represent free indirect discourse. For our rebuttal, see section 6.

(29)   'What do you think?' asked Dumbledore. He **might have** been asking Harry's opinion on whether it was a good site for a picnic. (J.K. Rowling 2005, *Harry Potter and the Half-Blood Prince,* p. 519)

(27)-(29) involve not only a shift to a past TP, but also a shift in the agent whose epistemic state is being accessed. This tendency for the TP and the agent whose epistemic state is relevant to shift in tandem is quite common in narratives, but as we have seen above, is not obligatory.

     To supplement our corpus search we also elicited judgments on some constructed examples, in an informal questionnaire study with 11 native-speaker participants. The following are examples of past epistemic readings which received very high acceptability ratings.[9]

(30)   This morning I opened my phone bill and was shocked when I saw that I owed $10,000. This **had to** be a mistake! Unfortunately, it turned out to be correct. My husband had used my phone on his latest trip to Papua New Guinea, forgetting about the roaming charges.

(31)   *Context: Mary is a school principal and at her school there is a policy that if there is even a possibility that a teacher has abused a student, the teacher will be fired. Five years ago, Mary fired one of her teachers because he was accused of abusing a student. This morning, the accuser recanted the accusation and conclusive proof was brought forward that the accuser had lied and the teacher was innocent. Mary is now being interviewed by a reporter.*

    Reporter:   How do you feel about the news today that the teacher you fired was in fact innocent?

    Mary:       Very upset. It is most unfortunate.

    Reporter:   So why did you fire him at the time, when you did not have conclusive proof that he was guilty?

    Mary:       Because he **might have** been guilty.

The example from Stowell in (23) above received a relatively high average score[10] when embedded in the discourse context in (32).

(32)   When Susan arrived at Bob's house, she saw that the place was packed. There **had to** be at least a hundred people there. But she found out later that actually, there were only 60.

This questionnaire study suggests that epistemic modals with past TP, while not as uniformly acceptable as those with present TP, are far from ruled out, and are often judged as essentially perfect by native speakers. One issue for potential future research is that, as indicated by Portner (2009:227), the cases with stative predicates were generally judged as better by participants than those with eventive verbs.

## 2.5   Summary so far

So far we have seen that in Dutch, Gitksan, St'át'imcets and English, epistemic modals can have past

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[9] Participants judged acceptability on a three-point scale, with 1 the best and 3 the worst. Control items were included, of straightforwardly acceptable or unacceptable modal claims. (30) and (32) were judged as '1' by ten and eight participants respectively.

[10] 1.5 on the three-point scale.

temporal perspectives. This evidence supports our proposal that a modal's TP is independent of the flavour of its conversational background. TP is provided by a higher-scoping temporal operator, typically tense, which may freely be either present or past, regardless of modal flavour.

## 3 Temporal orientation and aspect

In this section we show that in all four languages we discuss, TO is restricted both by modal flavour and by aspect (viewpoint and lexical). We begin by introducing the expected TO/flavour correlations, then we present the relevant data.

### 3.1 TO and conversational background: The Diversity Condition

As pointed out in section 1.2, there is a correlation between non-future TO and epistemic interpretations. For example, (33) and (34) can only be understood epistemically:

(33)    She must have left.                                                    PAST TO
(34)    He might be in his office right now.                                   PRESENT TO

Condoravdi captured the interaction between TO and modal flavour via her Diversity Condition,(see also Werner 2003, 2006, Kaufmann 2005, Copley 2006, Laca 2008, among others). This condition is based on a branching-futures model of time, in which the past and the present are 'settled': up until the TP, the same facts hold in all metaphysically accessible worlds. After the TP, the accessible worlds diverge, so the future is metaphysically unsettled. The Diversity Condition, given in (35), requires that there must be at least one world in any modal's modal base in which the prejacent is true, and one in which it is false.

(35)    There is w ∈ cg and w', w'' ∈ MB(w,t) such that:
        AT([t,_), w', P) & ¬ AT([t,_), w', P)                    (Condoravdi 2002:25)

The condition is satisfied by an epistemic modal with a non-future TO (since an epistemic modal base can simultaneously contain worlds in which a non-future prejacent is true, and in which it is false). The condition is however violated by a *metaphysical* modal with a non-future TO, since all worlds in a metaphysical modal base share the same truth value for propositions about past or present events.

.Condoravdi assumes that the relevant non-epistemic readings all involve metaphysical modal bases, and therefore that the Diversity Condition suffices to derive the restriction of non-future TO to epistemic modals. However, the TO restrictions actually extend beyond metaphysical modals proper, to other modals with circumstantial modal bases. We will see this below for our four languages, and the problem has been discussed by e.g., Abusch (2012), Thomas (2014). It is not our purpose here to explain the correlation between non-future TO and epistemic interpretations. We will simply assume (following Abusch 2012) that what Condoravdi calls 'metaphysical' modality is actually circumstantial modality with a past TP. We will see evidence from all four languages which supports the prediction that circumstantial modals are restricted to future TO., We will also see that in all four languages, TO in addition depends on a lower-scoping temporal operator, namely aspect. The evidence supports our proposed universal architecture in which modals scope under TP-restricting operators and over TO-restricting operators.

### 3.2 Dutch and English

In Dutch and English, a modal's TO is heavily influenced by the viewpoint and lexical aspect of the prejacent clause. We go through each of the main factors in turn.

#### 3.2.1 Perfect

In Dutch, the perfect is marked by means of the auxiliary *hebben* 'have' or *zijn* 'be' (depending on the verb), combined with a past participle. This is also possible in the complement of a modal. In that case, the perfect determines TO while TP is unaffected. This is illustrated in (36)a, which has present TP (because the modal is in the simple present) and past TO (because the complement of the modal has perfect aspect). The counterpart of (36)a with the modal in the simple past is (36)b; here we have past TP and past TO. Due to the Diversity Condition, the modal flavour of such past-TO sentences can only be epistemic.

(36)  a.  Hij  **moet**          /  **kan**        **hebb-en**   ge-wonn-en
          he   **must.PRS.SG**   /  **can.PRS.SG**  **have-INF**  PTCP-win-PTCP
          'He must / may have won', 'It is possible that he (has) won.'  PRESENT TP, PAST TO
      b.  Hij  **moest**         /  **kon**        **hebb-en**   ge-wonn-en
          he   **must.PST.SG**   /  **can.PST.SG**  **have-INF**  PTCP-win-PTCP
          'It was possible that he (had) won.'                    PAST TP, PAST TO

With respect to perfect prejacents, English behaves exactly the same way as Dutch, except for complications caused by English's inability to express past TP by means of tense inflection. To compensate for this gap in expressability, English has recruited combinations like *might have* and *could have* to encode past TP rather than past TO, rendering these expressions ambiguous. We return to this issue in section 5.

#### 3.2.2 Lexical aspect: Stative vs. eventive

In Dutch and English, prejacents which are unmarked for overt viewpoint aspect show a stative/eventive split with respect to possible TOs. Stative prejacents allow present or future TO, as shown in (37). This is true whether the TP is present or past.

(37)  De sleutels **moet-en** / **kunn-en** / **moest-en** / **kond-en**         in de la    ligg-en
      the keys    **must.PRS-PL** / **can.PRS-PL** / **must.PST-PL** / **can.PST-PL** in the drawer lie-INF
      'The keys must/might be / had to be / might have been in the drawer.'
                                                              PRESENT/FUTURE TO

When the prejacent contains an eventive verb, however, the TO can only be future, both in English and Dutch (unless the verb has an imperfective interpretation; see below for details). Again this is independent of whether the TP is present or past; see (38).

(38)  We   **moet-en** / **kunn-en** / **moest-en** / **kond-en**         winn-en
      we   **must.PRS-PL** / **can.PRS-PL** / **must.PST-PL** / **can.PST-PL** win-INF
      'We have to / are able to win.'                         FUTURE TO

### 3.2.3 (Im)perfective

Dutch and English do not have any overt morpheme dedicated to marking simple perfective or imperfective aspect. Progressive morphology, which typically appears only on eventive verbs, is a subtype of imperfective. We will assume that statives (which are incompatible with the progressive) receive an imperfective interpretation by default.

In English, in order for an eventive verb to get an episodic present interpretation, it is obligatorily marked with the progressive (Bennett and Partee 1978).

(39)      She #{sings}/{is singing} right now.

We see a parallel effect with modals. (40) shows that overt progressive marking is obligatory with a present TO modal when the verb is eventive. (40)a can only have future TO; to express present TO, the progressive is required as in (40)b. Our explanation of these data in section 4 is based on Bennett and Partee's analysis.

(40)    a.      She must /might sing.            ONLY FUTURE TO
        b.      She must /might be singing.     PRESENT OR FUTURE TO

In Dutch, the facts are slightly more complicated. The language has a progressive-like construction (the *aan het*-construction), but unlike in English it is not obligatory. For example, (41) is perfectly fine without *aan het* (in fact, using *aan het* with a non-agentive verb like 'rain' would be odd).

(41)    Het      regen-t        op      dit      moment
        it        rain.PRS-3SG   at     this    moment
        'It is raining right now.'

We interpret this as showing that in Dutch at least some eventive verbs can be imperfective without occurring in the progressive (cf. de Vuyst 1985). This accounts for the fact that in some cases modals with eventive prejacent verbs can have a present TO reading without progressive marking:

(42)    Het **kan**         (wel eens)     regen-en
        it     **can.PRS.SG**    PRT PRT      rain-INF
        'It might be raining.'

However, usually eventive verbs in a modal prejacent are biased towards future TO, and require the progressive to receive present TO, just like in English. We do not attempt to account for exactly when eventive verbs in the complement of a modal require progressive marking in order to obtain a present-TO reading. We will simply assume that verbs in the progressive are always imperfective in both English and Dutch, whereas eventive verbs in Dutch can sometimes be imperfective without overt progressive marking. Statives in both languages are always imperfective. In our formal analysis in section 4, we will account for why modals with an eventive complement get a present TO interpretation only if the complement is imperfective (overtly or covertly).

### 3.3 Gitksan and St'át'imcets

As observed in section 2.3, Gitksan and St'át'imcets lack overt tense marking. Following

Matthewson (2006), we assume that these languages also lack a covert instantaneous present tense. As we will discuss in section 4.3, an instantaneous present tense is what underlies the requirement we just saw for imperfective marking when eventive prejacents have present TO. This correctly predicts that in Gitksan and St'át'imcets, there are no such effects on modal TO of either the stative/eventive distinction, or the perfective/imperfective distinction.

Dealing with Gitksan first, observe in (43) that a prejacent which is unmarked for viewpoint aspect allows either past or present TO (the TP here is present – the speaker is talking about their utterance-time evidence). (44) shows that the prospective aspect marker *dim* is necessary and sufficient for a future TO. Exactly the same facts hold for stative prejacents, as shown by Matthewson (2013).

(43)  yugw=**imaa/ima'**=hl  wis
      IPFV=**EPIS**=CN          rain
      'It might have rained.' / 'It might be raining.' / ≠'It might rain (in the future).'
      √ Past TO context:       You see puddles, and the flowers looking fresh and damp.
      √ Present TO context:     You hear pattering on the roof.
      # Future TO context:      You hear thunder, so you think it might rain soon.
                                                          (Gitksan; Matthewson 2013:364-365)


(44)  yugw=**imaa/ima'**=hl  **dim**     wis
      IPFV=**EPIS**=CN          **PROSP**  rain
      ≠'It might have rained.' / ≠'It might be raining.' / 'It might rain (in the future).'
      #Past TO context
      #Present TO context
      √ Future TO context                               (Gitksan; Matthewson 2013:365)


(45)-(46) contain past-TP epistemics. Again we see that that past TO is achieved without any overt aspectual marking, but future TO is marked by obligatory prospective aspect.

(45)  *Context: When you looked out your window earlier today, the ground was wet, so it looked like it might have rained. But you found out later that the sprinklers had been watering the ground.*
      yugw=**imaa**=hl        wis      da'awhl
      IPFV=**EPIS**=CN          rain     then
      'It might have rained.' [based on my evidence earlier]   (Gitksan; Matthewson 2013:366)

(46)  *Context: This morning you looked out your window and judging by the clouds, it looked like it might have been going to rain, so you took your raincoat. Later you're explaining to me why you did that.*
      yugw=**imaa**=hl        **dim**     wis
      IPFV=**EPIS**=CN          **PROSP**  rain
      'It might have been going to rain.'                       (Gitksan; Matthewson 2013:366)

The same pattern holds for circumstantial modals, as shown in (47)-(49): future TO is obligatorily marked by prospective aspect. The difference here is that, following the Diversity Condition, circumstantial modals are restricted to future TO. Given the overt marking of prospective in this language, the result is that circumstantial modals are ungrammatical without a following *dim*.

(47)  **da'akhlxw**-i-s          Henry **dim**    jam-t
      CIRC.POS-TR-PN          Henry **PROSP** cook-3SG.II
      'Henry is able to cook.' / 'Henry was able to cook.'   PAST OR PRESENT TP, FUTURE TO
                                                             (Gitksan; Matthewson 2013:371)


(48)  *Context: You were watching the Canucks and at one point in the first period they were up 2-1. At that*
      *point, they might have still won (but they didn't in the end).*
      k'ay **da'akxw**-diit   **dim**   xsdaa-diit,  ii   ap      nee=dii    xsdaa-diit
      still **CIRC.POS**-3PL.II **PROSP** win-3PL.II  and  VERUM   NEG=FOC    win-3PL.II
      'They still could have won, but they didn't win.'       PAST TP, FUTURE TO
                                                             (Gitksan; Matthewson 2013:375)


(49)  **sgi**          **dim**   (ap)           ha'w=s        Lisa
      **CIRC.NECESS** **PROSP** (VERUM)        go.home=PN    Lisa
      'Lisa should/must go home.' / 'Lisa should have gone home.'
                                                  PAST OR PRESENT TP, FUTURE TO
                                                             (Gitksan; Matthewson 2013:380)


The data in (43)-(49) show that (whether the predicate is stative or not, and regardless of modal flavour) TO in Gitksan is determined by viewpoint aspect: prospective marking appears if and only if the TO is future.

We now turn to St'át'imcets. Just like in Gitksan, epistemic modals in St'át'imcets allow either past or present TO without any overt marking, but future TO is obligatorily overtly marked. Future TO can be marked either via the prospective auxiliary *cuz'* or the prospective clitic *kelh* (cf. Glougie 2007, Davis 2010). These generalizations are illustrated for modals with present TPs in (50)-(52).


(50)  *Context: You've been watching the gold medal hockey game, in the middle of it the power went off, so you had*
      *no TV. My power is out too, so I call up and ask 'Did the Canadians win?'*
      t'cúm=wit=**k'a**,         cw7aoz kw=s=áts'x-en=an
      win-3PL=**EPIS**          NEG    DET=NMLZ=see-DIR=1SG.ERG
      'They might have won, I don't know.'            (St'át'imcets)   PRESENT TP, PAST TO


(51)  wá7=**k'a**    séna7      qwenúxw
      IMPV=**EPIS**   COUNTER    sick
      'He may be sick.' (Context: Maybe that's why he's not here.)   PRESENT TP, PRESENT TO
                                                             (St'át'imcets; Rullmann et al. 2008:321)


(52)  *Context: Your grandson is celebrating a Canadian victory, but the game is only half over and so you say 'The*
      *Americans might win.'*
      **sxek**   t'cúm#(=**kelh**)=tu7   i=tlh7álqw-emc=a
      **EPIS**   win#(=**PROSP**)=then   DET.PL=border-person=EXIS
      'The Americans might win.'                    (St'át'imcets)   PRESENT TP, FUTURE TO


The same facts about temporal orientation hold if the temporal perspective is past, as in (53)-(55).

(53) *Context: When you looked out of your window earlier today the ground was wet, so it looked like it might have rained. But you find out later that sprinklers had been watering the ground.*
kwís=**k'a**=tu7
rain=**EPIS**=then
'It might have rained.'                    (St'át'imcets)    PAST TP, PAST TO

(54) *Context: As in (21): The Canucks were playing last night … Today, your friend asks you why you had told him there was good sports news when the Canucks had actually lost. You say:*
wá7=**k'a**      t'cum    i=Canucks=a
IPFV=**EPIS**     win     PL.DET=Canucks=EXIS
'The Canucks might have been winning.'    (St'át'imcets)    PAST TP, PRESENT TO

(55) *Context: When you looked out of your window earlier today it was cloudy, so it looked like it must have been going to rain. So you took your raincoat, but in the end it cleared up and the weather was sunny. Someone asks you later why you have your coat, and you say:*
**cúz'=k'a**(=tu7)      séna7      kwis
**PROSP=EPIS**(=then)   COUNTER    rain
'It might have been going to rain.'       (St'át'imcets)    PAST TP, FUTURE TO

Circumstantial data are shown in (56)-(57). St'át'imcets patterns similarly to Gitksan in that there is a strict Diversity Condition effect whereby circumstantial modals are future-oriented. However, St'át'imcets manifests this effect in an opposite way to Gitksan: rather than having obligatory overt marking of prospective aspect, in St'át'imcets the circumstantial modals convey their own inherent futurity, and overt prospective marking does not appear.

(56) ts'exts'x-ílc=kacw**(*=kelh)=ka(*=kelh)**
clean-AUT=2SG.SBJ**(*=PROSP)=DEON(*=PROSP)**
'You should clean up.'                    (St'át'imcets)    PRESENT TP, FUTURE TO

(57) wá7=lhkan    **ka-**cát-s-**a**        ta=k'ét'h=a
IPFV=1SG.SBJ    **CIRC-**lift-CAUS-**CIRC**   DET=rock=EXIS
'I can lift the rock.'                    (St'át'imcets)    PRESENT TP, FUTURE TO

### 3.4 Summary

When it comes to TO, our languages divide into two pairs. In Gitksan and St'át'imcets, the primary distinction is between prospective and non-prospective forms. For epistemic modals in these languages, the prospective forms allow only future TO and the non-prospective forms allow either past or present TO. This is shown in Table 3.

Table 3: TOs for epistemic modals in Gitksan and St'át'imcets

|             | UNMARKED      | PROSPECTIVE |
|-------------|---------------|-------------|
| Gitksan     | past/present  | future      |
| St'át'imcets| past/present  | future      |

For circumstantial modals, Gitksan and St'át'imcets again display an unmarked vs. prospective split,

but implement it in opposite ways. Gitksan requires, and St'át'imcets disallows, prospective marking for circumstantial modals.

Table 4: TOs for circumstantial modals in Gitksan and St'át'imcets

|  | UNMARKED | PROSPECTIVE |
|---|---|---|
| Gitksan | * | future |
| St'át'imcets | future | * |

For English and Dutch, on the other hand, the core viewpoint aspectual distinction is between perfect and non-perfect forms; the former force past TO, and the latter allow either present or future TO. Within the non-perfect forms, Aktionsart plays a role, as shown in Table 5.

Table 5: TOs for epistemic interpretations in English and Dutch

|  | PERFECT | IMPERFECTIVE | NON-IMPERFECTIVE[11] |
|---|---|---|---|
| STATIVE | past | present/future | N/A |
| EVENTIVE | past | present/future | future |

Circumstantial modals in English and Dutch, like those in Gitksan and St'át'imcets (and any language, assuming the Diversity Condition generalizes), can only be future-oriented. They are thus incompatible with a real perfect aspect which scopes under the modal, as shown in Table 6.

Table 6: TOs for circumstantial interpretations in English and Dutch

|  | PERFECT | IMPERFECTIVE | NON-IMPERFECTIVE |
|---|---|---|---|
| STATIVE | * | future | N/A |
| EVENTIVE | * | future | future |

## 4    Analysis

Recall our main claims: the flavour of a modal's conversational background is independent of its temporal perspective, so modals in the scope of past tense are able to be epistemic. Viewpoint aspect scopes under the modal, and (in combination with the Aktionsart of the predicate, and the Diversity Condition), determines temporal orientation.

In this section we spell out our formal analysis. We first sketch the basic outline (section 4.1) and then apply the analysis to Dutch, Gitksan, and St'át'imcets (4.2-4.3). A detailed discussion of the English modal system is given in section 5.

## 4.1    Outline of the analysis

We adopt the basic framework of Condoravdi (2002), but many details differ. We assume a basic syntactic hierarchy for the relevant portion of the clause as in (58).[12]

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[11] In our analysis, forms without imperfective marking will contain prospective aspect; see section 4.
[12] In some languages, (some) modals may have a different semantic type and may be able to appear above tense (cf. Chen et al. to appear).

(58)    tense > modal > perfect/prospective > perfective/imperfective

We assume a deictic analysis of tense. Tense morphemes are interpreted as functions that take an expression of type $<i,st>$ and apply it to a free variable over times (intervals), which receives its value from the assignment function g. The past or present feature of the tense morpheme is interpreted as a presuppositional restriction on the time assigned to the tense morpheme: a PAST morpheme can only refer to a time preceding the utterance time $t_0$, and a PRESENT morpheme can only refer to $t_0$.

(59)    $[[ \text{PAST}_i ]]^{g,t0,w0}$ is only defined if $g(i) < t_0$.
         If defined, $[[ \text{PAST}_i ]]^{g,t0,w0} = \lambda P_{<i,st>}.P(g(i))$.

(60)    $[[ \text{PRESENT}_i ]]^{g,t0,w0}$ is only defined if $g(i) = t_0$.
         If defined, $[[ \text{PRESENT}_i ]]^{g,t0,w0} = \lambda P_{<i,st>}.P(g(i))$.

In Gitksan and St'át'imcets, there is no past/present distinction. Instead, there is a single non-future tense morpheme (Matthewson 2006, Jóhannsdóttir and Matthewson 2007, Matthewson 2013). This (phonologically null) non-future tense is interpreted as follows. The notation '$g(i) \leq t_0$' means that no part of $g(i)$ is later than any part of $t_0$.

(61)    $[[ \text{NON-FUT}_i ]]^{g,t0,w0}$ is only defined if $g(i) \leq t_0$.
         If defined, $[[\text{NON-FUT}_i ]]^{g,t0,w0} = \lambda P_{<i,st>}.P(g(i))$.

Future time reference is obtained in all the languages via the combination of a past, present or non-future tense with a prospective aspect, which may also introduce modality. In this we follow Abusch (1985), who called this prospective element WOLL.

     In (62) we give our language-neutral lexical entries for possibility and necessity modals. POS and NEC are 'pure' modals, abstracting away from additional tense or aspect features that may be encoded in specific modals in certain languages. For instance, English *might* and *may* are lexicalizations of POS and *must* of NEC, but in addition these lexical items contain tense information, as will be discussed in section 5. In Dutch, on the other hand, the modal verb stems *kun-* and *moet-* spell out just POS and NEC, respectively, and tense is realized as a separate inflectional head, just as it is for any other verb.

     The modals are interpreted with respect to a modal base f and an ordering source h.[13] Modal base and ordering source are functions from world-time pairs to sets of propositions. After combining with its conversational backgrounds, the modal takes as its argument a prejacent proposition P of type $<i,st>$ and yields a proposition of the same type. The modal proposition asserts that the prejacent is true in some/all of the most highly-ranked worlds in the intersection of the propositions provided by the modal base, as evaluated at the evaluation world w and the reference time t (to be provided by tense higher up in the tree).[14, 15]

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[13] We are being sloppy in using f and h as variables of both the object language and the metalanguage.

[14] The BEST operator picks out the most highly-ranked world. For a definition, see von Fintel and Heim (2011:61), Portner (2009:67).

(62)　　a.　　　$[[ \text{POS} ]]^{g,t0,w0} = \lambda f \, \lambda h \, \lambda P_{<i,st>} \, \lambda t \, \lambda w \, . \, \exists w' \, [w' \in \text{BEST}_{h(w,t)}(\cap f(w,t)) \, \& \, P(t)(w')]$

　　　　b.　　　$[[ \text{NEC} ]]^{g,t0,w0} = \lambda f \, \lambda h \, \lambda P_{<i,st>} \, \lambda t \, \lambda w \, . \, \forall w' \, [w' \in \text{BEST}_{h(w,t)}(\cap f(w,t)) \, \rightarrow \, P(t)(w')]$

The viewpoint aspects which apply below the modal include firstly perfective and imperfective. Simple standard denotations for these aspects are given in (63)-(64); they are functions from properties of events (type *<l,st>*) to properties of times (type *<i,st>*). We assume that these have the same denotations in all four languages.

(63)　　$[[ \text{PFV} ]]^{g,t0,w0} = \lambda P_{<l,st>} \, \lambda t \, \lambda w \, . \, \exists e \, [P(e)(w) \, \& \, \tau(e) \subseteq t]$　　　　　　　　(Kratzer 1998)

(64)　　$[[ \text{IPFV} ]]^{g,t0,w0} = \lambda P_{<l,st>} \, \lambda t \, \lambda w \, . \, \exists e \, [P(e)(w) \, \& \, t \subseteq \tau(e)]$　　　　　　　　(Kratzer 1998)

In all four languages the perfective operator is phonologically null, but the languages differ in how imperfective is spelled out. For eventive verbs in English, IPFV is obligatorily realized as the progressive, whereas in Dutch IPFV can be phonologically empty in some cases. We assume for concreteness that stative predicates have a null imperfective in both languages (although an analysis of statives as perfective would be equally compatible with our analysis). Gitksan and St'át'imcets both have overt general imperfective morphemes (*yukw* and *wa7* respectively).

　　　　Between perfective/imperfective and the modal, either a perfect or a prospective can appear. We know that aspects can in principle stack in this way because of constructions like *He might **have been** waiting for you*; see also Pancheva (2003). Perfect and prospective are functions from properties of times to properties of times, as in (65)-(66). Here again, the languages differ in the overtness vs. covertness of the operators. The prospective in (66) is phonologically null in English and Dutch under modals, but is spelled out as *dim* in Gitksan, and as *kelh* in St'át'imcets under epistemic modals, as outlined in section 3.3.[16]

(65)　　$[[ \text{PERF} ]]^{g,t0,w0} = \lambda P_{<i,st>} \, \lambda t \, \lambda w \, . \, \exists t' \, [t' < t \, \& \, P(t')(w)]$

(66)　　$[[ \text{PROSP} ]]^{g,t0,w0} = \lambda P_{<i,st>} \, \lambda t \, \lambda w \, . \, \exists t' \, [t \leq t' \, \& \, P(t')(w)]$

The claim that the perfect can apply below a modal is familiar from Condoravdi, but we need to say a few words regarding our proposal about the prospective – especially since this aspect is phonologically invisible in English and Dutch. (We do not say things like *\*She might will wait for you,* at least not in most dialects.) The prospective aspect we propose represents the default non-past-orientation common to many if not all English and Dutch modals – the fact that, for example, *She might win* talks about a future winning, and *He might know* talks about a present or future knowing. In many analyses, this non-pastness is located within the modal's lexical entry, as for example in Condoravdi's denotation in (67), which utilizes Abusch's forward-extended interval [t,_), the interval which has t as its initial sub-interval and extends forward to the end of time.

(67)　　$\text{MAY/MIGHT}_{MB} = \lambda P \, \lambda w \, \lambda t \, \exists w' \, [w' \in \text{MB}(w,t) \, \& \, \text{AT}([t,\_), w', P)]$　　　　(Condoravdi 2002:13)

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[15] As far as the types are concerned it is possible to stack modals; this happens in Dutch, and with English semi-modals. The fact that English modal auxiliaries can't stack (in most dialects) is presumably due to morphosyntactic constraints.

[16] Because PERF and PROSP have the same type as the modals (apart from modal base and ordering source), they can also appear above the modal, e.g., *has been able* and *has had to*.

It is not crucial to our proposal that the non-past semantics is moved from the modal itself to a separate prospective aspect. However, PROSP *is* phonologically overt in some languages, such as Gitksan (and St'át'imcets for epistemic modals); see section 3.3 and Matthewson (2012, 2013). Moreover, Kratzer (2011) argues on independent grounds that English possesses a null prospective which co-occurs with modals, and Louie (2015) motivates a null prospective in some Blackfoot modal constructions.

We assume that PROSP is optional (cf. Kratzer 2011), but independent differences in other features of the languages lead to different results with respect to whether PROSP is required. For example, PROSP is forced to appear in present-TO eventive sentences in English, due to the instantaneous nature of the present tense (Bennett and Partee 1978). Without the prospective, a sentence like *John might dance* would assert that in some accessible world w' there is an event e of John dancing, whose run-time is contained within the instantaneous utterance time. As argued by Bennett and Partee, eventive verbs lack the Subinterval Property (Dowty 1986) and therefore cannot fit inside the instantaneous utterance time. In a modal sentence such as *John might dance,* the insertion of PROSP saves the mismatch. In St'át'imcets and Gitksan, on the other hand, PROSP is *not* forced by the Bennett and Partee effect, as there is no instantaneous present tense, but only a non-future tense which locates the potentially non-instantaneous reference time at some point no later than the utterance time. However, prospective aspect is obligatory under circumstantial modals due to the Diversity Condition, as discussed in section 3.3.

We will now apply the analysis to a representative range of examples to show that it derives the right truth conditions. We will discuss Dutch first, then Gitksan and St'át'imcets. English works mostly the same as Dutch, but has various complications. For that reason, we postpone a fuller discussion of English to section 5.

## 4.2    Applying the analysis to Dutch

Because Dutch modals generally do not have lexical restrictions on their modal flavour, the examples in this section in principle allow for both epistemic and non-epistemic readings, modulo Diversity Condition effects. Since our focus is on accounting for TP and TO, we will not usually comment on whether particular examples are biased towards any particular modal flavour. To illustrate our account, we use the modal verb *kunnen*, which is the closest analogue of English *might*.

In (68) we have present tense, an eventive predicate, and perfective aspect. For the reasons outlined above, prospective aspect also appears:

(68)    Jan    **kan**    dans-en
        Jan    **can.PRS.SG**    dance-INF
        'Jan can/might dance.'                                    PRESENT TP, FUTURE TO

$[[$ PRESENT(POS(f)(h)(PROSP(PFV(Jan dansen)))) $]]^{g,t0,w0}$ =
$\exists w'$ [w' $\in$ BEST$_{h(w0,t0)}$($\cap$f(w$_0$,t$_0$)) & $\exists t'$ [t$_0$ $\leq$ t' & $\exists e$ [Jan.dance(e)(w') & $\tau$(e) $\subseteq$ t']]]

(68)  asserts that there is a world w' which is accessible from $<w_0,t_0>$, in which there is an event e of Jan dancing, whose run-time is contained within some interval t' which starts no earlier than t$_0$. This correctly predicts (as in Condoravdi's system) that Jan's potential dancing is in the future.

Modal sentences containing stative predicates or imperfective viewpoint aspect are correctly predicted to allow either present or future TO. This is illustrated in (69).

(69) Jan     **kan**        {ziek} / {**aan het** zing-en}    zijn
      Jan     **can.PRS.SG**   {sick} / {**at**    **the** sing-INF}   be.INF
      'Jan might be sick / singing.'                PRESENT TP, PRESENT/FUTURE TO

$[[ \text{PRESENT}(\text{POS}(f)(h)(\text{PROSP}(\text{IPFV}(\text{Jan ziek/zingen zijn})))) ]]^{g,t0,w0} =$

$\exists w' [w' \in \text{BEST}_{h(w0,t0)}(\cap f(w_0,t_0)) \ \& \ \exists t' [t_0 \leq t' \ \& \ \exists e [\text{Jan.be.sick/Jan.sing}(e)(w') \ \& \ t' \subseteq \tau(e)]]]$

(69) asserts that there is a world w' which is accessible from $\langle w_0,t_0 \rangle$, in which there is an event e of Jan being sick/singing, whose run-time contains some interval t' which starts no earlier than $t_0$. This means that Jan's sickness/singing can begin before, at, or after the utterance time; the requirement is that Jan's sickness/singing must contain a non-past interval, i.e., the event cannot be entirely located in the past.

      Next we turn to sentences containing a perfect auxiliary in the modal's prejacent. The surface scope ordering of the perfect auxiliary and the modal leads to the analysis in (70) for an eventive predicate.[17] This is the reading of English *might have* which has present TP and past TO. For Dutch *kunnen* with a perfect complement this is the only available reading.

(70) Jan     **kan**        **zijn**    vertrokk-en
      John    **can.PRS.SG**   **be.INF** leave-PTCP
      'John may/might have left.'                      PRESENT TP, PAST TO

$[[ \text{PRESENT}(\text{POS}(f)(h)(\text{PERF}(\text{PFV}(\text{Jan vertrekken})))) ]]^{g,t0,w0} =$

$\exists w' [w' \in \text{BEST}_{h(w0,t0)}(\cap f(w_0,t_0)) \ \& \ \exists t' [t' < t_0 \ \& \ \exists e [\text{Jan.leave}(e)(w') \ \& \ \tau(e) \subseteq t']]]$

(70) asserts that there is a world w' which is (epistemically) accessible from $\langle w_0,t_0 \rangle$, in which there is an event of John leaving, whose run-time is contained within some interval t' which precedes $t_0$. This correctly derives present TP and past TO. In (71), the perfect auxiliary combines with either a stative predicate or an overt imperfective (progressive). Both these combinations derive present TP and past TO.

(71) Jan     **kan**        {ziek} / {aan het zing-en}   **zijn**    ge-wees-t
      Jan     **can.PRS.SG**    {sick} / {at the   sing-INF}   **be.INF** PTCP-be-PTCP
      'Jan may/might have been sick / singing.'            PRESENT TP, PAST TO

$[[ \text{PRESENT}(\text{POS}(\text{PERF}(\text{IPFV}(\text{Jan ziek/zingen zijn})))) ]]^{g,t0,w0} =$

$\exists w' [w' \in \text{BEST}_{h(w0,t0)}(\cap f(w_0,t_0)) \ \& \ \exists t' [t' < t_0 \ \& \ \exists e [\text{Jan.be.sick/Jan.sing}(e)(w') \ \& \ t' \subseteq \tau(e)]]]$

We have illustrated the analysis for examples with present TP here. Past-TP cases are exactly analogous, differing only in that the temporal perspective is not $t_0$, but instead is a past time interval given by the assignment function.

      This concludes the outline of our formal analysis of how TP and TO are determined by

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[17] We assume that the perfect in (70) has a (covert) perfective in its complement. See de Vuyst (1985), Boogaart (2007) and Gerrevink and de Hoop (2011) for evidence that the Dutch perfect is (or contains) a perfective. Presumably, this is overridden when the complement of the perfect has overt imperfective marking or is stative, as in (71).

tense and aspect in Dutch. We saw that TP is determined fully compositionally via the tense inflection on the modal, and TO is determined by aspect. We turn now to Gitksan and St'át'imcets.

## 4.3    Applying the analysis to Gitksan and St'át'imcets

As shown in section 2.3, Gitksan and St'át'imcets lexically distinguish epistemic from circumstantial modals, and there is just one non-future tense. As shown in section 3.3, both epistemic and circumstantial modals can have past TPs in these languages. The only relevant difference between the systems is that in Gitksan, future TO is obligatorily overtly marked by prospective aspect, while in St'át'imcets, this is the case only for epistemic modals. For St'át'imcets circumstantial modals, future TO is enforced by the Diversity Condition. These independent differences in the temporal systems of Gitksan and St'át'imcets as opposed to Dutch and English will correctly derive the different surface patterns of modal-temporal interactions, even though there is an identical hierarchy of elements, system of semantic types, and the same general architecture whereby tense provides TP and aspect provides TO.

   The main, independently-required change for Gitksan and St'át'imcets is that the lexical entries for the modals must encode restrictions on conversational background (Matthewson et al. 2007, Rullmann et al. 2008, Davis et al. 2009, Peterson 2010, Matthewson 2013). Lexical entries for the modals are given in (72)-(73). We are setting aside differences in the precise types of modal base and ordering source the modals require; these include evidential restrictions, which are not relevant for current concerns.[18]

(72)    $[[$ *k'a* (St'át'imcets) / *imaa* (Gitksan) $]]^{g,t0,w0}$ is only defined if the context provides an epistemic modal base f.
   If defined, $[[$ *k'a/imaa* $]]^{g,t0,w0} = \lambda f \lambda h \lambda P_{<i,st>} \lambda t \lambda w . \forall w'[w' \in \text{BEST}_{h(w,t)}(\cap f(w,t)) \rightarrow P(t)(w')]$

(73)    $[[$ *ka* (St'át'imcets) / *sgi* (Gitksan) $]]^{g,t0,w0}$ is only defined if the context provides a circumstantial modal base f.
   If defined, $[[$ *ka* / *sgi* $]]^{g,t0,w0} = \lambda f \lambda h \lambda P_{<i,st>} \lambda t \lambda w . \forall w'[w' \in \text{BEST}_{h(w,t)}(\cap f(w,t)) \rightarrow P(t)(w')]$

With respect to viewpoint aspects, the only tweak is that while in English and Dutch, perfect is overtly marked and prospective is not, in Gitksan and St'át'imcets, prospective is overtly marked and perfect is not. We work through just two representative examples here. (74) is from St'át'imcets and contains an epistemic modal with a present TP and a past TO. The example parallels the Dutch case in (70), with the above-mentioned difference that the perfect aspect is null in St'át'imcets.[19] The other difference between this example and the European languages is due to the non-future tense. The discourse context here enforces present TP, so the value of g(2) (the assignment function applied to the index of the tense) is $t_0$. In a different discourse context, the same modal could have

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[18] The modals in (72) are translated as universal quantifiers, but all of them except *sgi* are felicitous both in contexts which support necessity claims, and in contexts which support possibility claims. For detailed discussion, see Rullmann et al. (2008) and Peterson (2010).
[19] There is a potential candidate for an overt perfect morpheme in St'át'imcets: *plan* (Davis 2010, Matthewson 2013). However, it is not clear whether this is a perfect or simply a lexical item meaning 'already' (cf. Vander Klok and Matthewson 2015).

past TP without any additional marking. We thus see that although (Gitksan and) St'át'imcets have neither obligatory tense marking, nor a past/present distinction, our analysis still involves tense providing the TP in these languages, just as in Dutch and English.

(74)  *Context: You've been watching the gold medal hockey game, in the middle of it the power went off, so you had no TV. My power is out too, so I call up and ask 'Did the Canadians win?'*
t'cúm=wit=**k'a**
win=3PL=**EPIS**
'They might have won.'                    (St'át'imcets )          PRESENT TP, PAST TO

[[ NON-FUT$_2$($k'a$(f)(h)(PERF(PFV($t'cúmwit$)))) ]]$^{g,t0,w0}$ =
$\forall$w' [w' $\in$ BEST$_{h(w0,g(2))}$($\cap$f(w$_0$,g(2))) $\rightarrow$ $\exists$t' [t' < g(2) & $\exists$e [they.win(e)(w') & $\tau$(e) $\subseteq$ t']]]
(where g(2) $\leq$ t$_0$)

(75) is from Gitksan and contains a circumstantial modal with past TP and future TO. Here, the discourse context ensures that the value given to the non-future tense is in the past, giving past TP.

(75)  *Context: You were watching the Canucks and at one point in the first period they were up 2-1. At that point, they might have still won (but they didn't in the end).*

| ḵ'ay | **da'aḵxw**-diit | **dim** | xsdaa-diit, | ii | ap | nee=dii | xsdaa-diit |
|------|------------------|---------|-------------|-----|--------|-----------|------------|
| still | **CIRC.POS**-3PL.II | **PROSP** | win-3PL.II | and | VERUM | NEG=CNTR | win-3PL.II |

'They still could have won, but they didn't win.'          PAST TP, FUTURE TO
                              (Gitksan; Matthewson 2013:375)

[[ NON-FUT$_2$($da'aḵxw$(PROSP(PFV($xsdaadiit$)))) ]]$^{g,t0,w0}$ =
$\exists$w' [w' $\in$ BEST$_{h(w0,g(2))}$($\cap$f(w$_0$,g(2))) & $\exists$t' [g(2) < t' & $\exists$e [they.win(e)(w') & $\tau$(e) $\subseteq$ t']]]
(where g(2) $\leq$ t$_0$)

## 5    Past TP in English
### 5.1    Variation in the English modal system

Compared to the languages discussed so far, the modal system of English is complex and messy when it comes to its interaction with tense and aspect. We speculate that this is due mainly to a purely syntactic constraint prohibiting the co-occurrence of tense with a modal auxiliary. English has to resort to "patches" in its grammar in order to express past TP readings of modals, resulting among other things in the ambiguity of *might have*.

Looking beyond *might* at other modals, it becomes clear that English modals don't all behave the same way. For instance, *may* differs from *might* in that *may have* is unambiguous; it can only have a present TP, past TO reading:

Table 7: Interpretations of *might have* vs. *may have*

| | PRESENT TP, PAST TO | PAST TP, PRESENT/FUTURE TO | PAST TP, PAST TO |
|---|---|---|---|
| Mary might have left | √ | √ | √ |
| Mary may have left | √ | * | * |

While the facts in Table 7 hold for the standard dialect, there is some variation among English speakers with respect to the behaviour of individual modal auxiliaries. For instance, many speakers can use *may have* counterfactually, i.e., with a past TP in a situation in which it is known at the utterance time that the prejacent is false (Denison 1992, Huddleston and Pullum 2002):

(76)    If our goalie had not been injured, we **might / % may** have won.

The following are two attested examples of counterfactual *may have*:

(77)    a.    "An irrevocable catastrophe <u>may have</u> occurred if a worker or visitor had been in this location," wrote Thomas Quasney [...].                 (*Ubyssey,* March 1, 2012)

        b.    Had Roosevelt not died an untimely death, [...], the world <u>may</u> well <u>have</u> been spared the agonies of the cold war.              (*NYRB* LX(5):,24 (March 21, 2013)

        In this section we explicate the different sub-classes of English modals, pointing out where they do and do not obey the analysis proposed in section 4. We conclude with a tentative proposal for dealing with the problematic cases.

### 5.2    Semi-modals

We begin by looking at semi-modals such as *have to, be able to, be allowed to,* and *be possible.* These behave exactly as our analysis predicts. TP is determined by tense (or other temporal operators) scoping above the modal, and TO is determined by aspect scoping below it and the Aktionsart of the prejacent predicate. The modal flavour is constrained by the Diversity Condition in the usual way. This is illustrated for *have to* in Table 8:

Table 8: TP and TO for the semi-modal *have to*

| | TP | TO |
|---|---|---|
| *Sue has to leave.* | PRESENT | FUTURE |
| *Sue has to be sick.* | PRESENT | PRESENT/FUTURE |
| *Sue had to leave.* | PAST | FUTURE |
| *Sue had to be sick.* | PAST | PRESENT/FUTURE |
| *Sue has to have left.* | PRESENT | PAST |
| *Sue had to have left.* | PAST | PAST |

## 5.3    Three classes of modal auxiliaries

When not followed by *have*, all the modal auxiliaries allow only present TP in matrix clauses.[20]

(78)    Mary **may** / **must** / **might** {leave}/{be home}.
              - only PRESENT TP, PRESENT/FUTURE TO

However, the modal auxiliaries can be divided into (at least) three classes based on whether they can have past TP when followed by *have*; and whether they can have a simultaneous reading in Sequence of Tense (SOT) contexts (see also Huddleston and Pullum 2002). The simultaneous reading is illustrated in (79)a for a non-modal sentence: the event time of the embedded past-tense stative predicate coincides with that of the matrix verb. This contrasts with the double-access reading in (79)a, where the event time of the embedded present-tense stative predicate overlaps with both the utterance time and the event time of the matrix verb (see Ogihara 1996, Abush 1997, among others). When a modal auxiliary appears in an embedded clause, the simultaneous reading corresponds to past TP for the modal, and the double-access reading corresponds to a present TP (see examples below).

(79)    a.    John said that Sue was pregnant.        (simultaneous)
        b.    John said that Sue is pregnant.         (double access)

The three classes of modal auxiliaries are as follows; the information is summarized in Table 9.

I.      Modals which always have present TP: *may, can, shall, will.*

II.     Modals which can behave as if inflected for past tense in SOT contexts (i.e., allow for the 'simultaneous' reading when in the scope of a matrix past-tense verb): *must*

III.    Modals which can have the simultaneous reading in SOT contexts, and which <u>additionally</u> allow a past TP interpretation when their complement is morphosyntactically in the perfect: *might, could, should, would.*

Table 9: Classification of English modals[21]

|  |  | *simultaneous reading with SOT* | |
|---|---|---|---|
|  |  | − | + |
| *past TP when followed by* have | − | Class I | Class II |
|  | + |  | Class III |

In the rest of this section we present data that support the classification in Table 9, and then propose an analysis in the theoretical framework developed above.

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[20] An exception is free indirect discourse. See section 6.

[21] This table raises the question why there are no modals in English that can have past TP with *have* but which cannot behave like past verbs in SOT contexts. This might just be an accidental gap; we leave the question for further research.

**Class I:** *may, can, shall, will*

In the examples below we use *may* to illustrate the behaviour of Class I modals. The other modals in this class behave essentially the same way when it comes to TP and TO, but have idiosyncratic restrictions involving modal flavour and things like register. For instance, *can* resists epistemic readings, *will* expresses futurity, and *shall* is archaic.

   When embedded under a past-tense matrix verb, Class I modals cannot have the simultaneous reading, and only allow for the double-access interpretation:

(80)   John said that Mary **may** {leave}/{be home}.
               - only double-access reading (PRESENT TP, PRESENT/FUTURE TO)
               - no simultaneous reading (*PAST TP, PRESENT/FUTURE TO)

When followed by *have*, Class I modals can only express present TP and past TO; this is not only true in main clauses (as in (81)), but also when embedded in a past tense matrix clause, where again only the double-access reading is possible (82):

(81)   Mary **may** have {left}/{been home since 7 pm}.
               - only PRESENT TP, PAST TO

(82)   John said that Mary **may** have {left}/{been home since 7 pm}.
               - only double-access reading (PRESENT TP, PAST TO)
               - no simultaneous reading (*PAST TP, PAST TO)

**Class II:** *must*

Unlike Class I modals, *must* can have the simultaneous reading when embedded under a past-tense verb:

(83)   John said that Mary **must** {leave}/{be home}.
               - double-access (PRESENT TP, PRESENT/FUTURE TO)
               - simultaneous (PAST TP, PRESENT/FUTURE TO)

That *must* can have simultaneous readings in SOT contexts is shown by the following attested examples:

(84)   a.   Charlie never wrote of his health, so I supposed he <u>must</u> be all right.
                                             (Robertson Davies, *The Cunning Man,* p. 174).
        b.   They dutifully supported him in office until a conflict-of-interest commissioner [...]
             told Vander Zalm he <u>must</u> go.          (Christopher Moore, *1867*, p. 223)

However, when it is followed by *have* in a matrix clause, *must* behaves just like the Class I modals in that it can only have a present TP/past TO reading:[22,23]

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[22] Again excepting free indirect discourse.

(85)    Mary **must** have {left}/{been home since 7 pm}
            - only PRESENT TP, PAST TO

As expected, when *must have* is embedded under a matrix past-tense verb, it is again ambiguous between the simultaneous and double-access readings (so the TP is either past or present), but this time the TO is past, as shown in (86). This is consistent with the pattern we saw in (83)-(84):

(86)    John said that Mary **must** have {left}/{been home since 7pm}
            - double-access (PRESENT TP, PAST TO)
            - simultaneous (PAST TP, PAST TO)

Some attested examples of the simultaneous (i.e., past TP) reading with *must have* are the following:

(87)    a.    I thought someone <u>must have</u> given him my name to divert attention from the others. (Robertson Davies, *Fifth Business,* p. 38)
        b.    We knew your Ma <u>must have</u> sent you.    (Robertson Davies, *Fifth Business*, p. 96)


## Class III: *might, could, should, would*

We use *might* as our paradigm case for Class III modals; the other members of the class by and large behave the same way with respect to TO (although they are sometimes more limited or idiosyncratic in other ways).[24]
        Class III modals behave like *must* in that they can have the simultaneous, past TP reading when embedded under a past-tense verb:

(88)    John said that Mary **might** {leave} / {be home}.
            - double-access (PRESENT TP, PRESENT/FUTURE TO)
            - simultaneous (PAST TP, PRESENT/FUTURE TO)

However, class III modals differ from *must* in allowing past-TP readings when they are non-embedded but followed by *have*. This results in the famous ambiguity of *might have* that was the focus of Condoravdi (2002). As we have argued in this paper, these past-TP readings can not only be circumstantial, but also epistemic.
        The past-TP readings of *might have* allow not only present or future TO (as in the cases discussed in the literature), but also past TO. This reading is illustrated by the following variant of

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[23] According to Huddleston and Pullum (2002:109), *must have* sometimes occurs in counterfactual conditionals, in 'rare and marginal' examples such as %*If he had stayed in the army, he must surely have become a colonel.*

[24] Further refinements of our classification may be necessary. Huddleston and Pullum (2002:196-197) point out that non-epistemic *could* and *would* can have past-TP readings in main clauses, as in their examples (i)-(iii), unlike *should*:
(i)      In those days we could borrow as many books as we wished.
(ii)     Water could still get in.
(iii)    Only a few months later their love would change to hate.

von Fintel and Gillies's ice cream example:

(89)   A:   Why did you look in the freezer?
       B:   Somebody **might have** put the ice cream in there.      PAST TP, PAST TO

Here B is talking about a past epistemic state (past TP) concerning a hypothetical event (the putting of the ice cream in the freezer) that is located *before* the epistemic perspective time (past TO).

    Again, we see the same pattern in embedded clauses as in main clauses. These facts are summarized in (90)-(91).

(90)   Mary **might** have {left}/{been home}
        - PRESENT TP, PAST TO
        - PAST TP, PAST/PRESENT/FUTURE TO

(91)   John said that Mary **might** have {left}/{been home}
        - double-access (PRESENT TP, PAST TO)
        - simultaneous (PAST TP, PAST/PRESENT/FUTURE TO)

Table 10 summarizes the generalizations observed in this section.

Table 10: Readings of three classes of English modal auxiliaries

|  | without *have* | | with *have* | |
|---|---|---|---|---|
|  | past TP possible in matrix clause? | simultaneous reading under matrix past? | past TP possible in matrix clause? | simultaneous reading under matrix past? |
| Class I | * | * | * | * |
| Class II | * | √ | * | √ |
| Class III | *[25] | √ | √ | √ |

## 5.4    A partially lexical analysis

How can the classification of English modals we have arrived at be accounted for within the theory of modal/temporal interaction argued for in this paper? Let's start with Class I modals. These behave exactly the same way as English or Dutch present-tense verbs (including English semi-modals and Dutch modal verbs): they do not allow simultaneous past-TP readings when in the scope of a matrix past (see (80)). We therefore analyze Class I modals as having a built-in present tense morpheme which scopes over the modal. In fact, there is precedent for this analysis. Abusch (1985) proposed that *will* be decomposed into a present tense morpheme and an atemporal modal WOLL. Along similar lines, we could decompose *may* as PRESENT + an atemporal modal (and similarly for the other Class I modals).

    The behaviour of Class II modals (i.e., *must*) is a bit more mysterious. At first sight, *must* appears to be ambiguous between a present-TP interpretation (in main clauses like (78), (85)) and a past-TP interpretation (when embedded under a past tense matrix verb, as in (83), (86)). Thus, we might assume that *must* is ambiguous between having an inherent present tense or an inherent past

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[25] Past TP in matrix clauses is possible for non-epistemic readings of some other Class II modals; see the previous footnote.

tense. However, the facts are more complicated (and interesting) when *must* is in embedded clauses. As is well-known from the Sequence of Tense literature, (non-modal) past-tense verbs embedded under a past-tense matrix verb allow not only the simultaneous interpretation, they also have a "backshifted" reading:

(92)    Mary said that he was brave.
        a.      Mary said last week that he was brave last week. (simultaneous)
        b.      Mary said last week that he was brave a year ago. (backshifted)

In the backshifted reading, the past tense in the embedded clause moves the evaluation time backward relative to the (past) evaluation time of the matrix clause. Past-tense forms of semi-modals allow the backshifted reading, as we expect since they are ordinary verbs (the same holds in Dutch):

(93)    Mary said that he **had to** be brave.
        a.      simultaneous
        b.      backshifted

By contrast, the Class II modal *must* cannot have the backshifted reading (Boogaart 2007):[26]

(94)    Mary said last week that he **must** be brave.
        a.      simultaneous
        b.    # backshifted

These data show that although *must* can count as past tense for the purposes of SOT, it does not have a semantically active past tense morpheme that can shift the evaluation time backward. We conclude that *must* is ambiguous between having an inherent present tense morpheme (when used in a main clause, or when it has the double-access reading as in (83)) and having what we will call a "defective" past tense. By a defective past tense we mean a past tense morpheme which is morphosyntactically present and can fulfill the tense agreement requirement of SOT, but which is not semantically active and hence cannot on its own backshift the evaluation time.

        Finally, let's consider Class III modals. Recall that these are similar to *must* (Class II) in allowing the simultaneous reading (88). They also behave like *must* in not allowing the backshifted reading, as shown in (95) (Abusch 1997):

(95)    Mary said last week that he **might** be brave.
        a.      simultaneous
        b.    # backshifted

However, Class III modals <u>additionally</u> allow a past-TP reading to be expressed by means of *have* following the modal. Condoravdi analyzed this ambiguity in terms of *have* being able to raise over the modal at LF so that it assigns past TP instead of past TO. Although this is an attractive idea because it offers a compositional way to derive the past-TP reading, analogous to the classic QR account of quantifier scope ambiguities, it has several conceptual and empirical problems. First of all, raising

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[26] It is possible to obtain something like the backshifted reading by adding perfect *have* to the modal:
(i)      Mary said last week that she **must have** been pregnant a year ago.
But in that case, it is the past TO that is responsible for the apparent backshifting.

*have* over the modal violates well-known constraints on head movement (see also Arregui 2005, Hacquard 2006, Laca 2008).

Secondly, the raising account cannot explain why *have* following a modal can express a past-TP reading only for Class III modals and not for Classes I or II. For Class I this could perhaps be accounted for in terms of the inherent present tense morpheme blocking the raising of *have*, but no such explanation is available for *must* (Class II), which is otherwise exactly like Class III modals in having either an inherent present tense or a "defective" past tense. We conclude that the ability to allow a past-TP reading with *have* must be a lexical property, which Class III modals have but which *must* lacks.

A third problem for the *have*-raising account is that it cannot explain why it is possible for forms like *might have* (i.e., Class III modals followed by *have*) to have a past-TP/past-TO reading (as in (89) above). The problem that such cases pose is that *have* would have to do double duty: it would have to scope both over the modal (to explain the past-TP) and under the modal (to explain the past-TO) at the same time.

One way to account for all this is simply to stipulate that *might have* and the other Class III modals have two lexicalized non-compositional interpretations in addition to their regular compositional one, as in (96):

(96)   Possible interpretations of *might-have*(p):
    a.     PRESENT(POS(PERF(P)))    (compositional)     PRESENT TP, PAST TO
    b.     PAST(POS(PROSP(P)))     (non-compositional)   PAST TP, PRESENT/FUTURE TO
    c.     PAST(POS(PERF(P)))      (non-compositional)   PAST TP, PAST TO

This account has the virtue of making the past-TP readings a purely lexical property, which seems to be appropriate. Note that (as pointed out by Tim Stowell (p.c.)), the lexicalized *might have* forms allow other elements, such as negation, to intervene on the surface. This means that they are (potentially) discontinuous lexical items, perhaps comparable to particle verbs like *to pick up*.

Before concluding this section, we return to the issue of backshifting, since this has received some attention in the literature on epistemic modals. In our account, *might have* should have the non-compositional meanings in (96)b,c also in embedded clauses. In other words, we predict that when it occurs in the scope of a matrix past tense, *might have* (as opposed to plain *might*) should allow backshifting. Moreover, this should in principle be independent of modal flavour (epistemic or non-epistemic). And in fact, although backshifted readings for epistemic modals may be difficult to get (Iatridou 1990, Eide 2003, Boogaart 2007, among others), they are sometimes possible, as pointed out by Homer (2010) for French (see also Martin 2011, and Eide 2003 for Norwegian). The generalization appears to be that backshifting is possible if the modal is embedded under an attitude verb which is not one of thinking or believing. This is shown in (97). (97)a is compatible with a backshifted situation where yesterday, I no longer considered it possible that my bracelet was in my mother's jewelry box. (97)b, in contrast, can only mean that it was consistent with my epistemic state yesterday that the bracelet had been in the jewelry box the day before. (Note that as predicted, plain *might* without *have* here does not allow backshifting.)

(97)    *Context: On Monday, I looked in my mother's jewelry box for my bracelet, thinking it might have been put in there by mistake. On Tuesday, my mother asked me why I had looked in her jewelry box the day before, and I told her that for all I knew, my bracelet might have been in there. Now it's Wednesday and I'm telling the whole story to a friend.*
   a.        I **told** my mother (yesterday) that my bracelet **might have** been in her jewelry box.
   b.   #   I **thought** (yesterday) that my bracelet **might have** been in her jewelry box.

We argue that although epistemic modals with a non-defective past tense (i.e., semi-modals with past-tense inflection and Class III modals followed by *have*) can in principle have backshifted readings, they are for pragmatic reasons unable to do so when the attitude is one of belief. This is because epistemic modals are closely tied to epistemic states – or at least, to bodies of evidence that support beliefs by agents. Expecting an epistemic modal to have a TP which differs from the contextually or overtly given belief-time would be akin to expecting the "judge" (in the sense of Stephenson 2007) in (98)a to not be Mary, or the modal in (98)b to rely on evidence available to someone other than Mary. While in principle possible, it would be for obvious reasons extremely pragmatically dispreferred. The same is true of (97)b, which introduces my epistemic state yesterday, and therefore does not allow the modal to target my epistemic state the day before.

(98)    a.        According to Mary, Whiskas is tasty.
   b.        According to Mary, it might rain tomorrow.

## 6        Comparison with other analyses

In this section, we discuss research which challenges the ideas on which our analysis is based. The focus is once again on epistemic modals with past TPs.

Although the majority of the literature assumes that epistemic modals cannot take a past TP, a minority of researchers have argued that these readings do exist, usually in languages other than English (see for example Eide 2003, 2005, Kratzer 2009, Soare 2009, Homer 2010, Mari 2010, and Martin 2011). Even when the existence of the past-TP readings is admitted, authors often try to explain the readings away, denying that they reflect the simple ability of an epistemic modal to scope under past tense. For example, it has been proposed that the readings involve an elided embedding attitude verb (Hacquard 2006, 2011), or that they are felicitous only in contexts of (free) indirect discourse (Fagan 2001, Boogaart 2007). See also Portner (2009:222-236).

The researcher who has most systematically addressed the complexities of the data in this area is Hacquard (2006, 2010, 2011). Hacquard's claim for English is that the TP of an epistemic modal is always the local time of evaluation, which is the utterance time in a main clause. Although epistemic modals do allow past TP in some contexts, according to Hacquard this is never due to the modal simply being able to scope under a clause-mate past tense. Rather, the readings are licensed by a range of mitigating factors, and are usually not cases of 'real' semantic past. Our position is that although Hacquard is right about the types of contexts which *favour* past TPs for epistemic modals, the mitigating contexts are not *necessary* for the relevant readings. Moreover, there are empirical and theoretical problems with some of the individual proposals about mitigating factors.

Hacquard's empirical claim is that epistemic modals can have past TPs only in a restricted set of circumstances: either (a) when embedded under an attitude verb, (b) in a free indirect discourse environment, (c) when an adverbial specifies an overt conversational background with a past TP, or (d) when there is an elided 'because'. In earlier work (2006), Hacquard also allowed for the possibility of (e) elision of a matrix attitude verb. These options are illustrated in (99)a-e respectively.

(99)  a.  Two days ago, Poirot thought that Mary had to be the murderer.  (Hacquard 2011:1501)
   b.  This didn't make sense, thought Poirot ... Mary had to be the murderer.
                                                                 (Hacquard 2011:1501)
   c.  Given what we knew then, Mary had to be the murderer.         (Hacquard 2011:1501)
   d.  A: Why did you look in the drawer?
      B: (I looked in the drawer because) my keys might have been in there.
         (adapted from von Fintel and Gillies 2008; cf. discussion in Hacquard 2011:1501)
   e.  A: Why did you look in the drawer?
      B: (I thought that) my keys might have been in there.
                        (Hacquard 2006:159, adapted from von Fintel and Gillies 2008)

The first thing to note is that these data involve either *had to* (99)a-c) or *might have* (99)d-e), but as we showed in the preceding section, English (semi-)modals fall into four different classes with respect to their behaviour in past-TP contexts. A full assessment of Hacquard's proposals would require a detailed look at each of these four classes in each of the five environments in (99). Here we will limit ourselves to pointing out some places where Hacquard's analysis either under- or over-generates readings.

      With respect to cases like (99)a, Hacquard argues that past TP arises here because the TP of the embedded modal is set to the internal 'now' of the attitude verb. One piece of evidence for this is that the apparent past interpretation of the modal 'lacks the characteristic backshifting of a true semantic past tense. For instance in [(99)a], the modal's time of evaluation must be Poirot's thinking time; it cannot precede it' (Hacquard 2011:1501). Hacquard therefore argues that apparent past tense on epistemic modals is actually sequence of tense; there is morphological agreement, but no real past semantics (Hacquard 2011:1501; see also Iatridou 1990).

      However, as we argued in section 5, some classes of English modals *do* allow backshifted readings under attitude verbs when interpreted epistemically. For *must,* or for plain *might* without *have,* Hacquard's claim that backshifted readings do not exist is upheld, but *had to* and *might have* do allow backshifting (see (93)b, (97)a)). Hacquard's analysis therefore under-generates the available readings here.

      The next environment which Hacquard argues licenses past epistemic readings is free indirect discourse (FID). FID is illustrated in (100). The adverb *tomorrow* is interpreted with respect to an earlier time at which a character in the story had the relevant thought. Temporal adverb shifting is a diagnostic for FID interpretations (Banfield 1982, Doron 1991, Schlenker 2004, Sharvit 2008, Eckardt 2015).

(100)  Tomorrow was Monday, Monday, the beginning of another school week!
       (Schlenker 2004; originally from D.H. Lawrence, *Women in Love*)

FID certainly facilitates past-TP readings for epistemic modals. The Class II modal *must* and Class III modals like *might* allow past-TP readings in FID environments, as revealed by a mini-corpus search of one English novel (John Lanchester 2012, *Capital*).[27] Two of many instances in this novel of past-TP *must/might* in FID environments are given in (101)-(102).

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[27] See also de Hoop and Lestrade (2015) for examples of perspective-shifting with *might*.

(101)   Today, turning the corner of Pepys Road, she caught the smell of burning wood, of hot ash, and was suddenly back on the outskirts of Harare [...]. An odd time for someone to be burning wood in London; it <u>must</u> be a fire someone had held back because of the terrible weather. (chapter 73)

(102)   Patrick had not wanted to betray his own anxieties by asking too many questions about what Freddy really felt. The end result was that now, [...] he had no reliable idea about Freddy's state of mind. He <u>might</u> be panicking, just as Patrick was. (chapter 16)

Offering an analysis of FID would go far beyond the scope of this paper; we will just assume that the past TP readings of modals with defective past tense such as (plain) *might* and *must* in examples like (101)-(102) are a subcase of the more general kind of indexical shifting that is characteristic of FID. It is worth pointing out that in English this temporal shifting is only possible with modals belonging to Classes II and III; if we substitute a Class I modal such as *may* in (101)-(102), a past TP reading is completely impossible. So in terms of our analysis, only modals with a defective past tense can be shifted in FID. Moreover, this is not restricted to *epistemic* modals; non-epistemic readings, such as deontics, are equally possible:

(103)   I suppose this is what they call denial, thought Mary. Except it didn't seem to her that she was denying anything; what she was mainly felt was numb. Anaesthetised. She <u>must</u> call Alan. (*Capital,* chapter 57)

However, outside of the restricted narrative contexts supporting FID, English plain modals with defective past tense (Classes II and III) cannot have past TP in main clauses. This distinguishes them from the non-defective past-tense forms of semi-modals, and also from the lexicalized *have*-forms of Class III modals (e.g., *might have*). Thus, although we agree with Hacquard that FID plays a role in *some* cases of epistemic modals with past TP, the special narrative contexts required for FID are not in general a necessary condition for past-TP epistemic readings.

Another proponent of the idea that epistemic modals can have past TPs *only* in FID contexts is Boogaart (2007). While Boogaart argues that the past TP of Dutch epistemic modals reflects a real past tense (rejecting a sequence of tense analysis), he nevertheless claims that the relevant readings arise only when there has been a perspective shift away from the speaker. (See Fagan (2001) for a similar claim for German.) However, as pointed out by Homer (2010), (some) epistemic modals can have past TPs in non-narrative contexts, as in von Fintel and Gillies' (2008) ice-cream example. Homer (2010) also points out that in French, (some) epistemic modals can occur with past TP even when they do not correlate with the prime diagnostic for FID, the shifting of indexicals like *today* or *tomorrow*. Compare (104), where *today* picks out the day of Betty's attitude, with (105), where *today* cannot refer to the day on which B held the relevant epistemic state.

(104)   Betty woke up feeling nervous. Today was going to be awful.

(105)   A (talking about what B did yesterday): Why did you look in the freezer?
        B: The ice-cream **might have** been / **had** to be in there (#today).

Data like these show that *might have* and *had to* can have past TP even in contexts where temporal

adverbs cannot shift, and which therefore cannot be instances of FID.[28]

The next method by which Hacquard tries to explain past TP for epistemic modals without recourse to past tense is overt conversational backgrounds (as in (99)c). The fact that an overt conversational background facilitates the relevant reading is not surprising, but it is not required, as shown by the data presented throughout sections 3 and 5.

Turning finally to the proposal that elision is involved in cases like (99)d,e, we first observe that this would be a theoretically unusual elision process, as it would involve deletion of a non-constituent string. There is also an empirical problem with the attitude verb cases, illustrated in (106)-(107). (106)a-b are fine for the elision analysis, since they have equivalent temporal properties, as the elision account predicts. But (107)a-b are problematic. (107)a allows past TP, indicating that the presence of *have* is not crucial for the past-TP reading in a sequence of tense environment (cf. Abusch 1997:21-22). But then (107)b is incorrectly also predicted to allow a past TP.

(106)  a.  I thought my keys might have been in there.                    PAST TP
       b.  ~~I thought~~ my keys might have been in there.                 PAST TP

(107)  a.  I thought my keys might be in there.                           PAST TP
       b.  ~~I thought~~ my keys might be in there.                      * PAST TP

Under our proposal, no elision is involved. We have argued that the different classes of modals differ with respect to whether they allow past TP in the absence of a higher past-tense attitude verb. Semi-modals and *might have* allow these readings, but plain *might, must* or *may* do not. The only cases in which plain *might* (without *have*) and *must* can have past TP is when they occur under a matrix past-tense verb (as in (107)), or in FID, which is only possible in very specific kinds of narrative contexts, such as (101)-(102). The issue for Hacquard's account is that it doesn't distinguish between the behaviour of *might* and *might have* (and ignores *must* altogether).

What about the cases of elided matrix clauses plus *because?* Hacquard's idea here builds on Stephenson's (2007) proposal that epistemic modals have a judge parameter, representing the agent whose knowledge or beliefs are relevant. Stephenson proposes (2007:506) that 'in *because*-clauses which express a person's conscious reasoning or rationale, the judge parameter is shifted to the person whose reasoning is involved.' The problem here is that although *because* may shift the judge to being a different *person*, there is no independent evidence that *because* shifts the *time* at which the judging takes place. In fact, *because* does *not* shift the judging time to the past in the absence of other elements with past semantics. In (108), for example, the judge of the taste predicate *tasty* shifts to Fido, but there is no effect of the perceived tastiness being in the past.

(108)   Fido always eats Whiskas because it's tasty.

Similarly, *because* does not induce pastness for modals in the absence of either a real past tense inflection on the modal, *have,* or a higher attitude verb. For example, (109) does not allow past TP. Our analysis correctly predicts this, since *might* cannot have past TP without the help of *have*.

(109)   I looked in the drawer because my keys **might** be in there.

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[28] Plain *might* or *must* would be unacceptable in B's answer in (105) (either with or without *today*). This is predicted by our analysis because defective past tense is not able to backshift the TP in a main clause outside of an FID context.

We have now considered all the main ways in which authors explain away past TPs for epistemic modals. We have argued that while past-TP readings are certainly facilitated by higher attitude verbs, FID, and overt conversational backgrounds, none of these conditions are *necessary* for the past-TP readings to arise. We have thus argued that past-TP readings are more generally possible than is often assumed. Conversely, we have shown that none of these environments produce past TPs by themselves; instead, only certain classes of epistemic modals allow these readings, either because they accept (non-defective) past tense morphology (as with semi-modals in English or all modal verbs in Dutch), or because they have special lexicalized forms with past TP (such as English *might have*).

## 7      Conclusion

This paper has provided a compositional analysis of modal-temporal interactions in Dutch, English, Gitksan and St'át'imcets. The analysis allows modals to interact freely with the tense-aspect architecture in each language. The analysis includes no extra restrictions on possible combinations of modal flavour and temporal perspective. It freely allows epistemic modals to have past TPs, a result which we have argued is empirically correct for at least the four languages discussed here. Our basic compositional architecture straightforwardly accounts for the cross-linguistically more transparent systems (Dutch, Gitksan and St'át'imcets). It allows language-specific features of each tense-aspect system to influence modal-temporal interactions in predictable ways, and it correctly casts English as the idiosyncratic and (partly) lexicalized system.

Our main proposals – which rely in part on insights of prior literature, in particular on Condoravdi (2002) – are that a modal's TP is determined by a higher operator, usually tense, while temporal orientation is determined by lower operators, usually aspect (and further restricted by the Diversity Condition). In contrast to some previous research, we have argued that epistemic past-TP readings should not be stipulated to be unavailable, and are not always dependent on free indirect discourse or other special licensing environments. Also in contrast to much previous research, we have pointed out that English modal auxiliaries cannot be treated as a single class, but fall into at least three classes with different temporal idiosyncrasies.

Further research is clearly required on a range of languages. We have not discussed other languages for which there is available literature on modal-temporal interactions, such as French (Hacquard 2006, Laca 2008, Homer 2010, Mari 2010, Martin 2011, among others). Our proposals also need to be tested on languages for which there has as yet been little or no work in this area. For preliminary research of this type on 12 languages, see Chen et al. (to appear).

A major question left open by the current paper is whether there is a need to assume *any* restrictions on the scope of epistemic modals. The literature has investigated the scopal relations of epistemic modals not only with respect to tense, but also with respect to co-occurring non-epistemic modals, quantifiers, negation, and adverbs (see, among others, Groenendijk and Stokhof 1975, Picallo 1990, Brennan 1993, Cinque 1999, Drubig 2001, von Fintel and Iatridou 2003, Hacquard 2006, 2011, Huitink 2008, Portner 2009, Chen et al to appear). Results are not fully conclusive, but there is at least a general tendency for epistemic modals to prefer higher scope than non-epistemic ones. We have little to add to that debate at this time, beyond our core proposal that there is no general restriction against epistemic modals appearing in the scope of tense. We hope that this paper will help to spur further cross-linguistic investigation of these issues.

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