

Modality
Lisa Matthewson¹

1 Introduction

There are an infinite number of ways the world could have been. For example, my first name happens to be ‘Lisa’, but my parents *could* have named me ‘Super Princess Lisa Superhero Easter Bunny’.² Another way to say this is there are some possible worlds (Lewis 1973) where my name is Super Princess Lisa Superhero Easter Bunny. Natural language allows us to say all kinds of things about these possible worlds – such as ‘My parents should have named me Super Princess Lisa Superhero Easter Bunny’, or ‘If my parents had named me Super Princess Lisa Superhero Easter Bunny, I would have been angry at them.’ The ability to talk about possible worlds is known as modal displacement (von Stechow and Heim 2011, who follow Hockett’s 1960 discussion of temporal and spatial displacement).

Modal displacement is, as far as we know, unique to human language, universal to all languages, and acquired early. English-acquiring two-year-olds freely talk about what is permitted, obligated, or compatible with someone’s abilities; they say things like ‘you can’t get it till it’s Mother’s Day’ (<http://www.youtube.com/watch?v=YQ9vv4CPzcY&feature=related>), ‘he just can borrow him’ (<http://www.youtube.com/watch?v=NDLK6dopfuc>), or ‘you have to be quiet so she can sleep’ (<http://www.youtube.com/watch?v=4Y5nbStIjeI>), and we expect that speakers of all languages (even those under-represented on YouTube) can similarly talk about permission, obligation, and ability.

Interestingly, however, languages also vary in how they express and categorize modal meanings. Unlike in English, in the Salish language St’át’imcets (Lillooet) the same morpheme (the enclitic =*ka*) can express *either* permission *or* obligation, as in (1). A different morpheme (the circumfix *ka-...-a*) is used to express ability, as in (2).³

- (1) wá7=**ka** s-lep’ i=k’ún7=a ku=pála7 máqa7
IPFV=**DEON** STAT-bury DET.PL=fish.egg=EXIS DET=one snow
i. ‘The eggs *can* stay in the ground for a year.’

¹ I am very grateful to Maria Aloni, Henry Davis and an anonymous reviewer for helpful feedback on an earlier version of this paper. Many thanks to St’át’imcets consultants Carl Alexander, Gertrude Ned, Laura Thevarge, the late Beverley Frank and the late Rose Agnes Whitley, to Gitksan consultants Vincent Gogag and Barbara Sennott, and to Niuean consultant Lynsey Talagi. This research was supported in part by SSHRC grant #410-2011-0431.

² Thanks to Madeleine Davis (p.c.) for the name idea.

³ Abbreviations in this paper not covered by the Leipzig Glossing Rules: II: series II pronoun, CIRC: circumstantial, CN: common noun connective, CUST: customary aspect, DEIC: deictic, DEON: deontic, DIR: directive transitivizer, EMPH: emphatic, EPIS: epistemic modal, EXIS = assertion of existence, INFER: inferential evidential, LEX: lexical particle, MID = middle, MOD: modal, NECESS: necessity modal, NONAFF: non-affirmative, PN: proper name, POSSIB: possibility modal, PROSP: prospective aspect, SENS.NON.VIS: sensory non-visual evidential, S.PL: plural subject, STAT: stative, VAI: intransitive animate verb, VAL: valency adjuster, VTI: transitive inanimate verb.

ii. ‘The eggs *have to* stay in the ground for a year.’ (Rullmann et al. 2008:329)

(2) *Context: They also wrestled the young bulls.*

wa7 xílem=wit ets7á kw=s=zwat-en-ítas swát=as ku=wá7
IPFV do-MID=3PL DEIC DET=NMLZ=know-DIR-3PL.ERG who=3SBJV DET=IPFV

ka-xilh-ts-tal’í-ha áti7 ku=xwém

CIRC-do-CAUS-TOP-CIRC DEIC DET=fast

‘They did that to find out who could do it the fastest.’ (Matthewson 2005:89)

The goal of this paper is to provide an introduction to three topics which are central to understanding the semantics of modal elements: modal flavour (section 2), modal force (section 3), and modal-temporal interactions (section 4). For each of these phenomena I will outline its treatment in a standard Kratzerian semantics (Kratzer 1981, 1991, 2012), present some data on its expression cross-linguistically, and point the reader to some ongoing debates and interesting unanswered questions. In the remainder of this section I give a basic introduction to the possible worlds approach to modality and to the three major topics we will be discussing.

Several introductions to modality are already available: see for example von Stechow and Heim (2011), Hacquard (2011), or Swanson (2008) from a more philosophical perspective. Other relevant recent works include Portner’s (2009) comprehensive monograph, and Kratzer’s (2012) collection of updated versions of her seminal papers. In this paper I will be unashamedly Kratzerian, because Kratzer is where every student of modality needs to begin. There are other approaches (see for example Groenendijk et al. 1996, Ninan 2005, Yalcin 2007, Lassiter 2011b), and there is also of course no single Kratzerian analysis, but rather a family of related analyses, which are constantly being developed and updated in ongoing research.

1.1 Possible worlds and modality

Propositions containing modal elements make contingent claims about the actual world, by asserting something about a set of worlds in which certain propositions are true. A simple example is given in (3).

(3) *Context: The Youth Orchestra is holding auditions. At one point the conductor says:*
Madeleine **can** put her violin away now.

Can is a possibility modal, which introduces existential quantification over worlds. So as a first pass, (3) asserts that there is at least one possible world in which Madeleine puts her violin away. However, that first pass is far too weak. There are an infinite number of worlds in which Madeleine puts her violin away, and there are an infinite number of worlds in which she keeps playing. (There are also other, less ‘normal’ worlds, in which she keeps her violin out but starts using it as a coffee cup, or in which her violin spontaneously crumbles to dust.) As a second pass, (3) asserts that there is at least one world in which Madeleine obeys the conductor’s actual-world rules for the audition, and in which she puts her violin away.

Why did we say ‘the conductor’s *actual-world* rules’? This is what ensures that (3) makes a contingent claim. In the actual world, the conductor’s rules happen not to exclude Madeleine

from putting her violin away. (Maybe the rules include the proposition that each auditioner plays one piece and two scales, and Madeleine has already played those things.) But it could easily have been the case that the conductor demanded that she keep playing (if, for example, the rules contained the proposition that auditioners play two pieces and four scales). It is a general feature of modal elements that they use some facts about the evaluation world to narrow down the set of worlds being quantified over.

How did we know that (3) was a statement about rules (rather than about abilities, or wishes, or what is possible given the available evidence)? And given that it is about rules, how did we know that it expressed permission, rather than obligation? The former question concerns *modal flavour*, and the latter concerns *modal force*. With English modal auxiliaries, modal flavour questions are primarily (but not exclusively) settled pragmatically, while modal force questions are primarily settled lexically.

The modal flavour of *can* in (3) is deontic. We know this because of the discourse context, as the conductor is in a position of power and is likely to make pronouncements about rules. In the alternative context in (4), *can* has a different modal flavour: it imparts information about ability.

- (4) *Context: Madeleine is three and has recently started violin lessons. At first, she wasn't able to put her violin away in its case because she wasn't strong enough to loosen the bow. But she has grown stronger.*
Madeleine **can** put her violin away now.

The modal flavour of *can* is not completely determined by context; it is also lexically restricted. *Can* cannot have an epistemic flavour: it cannot assert something about the worlds compatible with a body of evidence.⁴ *Might*, on the other hand, can easily have this interpretation, as shown in (5b).

- (5) *Context: A homicide detective is summarizing the content of a report which presents the findings of the investigative team.*
a. #According to the report, Gerry **can** be the murderer.
b. According to the report, Gerry **might** be the murderer.

Non-auxiliary modal elements frequently lexically encode modal flavour. For example, the attitude verb *want* encodes bouletic modality (to do with desires), and the adverb *maybe* is unambiguously epistemic.

Turning to modal force, our example modal *can* is lexically specified to existentially quantify over worlds. It contrasts with universally-quantifying modals like *must* or *have to*, as shown in (6).

- (6) *Context: A violin audition. The conductor says:*
a. Madeleine **can** put her violin away now.

⁴ Except when it appears under negation; see Palmer (2001:103), McCormack and Smith (2002:135), among others.

- b. Madeleine **must / has to** put her violin away now.

(6b) expresses obligation, rather than permission; it says (roughly) that in *all* worlds in which Madeleine obeys the conductor's actual-world rules, she puts her violin away.⁵ In other words, there is no way to obey the actual rules without putting the violin away. But there is a pragmatic element to modal force, too: notice that even (6a) probably leads, in the audition context, to Madeleine putting her violin away. Thus, in certain contexts *can*-sentences can pragmatically function almost like obligations. However, the obligation is cancelable in (6a), but not in (6b), as shown in (7). This shows that *must/have to* semantically conveys obligation, but *can* does not.

- (7) a. Madeleine **can** put her violin away now (but she can also keep playing if she wants).
 b. Madeleine **must / has to** put her violin away now (#but she can also keep playing if she wants).

We have seen so far that the truth values of modal assertions depend on the world in which they are uttered, because the set of worlds quantified over is narrowed down by a set of propositions which are true in the evaluation world. In a similar fashion, their truth values depend on the *time* at which they are uttered. Suppose, for example, that the conductor's actual-world rules require that each auditioner play at least one piece and two scales. At time *t*, Madeleine has played one piece and no scales, and five minutes later at *t'*, she has played two scales as well. Sentence (3) would be false at *t*, and true at *t'*, because at *t* Madeleine's putting her violin away is not compatible with the conductor's actual rules, but at *t'*, it is. Moreover, the propositions we use to narrow the worlds quantified over can change over time: the conductor could change her rules from one minute to the next, or a person's abilities could change.

Just like modal flavour and modal force, modal-temporal interactions can be lexically restricted. More often, however, they are influenced by tense or aspect functional heads; this is especially easy to see in languages where modals overtly inflect for these categories. The Dutch data in (8) show that past marking on the modal auxiliary causes the modal to be evaluated at some past time.

- (8) a. we **moeten** winnen
 we **must.PRS.1PL** win.INF
 'We have to win.'
 (In all worlds compatible with our obligations or goals at the *utterance time*, we win.)
- b. we **moesten** winnen
 we **must.PST.1PL** win.INF
 'We had to win.'
 (In all worlds compatible with our obligations or goals at some *past time*, we win.)
- c. we **kunnen** winnen
 we **can.PRS.1PL** win.INF
 'We are able to win.'

⁵ This is a simplification; see section 2.1.

(In some world compatible with our abilities at the *utterance time*, we win.)

- b. we **konden** winnen
we **can.PST.1PL** win.INF
'We were able to win.'

(In some world compatible with our abilities at some *past time*, we win.)

(Hotze Rullmann, p.c.)

In the next section we turn to a more in-depth discussion of modal flavour.

2 Modal flavour

Our discussion so far has been completely informal, and has also been simplified. The first way in which it has been simplified is that we have bluntly talked about 'modal flavour'. However, one of Kratzer's important proposals is that modal flavour comprises two separate parameters – called 'conversational backgrounds' – a *modal base* and at least one *ordering source*. In section 2.1 we briefly review the motivation for this double relativity of modals, and in section 2.2 we discuss where the conversational backgrounds come from. Section 2.3 presents some cross-linguistic data, and section 2.4 discusses ongoing debate about the status of the epistemic-circumstantial division in conversational backgrounds.

2.1 Modal base and ordering source

What we have so far can be formalized as in (9).⁶ Modals are interpreted relative to one conversational background, a function from worlds to sets of propositions. By intersecting that set of propositions we obtain a set of worlds accessible from w , the worlds in which all the propositions are true.⁷ Necessity modals like *must* assert that the prejacent (the core proposition embedded under the modal) is true in all the accessible worlds. Possibility modals existentially quantify over the accessible worlds.

- (9) a. $[[must]]^{w,g} = \lambda f_{\langle s, \langle st, t \rangle \rangle} . \lambda p_{\langle s, t \rangle} . \forall w' [w' \in \cap f(w) \rightarrow p(w') = 1]$
b. $[[can]]^{w,g} = \lambda f_{\langle s, \langle st, t \rangle \rangle} . \lambda p_{\langle s, t \rangle} . \exists w' [w' \in \cap f(w) \& p(w') = 1]$

Kratzer shows conclusively that such an analysis is inadequate. The first problem is that sometimes the propositions given by the conversational background are inconsistent, in which case all necessity claims come out trivially true and all possibility claims come out trivially false. Take (10):

- (10) *Context: The conductor's rules state that auditioners play at least one piece and two scales, they play no more than five scales, and they play everything from memory. When*

⁶ I assume a basic familiarity with semantic formalism, approximately to the level of Heim and Kratzer (1998).

⁷ Propositions are sets of worlds (the worlds in which the proposition is true), so a set of propositions is a set of sets of worlds. The intersection of those sets of worlds gives the set of worlds in which all the propositions are true.

Jane auditions, she uses sheet music rather than playing from memory. Now it's Madeleine's turn and she has played one piece and two scales.

- a. Madeleine **must** stop playing now.
- b. Madeleine **can** stop playing now.

We want to predict that (10a) is false, and (10b) is true. The simple system so far predicts the reverse. The problem is that the conversational background lumps together propositions describing the rules with propositions describing Jane's actions, and the resulting set of propositions is inconsistent (there are no worlds in which all the rules are obeyed and in which Jane disobeyed the rules). Since there are no worlds to quantify over, the universal quantification in (10a) is trivially true, and the existential quantification in (10b) is false.

A second problem with the simple system is that it has no way to deal with graded modality, as in (11).

- (11) a. Michl is **probably** the murderer.
- b. There is a **good possibility** that Michl is the murderer.
- c. There is a **slight possibility** that Michl is the murderer.
- d. Michl is **more likely** to be the murderer than Jakl. (Kratzer 1991:643)

An analysis of these examples requires more than just checking whether Michl is the murderer in at least one accessible world. We need to be able to rank possibilities using a notion of normalcy or stereotypicality: given the facts, some things are more expected than others.

A third problem is that the simple system predicts that (12a) asymmetrically entails (12b). If someone climbed Mount Toby in all worlds compatible with the actual-world evidence, then they climbed it in the actual world (since the actual world has to be compatible with the actual-world evidence).⁸

- (12) a. She must have climbed Mount Toby.
- b. She climbed Mount Toby. (Kratzer 1991:645)

The solution to all these problems is that modals are interpreted relative to *two* conversational backgrounds: a modal base and at least one ordering source. The modal base assigns to each world a set of propositions which are true in that world, and the ordering source assigns to each world a (possibly inconsistent) set of propositions representing norms, ideals, laws, desires, etc. The set of worlds in which all the modal base propositions are true is then ordered according to how many of the ordering source propositions are true in each world, and the modal quantifies over only the most ideal worlds as identified by the ordering source.

The ordering determined by a set of propositions A is defined in (13): w is at least as close as z to the ideal determined by A if and only if all propositions in A that are true in z are also true in w.

⁸ Von Stechow and Gillies (2010) argue that (12a) *does* entail (12b); see 3.1 below.

- (13) For all worlds w and $z \in W$: $w \leq_A z$ iff $\{p: p \in A \text{ and } z \in p\} \subseteq \{p: p \in A \text{ and } w \in p\}$
(Kratzer 2012:39)

If we assume for the purposes of simplicity that there is always a world (or set of worlds) which comes closer to the ideal than any other worlds (i.e., we adopt the Limit Assumption), we can define an operator which selects the ‘best’ worlds, and then have the modals quantify only over these. (14) and (15) draw on von Fintel and Heim (2011:61) and Portner (2009:67); f is the modal base and h is the ordering source. (See Lewis 1973 and Stalnaker 1984 on the Limit Assumption, and for modal definitions which do not adopt it, see Kratzer 1981:48, 1991:644.)

- (14) For a given order \leq_A on worlds:

$$\forall X \subseteq W [\text{BEST}_A(X) = \{w \in X: \neg \exists w' \in X [w' \leq_A w]\}]$$

- (15) a. $[[\textit{must}]]^{w,g} = \lambda f_{\langle s, \langle st, t \rangle \rangle} . \lambda h_{\langle s, \langle st, t \rangle \rangle} . \lambda p_{\langle s, t \rangle} . \forall w' \in \text{BEST}_{h(w)}(\cap f(w)): p(w) = 1$
b. $[[\textit{can}]]^{w,g} = \lambda f_{\langle s, \langle st, t \rangle \rangle} . \lambda h_{\langle s, \langle st, t \rangle \rangle} . \lambda p_{\langle s, t \rangle} . \exists w' \in \text{BEST}_{h(w)}(\cap f(w)): p(w) = 1$

Here is an example of how the modal base and the ordering source interact to give the right results.

- (16) *Context: As in (10), except that Madeleine has played one piece and five scales.*
Madeleine **must** stop playing now.

(16) asserts that in all worlds which are compatible with the facts about the audition and which are best according to the conductor’s actual-world rules, Madeleine stops playing. This is the right result. The set of worlds compatible with the facts includes only worlds where one of the conductor’s rules has already been broken. But that’s okay – we just find the best we can. Out of the worlds where Jane has already broken the rules, the best ones are those where Madeleine obeys the rules. And in all of those, she stops playing now.

As hinted already, all modal bases are *realistic*: they assign to any world a set of propositions which are true in that world. In other words, for any world w and modal base f , w is a member of $\cap f(w)$ (see e.g., Kratzer 2012:55). It is often assumed that there are two types of realistic conversational background: epistemic, and circumstantial/root. The former produces sets of propositions representing the available evidence; the latter produces sets of propositions representing relevant facts about the circumstances. (In section 2.4 I discuss this dichotomy further, and the difficulties with formally distinguishing the two types.) If a conversational background is non-realistic it must be an ordering source.⁹ Common examples of flavours of ordering source are deontic (dealing with rules), bouletic (dealing with desires), teleological (dealing with goals), and stereotypical (dealing with normalcy). The first three of these operate on circumstantial modal bases; Portner (2009) groups them under the term ‘priority modals’. See Palmer (2001) on the different categories of modal flavour which are made use of cross-linguistically.

⁹ This is because a non-realistic conversational background may contain an inconsistent set of propositions, and using this as a modal base would lead to the triviality problems discussed above.

2.2 Where do conversational backgrounds come from?

One of Kratzer's important insights is that conversational backgrounds can be restricted by things external to the semantics of the modal itself. For a start, they can be restricted via overt adverbial phrases, as shown in (17).

- (17) a. **According to the audition rules**, Madeleine can put her violin away now.
b. **Physically**, Madeleine can put her violin away now.
c. **Given the information in the report**, Gerry might be the murderer.

If there is no overt restriction on conversational background, it can be provided by the context of use.¹⁰ When uttered by a conductor during a violin audition, *can* is likely to be interpreted deontically, while in a different context, *can* can impart information about abilities. This context-dependency can be modeled in various ways. In the system I adopted for concreteness in (15), the modal base and ordering source are given by variables present in the syntax, which receive their value from the contextually-given assignment function.

Given that modals can receive their conversational backgrounds from the context of use, Kratzer argues that it is not necessary to postulate lexical ambiguity for modals which allow varying flavours of conversational background. For example, we do not need *can*₁ and *can*₂ in the lexicon, where *can*₁ is deontic and *can*₂ is an ability modal.

Importantly, Kratzer does not claim that conversational backgrounds are restricted *exclusively* by context or by overt adverbial phrases. There is no reason why conversational backgrounds should not also be linguistically restricted by the modal itself, and Kratzer (1981, 1991, 2012) gives examples of German modals which are compatible only with certain types of conversational background. We already saw that affirmative *can* may not be interpreted epistemically (see Portner 2009:55 for further details), and that non-auxiliary modal elements routinely place lexical restrictions on conversational background.

Interestingly, the fact that modals may have lexically restricted conversational backgrounds weakens the argument against an ambiguity analysis. It is still conceptually preferable to avoid having *can*₁ and *can*₂, if possible. But if there are languages which have distinct lexical items for these two meanings, there might in fact be some hidden ambiguities in languages which use just one lexical item.

Recent work on the evidential properties of epistemic modals also suggests that we may need to contemplate ambiguity for English modal auxiliaries. Von Stechow and Gillies (2010) and Kratzer

¹⁰ Even in the presence of an overt adverbial phrase, the conversational background can be given by the context, as pointed out by Nauze (2008:157). The modal in (i) has an epistemic interpretation, in spite of the deontic adverbial.

(i) *Context: We are discussing the upcoming trial of the suspected criminal, Jockl. The trial has not yet begun and we wonder what the outcome will be.*
In view of what the law provides, Jockl **may** be executed. (Nauze 2008:157)

(2009, 2012) (among others) argue that at least some epistemic modals, including *must*, are lexically restricted to relying on indirect evidence for the embedded proposition. One simple way to implement such a restriction only for epistemic uses would involve ambiguity or polysemy between epistemic and non-epistemic *must*.^{11,12}

A final option for conversational backgrounds is that modals might acquire some of their meaning restrictions through their position in the syntactic structure. A recent proponent of this approach is Hacquard (2006, 2009, 2010), who spells out an analysis in which the structural height of a modal indirectly restricts its conversational background. Hacquard proposes that modals are relativized to events rather than worlds, and their interpretation depends on features of the relevant event, such as its run-time or participants. High-scoping modals in matrix clauses depend on the speech event, and thus on the time of utterance and the speaker. Usually, high modals receive epistemic interpretations, because epistemic modal bases require an information state, which is usually provided by the speaker of the speech event.¹³ Circumstantial modal bases, on the other hand, depend on the circumstances of an event (its location, time, participants, etc.). As such they are VP-event-relative and will tend to scope low. This provides a principled explanation for the pervasive finding that epistemic modals scope above non-epistemic ones; see for example Jackendoff (1972), McDowell (1987), Picallo (1990), Brennan (1993), Cinque (1999), Barbiers (2001), and Butler (2003).

The goals of Hacquard's proposal are a unified analysis which avoids lexical ambiguity, and an explanation for the correlation between syntactic height and interpretation. Her analysis insightfully addresses one of the most puzzling issues in the study of modals, the tension between the desire for a unified analysis, and an explanation for distinct readings. One interesting question is whether the unified analysis is tenable cross-linguistically. Hacquard states that a major motivation for rejecting an ambiguity analysis of modals is the generalization that cross-linguistically, modal elements express a range of flavours. She writes that 'this multiplicity of modal meanings is common enough cross-linguistically, and in languages from different families, so as to make a lexical ambiguity account unlikely: it is highly improbable that the same lexical accident should be found in language after language' (2011:1489). She also argues that a problem with proposals which assign separate lexical entries for roots and epistemics is 'the fact that, cross-linguistically, they are expressed by the same lexical items' (2006:114).

¹¹ Nauze (2008:153), for example, argues for a polysemy account.

¹² An argument which is sometimes advanced against an ambiguity analysis is that there are as many different particular conversational backgrounds as there are contexts, and that this multiplicity of meanings would be impossible to deal with lexically (see e.g., Hacquard 2011:11). However, this argument is weakened by the fact that modals in many languages do lexically encode overarching modal flavours like 'deontic' or 'epistemic'. An ambiguity account combined with contextual dependence is therefore tenable, and would be parallel to Partee's (1988) analysis of the quantifiers *many* and *few*. Partee claims that *many* and *few* are each ambiguous between cardinal and proportional readings, but the specific cardinalities or proportions they require are dependent on context.

¹³ Or by the holder of the attitude event, in the case of a modal embedded under an attitude verb.

However, it is not obviously true that the pervasive cross-linguistic pattern is for single modal elements to express a range of modal flavours. According to van der Auwera and Ammann (2011), slightly more than half of their sample of 207 languages have no modals which allow both epistemic and non-epistemic interpretations (i.e., no instances of what they call ‘overlap’ between modal flavours). And the percentage of languages which lexically encode conversational background may actually be higher than this. As outlined by Matthewson et al. (2012) and Matthewson (2013b), there are cases which van der Auwera and Ammann analyze as involving overlap, but which really involve lexical distinctness. For example, van der Auwera and Ammann argue that Kiowa has overlap between modal flavours in half of its system (i.e., either in the possibility domain, or the necessity one). However, there is no evidence for overlap in the source cited (Watkins 1984:220-2), and Kiowa is actually a language where epistemic and non-epistemic modality are expressed via distinct morpho-syntactic strategies (Andrew McKenzie, p.c.). Epistemic modals are typically adverbs, deontic possibility is expressed using the irrealis, and ability or the lack of it is expressed by incorporating auxiliaries, inflection, or out-of-control marking.¹⁴ Similarly, Mandarin is classified by van der Auwera and Ammann as a language which standardly allows overlap, but this appears to be incorrect: the overwhelming pattern in Mandarin is for modals to lexically restrict modal flavour (Liu 2013).

In short, our current cross-linguistic understanding only allows us to conclude that some modals in some languages allow variable modal flavour, while some or all modals in other languages lexically specify modal flavour. This is just what the Kratzerian analysis leads us to expect. Languages can view the common meaning components (quantification over possible worlds) as criterial for lexical division, or they can focus on the distinction between different modal flavours. As a final comment, a requirement for extending Hacquard’s analysis to a universal proposal would be evidence that the syntactic differences between different modal interpretations show up in languages from different families. As shown by Hacquard and others, the tests required to establish syntactic differences are often quite subtle, and they have not been done for the majority of the world’s languages. This is an area where further research is needed.

In the next section we will get a taste of a language which lexically encodes conversational background throughout its modal system.

2.3 Modal flavour in Gitksan

Gitksan is an endangered and understudied Tsimshianic language spoken in northern British Columbia, Canada.¹⁵ Its core modal system is summarized in Table 1 (Matthewson 2013a; see also Peterson 2010).

Table 1: Gitksan modal system

¹⁴ These different morpho-syntactic strategies may turn out to support the syntax-meaning correlations argued for by Hacquard, but they would not support the claim that different modal flavours are produced by the syntax in combination with a maximally general modal lexical entry.

¹⁵ ISO 639-3 code ‘git’. The term ‘Gitksan’ is conventionally used to cover that part of the Nass-Gitksan dialect continuum which stretches from Gitanyow to Ansbayaxw (Kispiox).

		POSSIBILITY	(WEAK) NECESSITY
CIRCUMSTANTIAL	PLAIN	<i>da'akhlxw</i>	<i>sgi</i>
	DEONTIC	<i>anook</i>	
EPISTEMIC	PLAIN	<i>ima('a)</i> ¹⁶	
	REPORTATIVE	<i>gat</i>	

We see that there is no overlap between epistemic and circumstantial interpretations. The former are strictly expressed by means of the second-position clitics *ima('a)* and *gat*, the latter strictly by the clause-initial verbs or predicative particles *da'akhlxw*, *anook* and *sgi*. Examples are given in (18-19). The reportative *gat* in (18b) is not necessarily translated into English using a modal; however, Peterson (2010) argues that it has epistemic modal semantics. A more revealing translation of (18b) would be ‘Given what I heard, the berries might/must be ripe.’

- (18) a. *Context: There was a bad can of fish; everyone at the dinner got sick.*
yugw=**ima**'=hl nee=dii am=hl hon=hl gup=diit
IPFV=**EPIS**=CN NEG=CNTR good=CN fish=CN eat-3PL.II
‘The fish they ate must’ve been bad.’
(Matthewson 2013a:360, adapted from Peterson 2010:162)
- b. *Context: Your brother told you the berries are ripe now. Later, you tell me the berries are ripe, based on what your brother told you.*
hlaa mukw-t=**gat**=hl maa'y
INCEPT ripe-3SG.II=**REPORT**=CN berries
‘The berries are ripe (I heard).’
(Matthewson 2013a:362)
- (19) a. **da'akhlxw**-i-s Henry dim jam-t
CIRC.POSSIB-TR-PN Henry PROSP cook-3SG.II
‘Henry is able to cook.’ / ‘Henry was able to cook.’
(Matthewson 2013a:371)
- b. **anook**-xw(=hl) dim ha'w-s Savanna (k'yoots)
DEON.POSSIB-VAL(=CN) PROSP go.home-PN Savanna (yesterday)
‘Savanna was allowed to go home (yesterday).’
(Matthewson 2013a:377)
- c. **sgi** dim (ap) ha'w-s Lisa
CIRC.NECESS PROSP (EMPH) go.home-PN Lisa
‘Lisa should/must go home.’ / ‘Lisa should (have) gone home.’
(Matthewson 2013a:380)

The split between epistemic and circumstantial readings is absolute in Gitksan: not only can the modals be used with the flavours illustrated here, they cannot be used with the opposite ones. For example, in (20) the context is (pure) circumstantial: the issue is not whether it is compatible with the evidence that berries are growing here, but whether it is compatible with the circumstances that berries could grow here (this is adapted from Kratzer’s hydrangea example,

¹⁶ This element has various pronunciations, partly dependent on dialect: either *ima*, *imaa*, or *ima'*.

1991:646). We see that epistemic *ima('a)* is infelicitous.

(20) *Context: You're up in the Suskwa and notice a burnt patch of forest. You know that huckleberries typically take seed in burnt alpine areas.*

a. **da'akhlxw**=hl dim lim_{xs}=hl maa'y go'osun
 CIRC=CN PROSP grow.PL=CN berries LOC.here
 'Berries might/can/are able to grow here.'

b.# lim_{xs}=**ima**=hl maa'y go'osun
 grow.PL=**EPIS**=CN berries LOC.here
 'Berries might be growing here.'

(Peterson 2010:158)

Lexical distinctions between modal flavours are pervasive in many languages, as mentioned in section 2.2, and as shown recently in formal work on St'át'imcets (Lillooet Salish; Matthewson et al. 2007, Rullmann et al. 2008, Davis et al. 2009), Javanese (Austronesian; Vander Klok 2008, 2012), Blackfoot (Algonquian; Reis Silva 2009, in prep.), Kwak'wala (Wakashan; Menzies 2010), Nez Perce (Penutian; Deal 2011) and Nsyilxcen (Okanagan Salish; Menzies 2012).

Even though many languages lexically distinguish epistemic from circumstantial modal bases, it turns out to be not so easy to distinguish the two types theoretically. I turn to this issue in the next section.

2.4 Epistemic vs. circumstantial: the issues

Epistemic and circumstantial interpretations should be easy to tell apart. Kratzer (2012:52) gives the German pair in (21) to illustrate (English translations added). (21a) is circumstantial, and asserts that Kathl has the ability to make a pound of Quark out of this can of milk. (21b) is epistemic, and asserts that it is compatible with the evidence that Kathl might actually do that. If Kathl can, but surely won't, make a pound of Quark out of this milk, (a) is true and (b) is false.

(21) a. aus dieser Kanne Milch **kann** die Kathl ein Pfund Quark machen
 from this can of milk **can** the Kathl one pound of cottage cheese make
 'Kathl can make a pound of Quark out of this can of milk.'

b. es **kann** sein, dass die Kathl aus dieser Kanne Milch ein Pfund Quark macht
 it **may** be that the Kathl from this can of milk one pound cott. cheese makes
 'Kathl might make a pound of Quark out of this can of milk.'

The theoretical problem is that both types of modal base depend on facts about the world of evaluation, and as such, there is no formal way to distinguish the two. As Nauze (2008:155) points out, in many contexts the very same set of propositions can serve either as an epistemic modal base, or a circumstantial one. Kratzer (2012:24) concurs, and writes that '[i]t now seems to me a hopeless enterprise to try to characterize formal objects like conversational backgrounds as "circumstantial" versus "epistemic".'

To see the problem, imagine that the relevant circumstances for a particular modal assertion are

identical to the relevant evidence we have (that is, we know everything that is relevant). In this case, a circumstantial and an epistemic modal base will contain the exact same set of propositions. Nauze gives the example in (22), which involves similar modal flavours to (21), but has a context in which the two modal bases (which we want to classify as circumstantial and epistemic respectively) contain identical propositions.¹⁷

- (22) *Context: It is 2.50pm on Saturday and we all know that France is playing England at 3.00pm in the Six Nations rugby tournament. Furthermore we know that Fabrice is home (and has a television receiving the game).*
- a. Fabrice **can** watch the game.
 - b. Fabrice **might** watch the game. (Nauze 2008:154-155)

In recent work, Kratzer (2009, 2012, 2013) (building on work by Arregui 2005, 2007, 2009 and Hacquard 2006, 2010) develops an alternative approach to restricting the domains over which modals quantify. The new approach includes a substantive re-thinking of the epistemic-circumstantial divide.¹⁸ The major division Kratzer proposes is between *factual* and *content* modes of projecting conversational backgrounds. Factual mode functions return a set of worlds which all contain *counterparts* of some actual-world situation or body of evidence.¹⁹ For example, (23) contains a factual modal. The claim is that in all worlds in which the same rumor exists as in the actual world, and in which the rumor bears the same relation to reality as it does in the actual world, Roger was elected chief. The sentence commits the speaker to the belief that Roger was elected in the actual world (modulo the wiggle-room provided by a stereotypical ordering source).

- (23) Given the rumor, Roger **must** have been elected chief (#but he actually wasn't).

The content mode, on the other hand, provides functions which return sets of worlds compatible with the *propositional content* of some actual-world source of information. This is illustrated in (24). Here, the claim is that in all worlds in which the *content of the rumor* is true, Roger was elected chief. This allows the speaker to believe that the rumor was a lie.

- (24) According to the rumor, Roger **must** have been elected chief (but he actually wasn't).

Notice that *must* behaves differently in (23) and (24), even though both these uses would traditionally be classified as epistemic. The new classification therefore splits the old class of epistemic modals. Content-mode epistemics are not based on the speaker's knowledge, or necessarily on *anyone's* knowledge – the content of rumors and other similar sources of

¹⁷ The problem cannot be solved by using different types of ordering sources. Nauze (2008:155) also shows that deontic and stereotypical ordering sources can contain identical sets of propositions in the same context.

¹⁸ Another facet of the new approach is the idea that a modal's domain is projected from an *anchor*. Anchors may be individuals, events, situations, or bodies of evidence. Implicit domain-fixing functions map the anchors to ordered sets of modal alternatives. Here I set the details of anchors aside, concentrating on the issue of the epistemic-circumstantial divide.

¹⁹ On counterparts, see Lewis (1986).

information can be false.²⁰

The traditional class of circumstantial modals, on the other hand, all use the factual mode, as they all rely on some actual-world facts and quantify over worlds in which counterparts of those facts hold. The relation between the old and new classifications is schematized in Table 2.

Table 2: Traditional vs. new classifications of (modes of projection of) conversational backgrounds

traditional classification	circumstantial	epistemic
new classification	factual	content

The split between factual- and content-mode epistemics is lexicalized in many languages. For example, the St'át'imcets reportative modal *ku7* is factual, as shown by the fact that the St'át'imcets sentence on which (23-24) are based does not allow the speaker to totally disbelieve the rumor (see Matthewson et al. 2007). In contrast, the German reportative modal *sollen* is an informational modal, and *does* allow the speaker to disbelieve the rumor (Kratzer 2012:35).²¹ Other elements traditionally analyzed as evidentials also lexically encode the difference between factual- and content-mode conversational backgrounds. This is shown in (25-28) for St'át'imcets. The factual modal *k'a* requires the speaker to have indirect inferential evidence for the prejacent, while the content modal *lákwa* requires the speaker to have sensory, non-visual evidence for the prejacent. Only *lákwa* allows the speaker to believe that the prejacent is false (Matthewson 2011, 2012a).

(25) # wá7=k'a ku=mám'teq láku7 álsq7=a, t'u7 nílh=a cwílh=t' u7 ti=sk' éxem=a
 be=INFER DET=walk DEIC outside=EXIS but FOC=a after.all=just DET=wind=EXIS
 wa7 qan' ím-ens-an
 IPFV hear-DIR-1SG.ERG
 'Someone might/must have been walking outside, but it was the wind.'

(26) wa7 **lákwa** ku=mám'teq láku7 álsq7=a, t'u7 nílh=a cwílh=t' u7
 be SENS.NON.VIS DET=walk DEIC outside=EXIS but FOC=a after.all=just
 ti=sk' éxem=a wa7 qan' ím-ens-an
 DET=wind=EXIS IPFV hear-DIR-1SG.ERG
 'It sounded like someone was walking outside, but it was the wind.'

(27) # t'ec=k'a=t'u7 ku=páoy, t'u7 áoz=t'u7 kw=a=s áma
 tasty=INFER=just DET=pie but NEG=just DET=IPFV=3POSS good

²⁰ Kratzer (2012) calls the two types of epistemic modals *evidential* vs. *informational*. This is a different use of the term 'evidential' from its traditional use, which picks out elements which encode information source (Aikhenvald 2004).

²¹ The Quechua and Cheyenne reportatives also allow the speaker to disbelieve the report (Faller 2002, Murray 2009). Faller (2002) and Murray (2009) do not analyze their respective reportatives as having modal semantics, but Faller (2011) analyzes the Quechua one as a content-mode ('informational') modal, similar to German *sollen*.

‘The pie might/must have been good, but it wasn’t good.’

(28) *Context: It smelled as if the pie was good, but there was too much salt so it was actually horrible.*

t’éc=t’u7 **lák7a** ku=páoy, t’u7 áoz=t’u7 kw=a=s áma
sweet=just SENS.NON.VIS DET=pie but NEG=just DET= IPFV= 3POSS good
‘The pie seemed good, but it wasn’t good.’

This analysis requires us to assume, following ideas found in McCready (2010), that the sensory evidence invoked by *lák7a* has propositional content.²² So, the factual-mode (27) might assert that the pie was good in all worlds in which there was a counterpart of the actual-world smell, and in which the smell bore the same relation to the taste of the pie as it did in the actual world. (Anyone who asserts that cannot simultaneously assert that the pie was bad.) The content-mode (28), on the other hand, might assert that the pie was good in all worlds compatible with the content of the sensory-evidence proposition that I smelled a good pie smell. Since my sensory evidence might have been tricking me, it’s possible that the pie was bad.

The fact that the St’át’imcets evidentials *k’a* and *lák7a* lexicalize the split between factual and content modes of conversational background projection has two consequences. The first is that one diagnostic which is sometimes used to argue for a non-modal analysis of evidentials collapses. The diagnostic in question relies on whether an utterance containing the evidential is compatible with the speaker’s knowing or believing that the prejacent proposition is false (Faller 2002, Murray 2009). The story is that since a modal asserts that its prejacent proposition is possibly or necessarily true, an evidential which allows statements of the form ‘evidential- ϕ , but not ϕ ’ cannot have modal semantics. However, we just saw that content mode modals allow statements of this form, because they quantify over worlds compatible with the content of some body of evidence, and do not place any restriction on whether the prejacent is true in the actual world. So the diagnostic of deniability is not sufficient to rule out a modal analysis of evidential elements (Matthewson 2012a).

The second consequence of the *k’a/lák7a* situation is that it supports a recently emerging idea about how to unify the old class of epistemic modals, even under the new classification into factual and content modes. The idea is that epistemics are modals which rely on *indirect evidence* about propositions, and therefore that epistemic modals fall into the class of evidential elements. As von Stechow and Gillies (2011:113) put it, epistemic modals have a ‘resistance to plain facts but sensitivity to stores of information.’ The ‘stores of information’ can include ships’ logs, interview notes, or computers, but always constitute indirect evidence of actual-world events. The idea that epistemic modals *always* rely on indirect evidence is fleshed out in von Stechow and Gillies (2007, 2010) and Kratzer (2012). In general, we are seeing a convergence of research on epistemic modality in languages like English with cross-linguistic research on evidentiality, which since Izvorski (1997) has been exploring and debating the idea that at least some evidentials are epistemic modals (Garrett 2001, McCready and Asher 2006, Matthewson et

²² Thanks to an anonymous reviewer for raising this issue. McCready uses the example of a bloody knife hidden in a cupboard: the knife itself is just a knife, but the proposition that the knife is there is what serves as evidence.

al. 2007, McCready and Ogata 2007, Speas 2008, Peterson 2010, Faller 2011, Lee 2011, among many others).

The picture I have been sketching leads to a classification as in Table 3, where a three-way split is generated. The factual-content division is a difference in modes of projection (whether the modal quantifies over worlds containing a counterpart of some situation or body of evidence, or over worlds compatible with the propositional content of some body of evidence). The circumstantial-evidential division is a difference in whether information source is encoded.

Table 3: A three-way categorization of conversational backgrounds

	factual-circumstantial	factual-evidential	content-evidential
English	<i>can</i>	<i>might</i>	
	<i>must</i>		
St'át'imcets	<i>ka</i> (DEON), <i>ka-...-a</i> (CIRC)	<i>k'a</i> (INFER), <i>ku7</i> (REPORT)	<i>lákʷ7a</i> (SENS.NON.VIS)

We see that English lexically encodes the circumstantial-evidential split, as well as having some modals which allow all three modes of projection. St'át'imcets encodes the full three-way split. We also predict that languages may have modals which are lexicalized to cover all kinds of factual interpretations, including traditional circumstantial interpretations as well as factual-evidential ones. Whether this prediction is upheld is a topic for future research.

Before leaving the issue of modal flavour, I will mention one more issue of ongoing debate in the area of epistemic modality. Suppose we could agree that epistemic modals depend on stores of information which constitute indirect evidence for actual-world events. There is then still debate about whether epistemic modals necessarily rely on an *agent* who is the holder of that store of information. If an agent is involved, how is that relativism to an agent capturable? The literature on this topic is large and interesting, and consensus has not yet been reached; for relevant discussion, see Garrett (2001), Hacquard (2006, 2010), von Stechow and Gillies (2007, 2008, 2011), Stephenson (2008), Yalcin (2007), Kratzer (2009, lecture 3), and Waldie (2012), among others.

3 Modal force

3.1 Issues in modal force

So far we have looked mainly at necessity and possibility modals, but a picture of modals as encoding either universal or existential quantification over worlds is too simplistic in several important ways. First, there is the existence of graded modality, as we see in (29) (repeated from (11)).

- (29) a. Michl is **probably** the murderer.
 b. There is a **good possibility** that Michl is the murderer.
 c. There is a **slight possibility** that Michl is the murderer.
 d. Michl is **more likely** to be the murderer than Jakl. (Kratzer 1991:643)

Kratzer (1981, 1991) argues that the ordering source provides a way to account for graded modal force. Kratzer defines various graded modal notions such as ‘slight possibility’, ‘good possibility’, and ‘better possibility’; examples are given in (30-31) (see discussion in Portner 2009:69-71).

(30) p is a **good possibility** in w with respect to a modal base f and an ordering g iff:
 $\exists u \in \cap f(w) [\forall v \in \cap f(w) [v \leq_{g(w)} u \rightarrow v \in p]]$ (Kratzer 1991:644)

(31) p is **at least as good a possibility** as q in w with respect to f and g iff:
 $\neg \exists u \in \cap f(w) [u \in q-p \ \& \ \forall v \in \cap f(w) [v \in p-q \rightarrow u \leq_{g(w)} v]]$ (Kratzer 2012:41)

A proposition p is a good possibility if there is some world u , such that all higher-ranked worlds than u are p -worlds. To see whether p is at least as good a possibility as q , we look at the worlds p and q don’t have in common (i.e., the worlds in $q-p$ and in $p-q$). p is at least as good a possibility as q if there is no world in $q-p$ that is ranked higher than all worlds in $p-q$.

Recent work on graded modality has debated the extent to which the ordering source-based analysis is sufficient to capture all the relevant facts. One issue is the existence of overtly quantifiable degrees of probability, as in (32). These are not obviously handlable in a standard Kratzerian analysis (although see Kratzer 2012:42f).

- (32) a. It was twice as likely to rain as it was to snow. (Swanson 2008:1202)
 b. There is a 60% probability that it is raining. (Portner 2009:73)
 c. It is 95% certain that Jorge will win the race. (Lassiter 2011a:198)

Researchers such as Halpern (1997, 2003), Swanson (2006, 2008), Portner (2009), Yalcin (2007, 2010), Lassiter (2011a,b) and Kratzer (2009, 2012) have been exploring the idea that gradable modal elements like *probable/probably/probability* should be analyzed as probability operators, and/or that their analysis should adopt insights from the study of gradable adjectives (e.g., Kennedy and McNally 2005). A gradable adjectives analysis would mean that these elements introduce a scale which is an ordered set of degrees of possibility or probability.

A related issue to that of graded modality, which happens to be lexicalized in English modal auxiliaries, is the distinction between strong and weak necessity, illustrated in (33).

- (33) a. After using the bathroom, everybody **ought to** wash their hands; employees **have to**.
 (von Stechow and Iatridou 2008:116)
 b. After using the bathroom, everybody **should** wash their hands; employees **must**.

There are several different approaches to weak necessity modals; see Portner (2009:79ff) and Rubinstein (2012) for recent summary and discussion. One family of approaches adapts the probability semantics just discussed for epistemic elements; it views weak necessity modals as assigning a greater likelihood of success or utility to their prejacent than to other alternatives (see for example Goble 1996, Finlay 2009, 2010, Lassiter 2011b).

Another family of approaches to weak necessity involves domain restriction, and is based on the

fact that universally quantifying over a smaller set of worlds gives rise to a weaker claim.²³ Following an intuition by Sloman (1970), von Fintel and Iatridou (2008) argue that *ought* universally quantifies over a domain which is narrowed down by an additional restriction, over and above the restrictions on the domain of *must*. In (34a), for example, the claim is that in all the worlds where the relevant facts are the same as in the actual world and in which you meet your goal of getting to Ashfield, you take Route 2. There are no other options for meeting your goal. In (34b), the claim is weaker: in all worlds in which you satisfy a secondary goal (such as avoiding heavy traffic) you take Route 2.

- (34) a. To go to Ashfield, you **have to/must** to take Route 2.
b. To go to Ashfield, you **ought to** take Route 2. (von Fintel and Iatridou 2008:118)

Von Fintel and Iatridou argue that the secondary goal is due to a second ordering source, whose presence can be signaled by counterfactual morphology in a range of languages. This approach uses only tools provided by a standard analysis of modals, but/and it raises interesting questions about ordering sources. One issue discussed by Rubinstein (2012) is how we tell which ordering source is which – which is the ‘primary’ and which the ‘secondary’? Rubinstein proposes that weak necessity modals rely on ordering sources which involve a departure from the collective commitments of participants in the discourse. For example, suppose there are four ways to get to Amherst from Cambridge. A speaker who utters (35) conveys that while taking Route 9 is not a necessity given the collectively agreed-upon goal of getting to Amherst, it is a necessity given some assumption that the speaker presupposes is *not* collectively shared with the hearer (such as seeing nice scenery, or stopping for lunch at a particular place on the way).

- (35) To go to Amherst, you **ought** to take Route 9. (Rubinstein 2012:9)

Further questions raised by the ordering source approach include the issue of what prevents even a single ordering source from weakening a strong necessity modal more than we would like. Similarly, what prevents a weak necessity modal from becoming as weak as a possibility modal? And finally, do epistemic strong necessity modals really even have *one* ordering source? Both von Fintel and Iatridou (2008) and von Fintel and Gillies (2010) doubt that they do. These authors disagree with one of the basic empirical motivations for ordering sources, namely that (36a) is weaker than (36b) because it involves a non-realistic, stereotypical ordering source.

- (36) a. She **must** have climbed Mount Toby.
b. She climbed Mount Toby. (Kratzer 1991:645)

According to von Fintel and Gillies, epistemic *must* does *not* signal weakening with respect to the assertion of the plain prejacent. Instead, it signals indirect evidentiality (as discussed in the previous section), and this leads to a perceived weakening. One thing to note about this idea is that the evidentiality claim is independent of the no-ordering-source claim. It could conceivably be correct that *must* requires indirect evidence, but false that it makes no use of an ordering

²³ For a third set of approaches which rely on pragmatic differences between strong and weak necessity modals (for example, a presupposition on *must* that is missing on *should*, or evidential differences between the two), see Ninan (2005), Copley (2006), and Swanson (2008).

source.

A final strand of current research in the area of modal force is modals without duals. These are modals which do not come in necessity-possibility pairs, but can be used in contexts supporting either necessity or possibility claims. These have been most extensively discussed for languages other than English (Rullmann et al. 2008, Davis et al. 2009, Peterson 2010, Deal 2011). In the next sub-section I discuss two examples of such languages, Gitksan and Nez Perce.

3.2 Modal force in Gitksan and Nez Perce

The Gitksan epistemic modals *ima('a)* and *gat*, seen above in section 2.3, differ from English modal auxiliaries in that they do not appear to be specialized for a particular modal force. Instead of forming a paradigmatic universal-existential pair, they contrast with each other only in information source. *Ima('a)* and *gat* are compatible with situations which license necessity assertions, and with situations which license possibility assertions. Consequently, acceptable translations into English differ widely, as shown in (37).

(37) *Context: You're wondering where your friend is. You notice his rod and tackle box are not in their usual place.*

yugw=**ima**=hl dim ixw²⁴-t
IPFV=**EPIS**=CN PROSP fish.with.line-3
'He might be going fishing.' / 'He must be going fishing.' / 'He's probably going fishing.' / 'He's likely going fishing.' / 'He could be going fishing.' / 'Maybe/perhaps he's going fishing.' (Peterson 2010:161)

The claim that *ima('a)* is not semantically a necessity modal is supported by data such as (38). In this discourse context, *must* would be infelicitous in English.

(38) *Context: You thought your friend was fishing. But you see his rod and tackle box are still at his house. You really don't know if he's fishing or not.*

yugw=**imaa**=hl da'awhl ixwt oo ligi nee=**yimaa**=dii ixwt
IPFV=**EPIS**=CN then fish or INDEF NEG=**EPIS**=CNTR fish
'Maybe he's fishing, maybe he's not fishing.' (Matthewson 2013a:361)

Peterson (2010) analyzes *ima('a)* as a possibility modal which can be strengthened via an ordering source. This idea is the inverse of the domain-restriction approach to weak necessity discussed in the previous section, and relies on the idea that while narrowing the domain of a universal quantifier causes weakening, narrowing the domain of an existential quantifier causes strengthening.

Superficially similar data, in the non-epistemic realm, are presented for Nez Perce by Deal (2011). As shown in (39), the circumstantial modal *o'qa* is translatable as, and at first glance apparently interpretable as, either a possibility or a necessity modal.

²⁴ The spelling has been corrected here; cf. Rigsby (1986:170).

Matthewson (2013a) for Gitksan, and Deal (2011:566), who writes about Nez Perce that ‘Owing to difficulties in embedding certain epistemic expressions in downward-entailing contexts, the intricacies of the epistemic system are not yet fully understood.’

There are other approaches to modals without duals, for example a domain-restricted necessity analysis by Rullmann et al. (2008), and a degree-modal analysis by Kratzer (2012).²⁵ There are also yet more empirical configurations, which raise further analytical questions. For example, Nsyilxcen (Okanagan Salish) possesses two epistemic modals, *mat* and *cmay*. *Mat* is felicitous in both possibility and necessity contexts, but *cmay* is felicitous only in possibility contexts. This is shown in (42-43).

(42) *Context (possibility): You know that Mary loves to go running and often goes on runs randomly. She could also be at the store or at school. I ask you, where is Mary?*

a. Mary **mat** ac-qíc-əlx
 Mary **MOD** CUST-run-LEX
 ‘Mary might be running.’

b. Mary **cmay** ac-qíc-əlx
 Mary **MOD** CUST-run-LEX
 ‘Mary might be running.’

(Menzies 2012:2)

(43) *Context (necessity): Mary runs every day to train for a marathon. She usually runs at 6pm on Tuesdays. Today is Tuesday and it’s 6pm. I ask you, where is Mary?*

a. Mary **mat** ac-qíc-əlx
 Mary **MOD** CUST-run-LEX
 ‘Mary must be running.’

b.# Mary **cmay** ac-qíc-əlx
 Mary **MOD** CUST-run-LEX
 ‘Mary might be running.’

(Menzies 2012:2)

We thus see that within a single language’s epistemic system, one modal behaves as if it lacked a dual, while one behaves like a strict possibility modal. This raises interesting questions for the idea that possibility modals in languages like English are weak because of scalar implicatures induced by the contrasting necessity modal. See section 5 for discussion of an emerging formal typology of modal force.

4 **Modal-temporal interactions**

The denotations we have so far for English modal auxiliaries, repeated in (44), are dependent on

²⁵ One of Kratzer’s motivations for a degree-modal analysis is that Rullmann et al., Peterson and Deal fail to explain the absence of duals in the respective languages (Kratzer 2013:184-185). While a degree-modal analysis may turn out to be preferable, I am not sure that the absence of duals is something which necessarily requires explanation. Some modals have duals, some do not. Attitude verbs do not seem to have duals, for example.

both a modal base and an ordering source, but contain no sensitivity to time.

- (44) a. $[[must]]^{w,g} = \lambda f_{\langle s, \langle st, t \rangle \rangle} . \lambda h_{\langle s, \langle st, t \rangle \rangle} . \lambda p_{\langle s, t \rangle} . \forall w' \in \text{BEST}_{h(w)}(\cap f(w)) : p(w) = 1$
 b. $[[can]]^{w,g} = \lambda f_{\langle s, \langle st, t \rangle \rangle} . \lambda h_{\langle s, \langle st, t \rangle \rangle} . \lambda p_{\langle s, t \rangle} . \exists w' \in \text{BEST}_{h(w)}(\cap f(w)) : p(w) = 1$

However, as pointed out above and as discussed by many authors including Condoravdi (2002) and Ippolito (2003), the truth conditions of modal statements depend not only on a world of evaluation but also on a time of evaluation. Conversational backgrounds must therefore be functions which take times as one of their arguments. A time-dependent denotation for *must* is given in (45).

- (45) $[[must]]^{w,g} = \lambda f_{\langle s, \langle st, t \rangle \rangle} . \lambda h_{\langle s, \langle st, t \rangle \rangle} . \lambda P_{\langle i, \langle s, t \rangle \rangle} . \lambda t . \forall w' \in \text{BEST}_{h(w)}(\cap f(w, t)) : P(t)(w') = 1$

Simply introducing a time of evaluation is of course not the full story. As Portner (2009:223) observes, there are at least three ways in which the temporal interpretation of modal sentences can be restricted: first, by independent tense or aspect operators and their scope properties; second, by temporal restrictions in the lexical entries of the modals themselves, and third, by ‘general semantic or pragmatic principles which help determine temporal meaning, but which are not tied to any particular grammatical element.’ Portner (2009:chapter 5) gives a comprehensive overview of the issues in modal-temporal interactions and the major available approaches. In this section I will first outline an approach to modal-temporal interactions which draws on and generalizes Condoravdi’s (2002) work, and then discuss the contentious issue of whether epistemic modals can scope under past tense. In section 4.3 I present some cross-linguistic evidence for the proposed approach to modal-temporal interactions.

4.1 Sketch of an approach to modal-temporal interactions

The discussion in this sub-section is presented with respect to English data unless otherwise noted, but the architecture of the framework is intended to be cross-linguistically applicable. Following much work in the literature, I assume that modals appear syntactically below tense,²⁶ but above viewpoint aspect. The reference time interval which is provided by tense saturates the time argument in the lexical denotation of the modal (see (45) above). The tense thus provides the evaluation time for the modal base, called the *temporal perspective* by Condoravdi (2002). Viewpoint aspect restricts the relation between the temporal perspective and the time of the event described by the prejacent clause; this relation is called the *temporal orientation* of the modal by Condoravdi. Temporal perspective and temporal orientation are illustrated in (46).

- (46) a. Merlin might win the game.
temporal perspective: PRESENT (based on available evidence at utterance time)
temporal orientation: FUTURE (event follows temporal perspective)
- b. Merlin might have won the game.

²⁶ More generally (to take into account tenseless languages), what is crucial is that the modal is provided with a reference time in whatever way the language independently provides reference times to non-modal clauses.

temporal perspective. This also happens with English semi-modals such as *have/had to* or *is/was able to*. Otherwise, past TP in English is marked by the perfect auxiliary *have*. In (51c-d), *have* introduces a low-scoping perfect aspect and gives past temporal orientation, but *have* can also induce past temporal perspective when it combines with a modal which contains historical past tense morphology (such as *might* or *could*). These two different roles for *have* underlie the famous ambiguity of *might have*-constructions, pointed out by many including Huddleston and Pullum (2002), Condoravdi (2002) and Ippolito (2003), and illustrated in (52-53).²⁸

- (52) Q: Why is John looking happy?
 A: I'm not sure, but he **might have** won the game.
 PRES (*might* (PRF (PFV (λe . he-win (e))))))
 TP: present TO: past

- (53) Q: Why is John looking sad?
 A: Because he **might have** won the game, if he hadn't fumbled that pass.
 PAST (*might* (PROSP (PFV (λe . he-win (e))))))
 TP: past TO: future

The readings in (52) and (53) differ not only in temporal properties, but in conversational background: (52) is epistemic, while (53) is circumstantial (more specifically, metaphysical, according to Condoravdi 2002, although see Abusch 2012 for a dissenting view).²⁹ The question immediately arises of how the unattested combinations of temporal perspective, temporal orientation, and conversational background are ruled out. One sub-part of the puzzle is the restriction of the circumstantial reading in (53) to future orientation. If (53) does involve metaphysical modality, its future orientation follows from Condoravdi's (2002) Diversity Condition, or from Werner's (2003) Disparity Principle. These are general principles which rely on the fact that metaphysical modals quantify over worlds which only vary for times following the temporal perspective.

A second sub-part of the puzzle posed by (52-53) is the restriction of the epistemic interpretation to a present temporal perspective. This can be derived within Condoravdi's system via a stipulation that epistemic modals cannot scope under either past tense or the perfect auxiliary. This issue has been the subject of much debate, and I discuss it in slightly more detail in the next sub-section.

4.2 Past epistemics

Can epistemic modals have past temporal perspectives? The issue is whether sentences like (54a-

²⁸ The details of how *have* manages compositionally to contribute past temporal perspective have been debated in the literature, and go beyond what we can discuss here; see Condoravdi (2002), Ippolito (2003), Arregui (2005), Hacquard (2006), Laca (2008), and Rullmann and Matthewson (2012) for discussion.

²⁹ A metaphysical modal base is a circumstantial modal base which provides a set of worlds which are all identical to the actual world up to and including the time at which the modal base is calculated (Thomason 2002).

c) can make an assertion about what was epistemically possible or necessary at some past time.

- (54) 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)

Many researchers have denied that epistemic modals can have past temporal perspectives, at least in English. Hacquard (2011:1495), for example, states that 'epistemic modals are evaluated at the speech time'; see also Groenendijk and Stokhof (1975), Cinque (1999), Drubig (2001), Condoravdi (2002), Stowell (2004), Hacquard (2006), Borgonovo and Cummins (2007), Demirdache and Uribe-Etxebarria (2008), and Laca (2008). A common belief is that the semantic restriction on the temporal properties of epistemic modals derives from a syntactic restriction, namely that epistemic modals scope over tense, while non-epistemic modals scope under it. Hacquard (2011) (among others) adopts Cinque's (1999) hierarchy of functional heads, relevant portions of which are given in (55):³⁰

- (55) $\text{Mod}_{\text{epist}} > \text{Tense} > \text{Aspect} > \text{Mod}_{\text{volitional}} > \text{Mod}_{\text{deontic necessity}} > \text{Mod}_{\text{ability/deontic possibility}}$
(Hacquard 2011:1496)

The view that epistemic modals always scope over tense has not gone unchallenged. Epistemic modals have been shown to allow past temporal perspectives in a number of non-English languages; see Eide (2003, 2005) for Norwegian, Kratzer (2009) for (English and) German, and Homer (2010), Mari (2010) and Martin (2011) for French. Within English and to a certain extent for other languages, the issue is still controversial. Von Fintel and Gillies (2008) argue that (54c) does have a past-temporal perspective epistemic reading; the reading is facilitated by a discourse context as in (56). Von Fintel and Gillies state (2008:87) that here '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.'

- (56) *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. (von Fintel and Gillies 2008:87)

The debate about past epistemics goes beyond simple empirical disagreement: among those who acknowledge that epistemic modals can have a past temporal perspective, some deny that it reflects the ability of the epistemic modal to scope under a clause-mate past tense. It has for example been proposed that the relevant readings involve an elided embedding attitude verb or *because*-clause (Hacquard 2006, 2011), or that they are felicitous due to contexts of (free) indirect discourse (Fagan 2001, Boogaart 2007, Hacquard 2006, 2011). For arguments against some of these escape hatches, see Homer (2010), Rullmann and Matthewson (2012), and see

³⁰ As discussed in section 2.2 above, Hacquard does not derive the effects of syntactic position on interpretation simply from a cartographic syntax. Her proposal is that the different interpretations arise because modals interact locally with different elements which partially determine the modal's interpretation.

Portner (2009:222-236) for summary and discussion.³¹

In a broader cross-linguistic context, Matthewson et al. (2013) provide evidence that 11 languages from eight families allow past-temporal perspective epistemics: English, Dutch, German, Hebrew, Mandarin, St’át’imcets, Gitksan, Blackfoot (Algonquian), Atayal (Austronesian), Paiwan (Austronesian) and Ktunaxa (isolate). They argue that cross-linguistically, modal flavour is independent of temporal perspective, and that all possibility modals can have past temporal perspectives, whether they are interpreted epistemically or circumstantially. Some of the evidence for this claim is presented in the next sub-section.

4.3 Modal-temporal interactions across languages

In this section I present evidence for two proposals: first, that epistemic modals can have a past temporal perspective in a range of languages, and second, that viewpoint aspect within the preajacent clause helps determine the temporal orientation. The first claim is supported by the data in (57-59), from Blackfoot, Ktunaxa and St’át’imcets respectively. Each of these languages has lexical items dedicated to epistemic modality, so the modal flavour is unambiguously epistemic. The past temporal perspective is ensured by the discourse context, and is not overtly marked because tense is non-overt in all these languages.

- (57) *Context: Stacey bought a bone for Pat’s pet, thinking it might be a dog. Later, she finds out the pet is a snake. When Pat asks her why she bought a bone, she says:*

matonni ni-maat-ssksini-'p-wa ot-aanist-a'pssi-wa piiksiksinaa-wa
yesterday 1-NEG-know.VTI-LOC:0-NONAFF 3-manner-be.VAI-3 snake-3

aahkam-omitaa-wa

EPIS-dog-3

‘Yesterday, I didn't know it was a snake, it might have been a dog.’

(Louie 2012, elicited using the Feeding Fluffy storyboard, TFS Working Group 2011)

- (58) *Context: Your neighbor doesn’t show up for work and you know there’s been a flu going around. You send your son to bring her hot soup. She actually took the day off because her apartment flooded, so she asks why you sent her soup in the middle of the day.*

hin hin sa-nitxu?-ni

EPIS 2 sick-IND

‘You might have been sick.’

(Laternus 2012)

- (59) *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

³¹ Portner himself states (2009:227) that a past temporal perspective is rare but not impossible for epistemic modals, and that the past readings may be limited to stative sentences. See also Iatridou (1990) for relevant discussion, including the claim that some but not all of what we currently classify as epistemics can scope under tense.

‘It might have rained.’

Further evidence for past-TP epistemic modals is given in (60-62) from Gitksan; these data also support the second proposal of this section, namely that viewpoint aspects control temporal orientation. Observe that (60-62) are a minimal triplet containing the epistemic modal *ima(’a)*, a uniformly past temporal perspective (ensured by the context), and all three possible temporal orientations, past, present and future respectively. While in (60) there is no overt marking of past orientation, in (62) the future orientation is achieved by means of the overt prospective aspect marker *dim*.

(60) *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] (Matthewson 2013a:366)

(61) *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.’ (Matthewson 2013a:363)

(62) *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.’ (Matthewson 2013a:366)

Prospective aspect marking is obligatory whenever a modal is future-oriented in Gitksan (Matthewson 2013a). This leads to at least three consequences. First, English and Gitksan differ superficially, in that temporally unmarked epistemic modals can be future-oriented in English but not in Gitksan; this is shown in (63).

(63) yugw=**imaa**=hl wis
 IPFV=**EPIS**=CN rain
 ‘It might have rained.’ / ‘It might be raining.’ / ≠ ‘It might rain (in the future).’

√ Context: You see puddles, and the flowers looking fresh and damp. PAST TO
 √ Context: You hear pattering on the roof. PRESENT TO
 # Context: You hear thunder, so you think it might rain soon. FUTURE TO
 (Matthewson 2013a:364-365)

Second, English and Gitksan are mirror images, since past orientation is obligatorily marked in English (via *have*), but future orientation is obligatorily marked in Gitksan (via *dim*). And third,

English and Gitksan can be analyzed as abstractly parallel, if we are willing to postulate a null prospective aspect in English and a null perfect in Gitksan (cf. Van de Vate 2011).

In this section I have sketched a Condoravdi-inspired approach to modal-temporal interactions, which makes the universal hypotheses that temporal perspective is given by tense (or the language-internal functional equivalent) and temporal orientation is restricted by aspect. Obviously, languages vary independently in their temporal systems. An overarching goal is therefore to establish the extent to which variation in modal-temporal interactions reduces to those independent temporal differences. For example, we have already seen that languages without overt past-present distinctions allow past temporal perspectives without any overt marking. This is predicted by the system presented. Whether other predictions are upheld is a matter for future research.

5 Typological and other remaining questions

In this paper we have discussed the basics in three major areas in modality research: modal flavour, modal force, and modal-temporal interactions. Many empirical and analytical questions remain about all of these areas, as well as about the interactions between them. Assuming that our ultimate goal is a theory of universals and variation in human language, one important task for the field is to gather information about modality in unfamiliar and understudied languages. Formal research on such languages will allow us to develop a formal typology of modality, which in turn will facilitate greater theoretical understanding.

There is, of course, already a rich tradition of modality research in the typological literature; see Bybee et al. (1994), de Haan (1997), van der Auwera and Plungian (1998), Palmer (2001), Hengeveld (2004), van der Auwera and Ammann (2011), among others. These works provide extensive information about how modal notions are expressed across languages (as verbs, affixes, etc.), what types of categories are encoded, and the grammaticalization paths of modal elements. Added to this is a recent growth of formal research on modality, which is able (through hypothesis-driven investigation and the collection of negative evidence) to isolate precisely and accurately the semantics of modal elements in a range of languages.^{32,33}

One major set of questions which cross-linguistic study of modality needs to address is what the lexicalization patterns are across languages for modal flavour, modal force, temporal properties, and all combinations of these. There is already evidence that flavour, force, and temporal properties are not randomly combined. For example, there is a well-known flavour-orientation correlation which we hinted at above, namely that circumstantial modals usually – sometimes even obligatorily – have future orientation. As Kratzer (2012:54) writes, circumstantial modal bases target facts which are ‘external or internal circumstances of people, things or places that

³² For critiques of a non-hypothesis-driven typological approach to modality, see Matthewson (2013) and Matthewson, Davis and Gillon (2013). Along similar lines, Nauze (2008:19) points out that a good typology of modality must rely not only on general descriptive sources such as grammars, but on ‘semantically motivated descriptions’ of modal systems.

³³ For a recent example of formal cross-linguistic research on modality, see Arregui et al. (2013), who provide a modal analysis of imperfective aspects in several different languages.

determine their possible futures.’ In contrast, realistic epistemic modals target ‘evidence of things implying or suggesting the presence of other facts in the past, present, or future.’

The circumstantial/future-orientation correlation arises in different language families, and has been documented and analyzed by, among others, Coates (1995), Enç (1996), Condoravdi (2002), Stowell (2004), Copley (2006), Werner (2003, 2006), Borgonovo and Cummins (2007), van de Vate (2011), Chen (2012), Kratzer (2012, 2013), Matthewson (2012b, 2013a), and Thomas (2013). There are also three-way correlations between force, flavour and temporal orientation, such as a restriction of epistemic necessity modals to past orientation; see Werner (2006) and Portner (2009) on English, Lekakou and Nilsen (2008) on Greek, and Reis Silva (in prep.) on Blackfoot.³⁴ On the other hand, Tonhauser (2011) argues that the Paraguayan Guaraní future marker *-ta* allows epistemic necessity interpretations, and Giannakidou and Mari (to appear) argue that the future morpheme in both Greek and Italian conveys epistemic modality. Further research is obviously required.

There has not yet been as much research into flavour-force correlations, but an interesting question is whether one particular modal flavour might be more likely to lack duals than another. Impressionistically, it seems that epistemic modals (including elements which have traditionally been analyzed as evidentials) may be more likely to lack duals. Gitksan is a case in point; we saw above that this language encodes force distinctions in the circumstantial domain, but not the epistemic. Another example is Niuean (Polynesian), which possesses a general-purpose epistemic modal *liga*, usable in contexts of both high and low certainty, but two circumstantial modals, *maeke* and *lata*, which are specialized for force (possibility and necessity respectively). (64-66) show *liga* with various translations, which correspond to the different modal forces the modal allows.

(64) **liga** kua fano tei
 EPIS PRF go PRF
 ‘He/she/they **might** have left.’ (Matthewson, Quinn and Talagi 2012:224)

(65) *Context: Tom wasn’t fishing yesterday, and you were wondering about his health. But today you see him fishing.*
 Hī ika a Tom he aho nei ... **liga** malolo a ia
 catch.fish fish ABS Tom on day this EPIS strong ABS 3SG
 ‘Tom is fishing today ... he’s **probably** well.’
 (Matthewson, Quinn and Talagi 2012:228)

(66) ne **liga** kua veli hifo e tama ke he pelapela
 PAST EPIS PRF fall down ABS child to mud
 ‘The boy **must** have fallen in the mud.’ (Seiter 1980:13)

(67) shows the possibility modal *maeke* in one of its most frequent uses, an ability reading, and (68) shows the necessity modal *lata* with an obligation interpretation.

³⁴ Abraham (1998:233) argues more radically for modals of all forces that ‘reference to the future under no circumstances gives an epistemic reading.’

(67) kua **maeke** he tama ia ke taute pasikala afi
 PRF **CIRC.POSSIB** at child that SBJ fix bicycle fire
 ‘That child is able to fix motorbikes.’ (Seiter 1980:140)

(68) **lata** ke o a tautolu he aho nei ki Queen Street
CIRC.NECESS SBJ go.PL ABS we.PL.INCL on day this to Queen Street
 ‘We should go to Queen Street today.’ (Seiter 1980:133)

One of the most comprehensive contributions in the area of modal typology is Nauze (2008). Nauze investigates a relatively small sample (six languages from six families, as opposed to the 207 languages of van der Auwera and Ammann 2011). However, Nauze’s work has the advantage that it is based not just on traditional descriptions such as grammars (which typically give insufficient information about the semantics of modality), but also on fieldwork, personal discussion with language experts, and targeted and/or formal literature. Nauze advances the following (tentative) proposal:

Modal elements can only have more than one meaning along a unique axis of the semantic space: they either vary on the horizontal axis and thus are polyfunctional in the original sense of expressing different types of modality or they vary on the vertical axis and can express possibility and necessity, but they cannot vary on both axes (Nauze 2008:222).

This proposed universal rules out a modal element which is polyfunctional both in terms of modal flavour, and in modal force.

In very recent work, Vander Klok (2013) refines Nauze’s proposal. Vander Klok observes that Nauze predicts that a language could possess one modal expression which is polyfunctional along the modal force dimension, and another expression which is polyfunctional along the modal flavour dimension, within the same domain (epistemic or non-epistemic). For example, a language should be able to contain one modal which is specified for a particular non-epistemic flavour (e.g., deontic) and lacks a dual, covering both possibility and necessity readings, and simultaneously contain other circumstantial modals which are polyfunctional along the flavour dimension. A hypothetical system of this type is schematized in Table 4.

Table 4: Hypothetical modal system of the root domain: Predicted to exist under Nauze’s (2008) typology (Vander Klok 2013:18)

		MODAL FLAVOUR		
		ROOT DOMAIN		
		DEONTIC	PURE CIRCUMSTANTIAL	TELEOLOGICAL
MODAL FORCE	NECESSITY	<i>x</i>	<i>y</i>	<i>y</i>
	POSSIBILITY	<i>x</i>	<i>w</i>	<i>z</i>

Based on languages like Gitksan and Paciran Javanese, Vander Klok hypothesizes that a more restrictive universal might hold. She proposes that languages allow for referential ambiguity

along only one axis within each modal domain (epistemic vs. non-epistemic). The system in Table 4 violates this restriction, because it involves referential ambiguity along both the flavour and the force dimensions, within the same (circumstantial) domain. The Gitksan system satisfies the more restricted universal: although it possesses some modals which vary along a force dimension (the epistemic modals *ima('a)* and *gat*), and some modals which vary along a flavour dimension (the circumstantial necessity modal *sgi*, which allows deontic, pure circumstantial and teleological readings), the two types of polyfunctionality are each confined to their own half of the system. More cross-linguistic research is obviously required to test these typological predictions.

5.1 Other areas of modal research

Modality is a very large topic, and any one paper on it must unfortunately set aside many important sub-topics. One way in which the field of modality extends beyond what I have discussed here is simply in terms of construction types. In this paper the English data were drawn mainly from modal auxiliaries (as is the tradition in much of the literature). However, the data from other languages were not restricted to auxiliaries; we have looked at modal verbs, affixes, second-position clitics, and adverbs. Modal semantics also arises in conditionals, viewpoint aspects, tenses, moods, indefinite articles, adverbs, adjectives, infinitivals, and so on.³⁵ The null hypothesis is that the basic semantic concepts presented here will be equally applicable to other items involving modal semantics; any counter-examples to this provide interesting avenues of research.

Sometimes, the failure of a semantic analysis to extend to a new domain is due to independent factors like syntax. For example, I mentioned above that Matthewson et al. (2013) found that epistemic modals can have past temporal perspectives in 11 languages. There are two counter-examples to the pattern in Matthewson et al.'s language sample: SENĆOFEN (the Saanich dialect of Northern Straits Salish) and Hul'q'umi'num' (the Island dialect of Halkomelem Salish). According to Turner (2013), epistemic modals in these two languages do *not* allow past temporal perspectives. However, Turner suggests that this may be due to the fact that the epistemic modals in question are of the wrong syntactic category. She draws a parallel between the epistemic modals in SENĆOFEN and Hul'q'umi'num' and the English epistemic adverb *maybe*. Unlike the modal auxiliary *might*, *maybe* does not scope under tense and cannot receive a past temporal perspective.

- (69) *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.
Maybe there was ice-cream in the freezer. (adapted from von Stechow and Gillies 2008:87)

This is one simple example of how variation in modal semantics is reducible to independent factors like the syntactic category of the modal elements. It also illustrates how phenomena in unfamiliar languages turn out to have parallels or counterparts within familiar languages, once the latter are re-examined in the light of the former.

³⁵ References for any one of these topics would be too numerous to cite.

References

- Abraham, Werner 1998. The aspectual source of the epistemic-root distinction of modal verbs in German. In W. Boeder, C. Schroeder, K.-H. Wagner and W. Wildgen (eds.), *Sprache in Raum und Zeit, Band 2: Beiträge zur empirischen Sprachwissenschaft*. Tübingen: Gunter Narr Verlag, 231-249.
- Abusch, Dorit 2012. Circumstantial and temporal dependence in counterfactual modals. *Natural Language Semantics* 20:273-297.
- Aikhenvald, Alessandra 2004. *Evidentiality*. Oxford: Oxford University Press.
- Arregui, Ana 2005. On the accessibility of possible worlds: the role of tense and aspect. PhD dissertation, University of Massachusetts, Amherst.
- Arregui, Ana 2007. When aspect matters: The case of “would” conditionals. *Natural Language Semantics* 15:221-64.
- Arregui, Ana 2009. On similarity in counterfactuals, *Linguistics and Philosophy* 32:245-278.
- Arregui, Ana, Maria Luisa Rivero and Andres Salanova 2013. Imperfectivity: Capturing variation across languages. To appear in *Natural Language and Linguistic Theory*.
- van der Auwera, Johan and Andreas Ammann 2011. Overlap between situational and epistemic modal marking. In M. Dryer and M. Haspelmath (eds.), *The World Atlas of Language Structures Online*, ch. 76. Munich: Max Planck Digital Library. <http://wals.info/chapter/76>.
- van der Auwera, Johan and Vladimir Plungian 1998. Modality’s semantic map. *Linguistic Typology* 2:79-124.
- Barbiers, Sjef 1995. *The Syntax of Interpretation*. Holland Institute of Generative Linguistics.
- Bhatt, Rajesh 1999/2006. Covert modality in non-finite contexts. PhD dissertation, University of Pennsylvania. Published 2006 by Mouton de Gruyter.
- Boogart, Ronny 2007. The past and perfect of epistemic modals. In L. de Saussure, J. Moeschler and G. Puskas (eds.), *Recent Advances in the Syntax and Semantics of Tense, Aspect and Modality*. Berlin: Mouton de Gruyter, 47-70.
- Borgonovo, Claudia and Sarah Cummins 2007. Tensed modals. In J. Eguren and O. Fernández Soriano, (eds), *Coreference, Modality, and Focus*. Amsterdam: John Benjamins, 1-18.
- Brennan, Virginia 1993. Root and Epistemic modal auxiliary verbs. PhD dissertation, University of Massachusetts, Amherst.
- Butler, Jonny 2003. A minimalist treatment of modality. *Lingua* 113:967-996.
- Bybee, Joan, Revere Perkins and William Pagliuca 1994. *The Evolution of Grammar: Tense, Aspect and Modality in the Languages of the World*. Chicago: University of Chicago Press.
- Chen, Sihwei 2012. The temporal interpretation of modals in Mandarin Chinese. Poster presented at the Modality @ Ottawa U. Workshop.
- Cinque, Guglielmo 1999. *Adverbs and Functional Heads: A Cross-Linguistic Perspective*. Oxford: Oxford University Press.
- Coates, Jennifer 1995. The expression of root and epistemic possibility in English. In J. Bybee and S. Fleischman (eds.), *Modality in Grammar and Discourse*. Typological Studies in Linguistics 32, John Benjamins, 55-66.
- Condoravdi, Cleo 2002. Temporal interpretation of modals: Modals for the present and the past. In D. Beaver, L. Casillas Martinez, B. Clark and S. Kaufmann (eds.), *The Construction of Meaning*. Stanford: CSLI Publications, 59-88.

- Copley, Bridget 2006. What should *should* mean. Ms., CNRS.
- Davis, Henry, Lisa Matthewson and Hotze Rullmann 2009. Out of Control Marking as Circumstantial Modality in St'át'imcets. In L. Hogeweg, H. de Hoop and A. Malchukov (eds.), *Cross-Linguistic Semantics of Tense, Aspect and Modality*. Oxford: John Benjamins, 206-244.
- Deal, Amy Rose 2011. Modals without scales. *Language* 87:559-585.
- Demirdache, Hamida and Myriam Uribe-Etxebarria 2008. On the temporal syntax of non-root modals. In J. Guéron and J. Lecarme (eds.), *Time and Modality*. Dordrecht: Springer, 79-113.
- Drubig, Hans 2001. On the syntactic form of epistemic modality. Ms., University of Tübingen.
- Enç, Mürvet 1996. Tense and modality. In S. Lappin (ed.), *The Handbook of Contemporary Semantic Theory*. Oxford: Blackwell, 345-358.
- Eide, Kristin 2003. Modals and tense. In M. Weisgerber (ed.), *Proceedings of Sinn und Bedeutung 7*. Konstanz: Konstanz Universität, 120-135.
- Eide, Kristin. 2005. *Norwegian Modals*. Berlin: Mouton de Gruyter.
- Fagan, Sarah 2001. Epistemic modality and tense in German. *Journal of Germanic Linguistics* 13:197-230.
- Faller, Martina 2002. Semantics and pragmatics of evidentials in Cuzco Quechua. PhD dissertation, Stanford University.
- Faller, Martina 2011. A possible worlds semantics for Cuzco Quechua evidentials. In N. Li and D. Lutz (eds.), *Proceedings of SALT XX*, 660-683. Cornell University: CLC Publications.
- Finlay, Stephen 2009. Oughts and ends. *Philosophical Studies* 143:315-340.
- Finlay, Stephen 2010. What *ought* probably means, and why you can't detach it. *Synthese* 177:67-89.
- von Fintel, Kai and Anthony Gillies 2007. An opinionated guide to epistemic modality. In T. Szabó Gendler and J. Hawthorne (eds.), *Oxford Studies in Epistemology*, Vol. 2. Oxford: Oxford University Press, 32-62.
- von Fintel, Kai and Anthony Gillies 2008. CIA leaks. *The Philosophical Review* 117:77-98.
- von Fintel, Kai and Anthony Gillies 2010. *Must ... stay ... strong!* *Natural Language Semantics* 18:351-383.
- von Fintel, Kai and Anthony Gillies 2011. Might made right. In A. Egan and B. Weatherson (eds.), *Epistemic Modality*. Oxford: Oxford University Press, 108-130.
- von Fintel, Kai and Irene Heim 2011. Intensional semantics. Lecture notes, MIT. <http://web.mit.edu/fintel/fintel-heim-intensional.pdf>.
- von Fintel, Kai and Sabine Iatridou 2008. How to say *ought* in foreign: The composition of weak necessity modals. In J. Guéron and J. Lecarme (eds.), *Time and Modality*. Dordrecht: Springer, 115-141.
- Garrett, Edward 2001. Evidentiality and Assertion in Tibetan. Ph.D. dissertation, UCLA.
- Giannikidou, Anastasia and Alda Mari to appear. From prediction to epistemic evidential: Greek and Italian futures. *Lingua*.
- Goble, Lou 1996. Utilitarian deontic logic. *Philosophical Studies* 82:317-357.
- Groenendijk, Jeroen and Martin Stokhof 1975. Modality and conversational information. *Theoretical Linguistics* 2:61-112.
- Groenendijk, Jeroen, Martin Stokhof and Frank Veltman 1996. Coreference and modality. In S. Lappin (ed.), *The Handbook of Contemporary Semantic Theory*. Oxford: Blackwell, 179-213.
- de Haan, Ferdinand 1997. *The Interaction of Modality and Negation*. New York: Garland.

- Hacquard, Valentine 2006. Aspects of Modality. PhD dissertation, MIT.
- Hacquard, Valentine 2009. On the interaction of aspect and modal auxiliaries. *Linguistics and Philosophy* 32:279-315.
- Hacquard, Valentine 2010. On the event relativity of modal auxiliaries. *Natural Language Semantics* 18:79-114.
- Hacquard, Valentine 2011. Modality. In C. Maienborn, K. von Stechow and P. Portner (eds.), *Semantics: An International Handbook of Natural Language Meaning*. HSK 33.2. Berlin: Mouton de Gruyter, 1484-1515.
- Halpern, Joseph 1997. Defining relative likelihood in partially-ordered preferential structures. *Journal of Artificial Intelligence Research* 7: 1–24.
- Halpern, Joseph 2003. *Reasoning about Uncertainty*. Cambridge, MA: MIT Press.
- Heim, Irene and Angelika Kratzer 1998. *Semantics in Generative Grammar*. Oxford: Blackwell.
- Hengeveld, Kees 2004. Illocution, mood and modality. In G. Booij, C. Lehmann, J. Mugdan and S. Skopeteas (eds), *Morphology: An International Handbook on Inflection and Word-Formation* Vol. 2. Berlin: Walter de Gruyter.
- Hockett, Charles 1960. The origin of speech. *Scientific American* 203:89-96.
- Homer, Vincent 2010. Epistemic Modals: High ma non troppo. *Proceedings of NELS* 40.
- Iatridou, Sabine 1990. The past, the possible and the evident. *Linguistic Inquiry* 21:123-129.
- Ippolito, Michela 2003. Presuppositions and implicatures in counterfactuals. *Natural Language Semantics* 11:145-186.
- Izvorski, Roumyana 1997. The present perfect as an epistemic modal. *Proceedings of SALT VII*: 222–239.
- Jackendoff, Ray 1972. *Semantic Interpretation in Generative Grammar*. Cambridge, MA: MIT Press.
- Kennedy, Chris and Louise McNally. 2005. Scale structure, degree modification, and the semantics of gradable predicates. *Language* 81:345-381.
- Kratzer, Angelika 1981. The notional category of modality. In H.-J. Eikmeyer and H. Rieser (eds.). *Words, Worlds, and Contexts. New Approaches in Word Semantics*. Berlin: Mouton de Gruyter, 38-74.
- Kratzer, Angelika 1991. Modality. In D. Wunderlich and A. von Stechow (eds.), *Semantics: An International Handbook of Contemporary Research*. Berlin: de Gruyter, 639-650.
- Kratzer, Angelika 2009. Modality in context: Context and content lectures. Institut Jean Nicod, Paris. <http://cpr.nicod.free.fr/Texte/>.
- Kratzer, Angelika 2011. What “can” can mean. Lecture notes, Univ. of Massachusetts, Amherst.
- Kratzer, Angelika 2012. *Modals and Conditionals: New and Revised Perspectives*. Oxford: Oxford University Press.
- Kratzer, Angelika 2013. Modality for the 21st century. To appear in *Proceedings for the Geneva World Congress of Linguistics*, 181-201.
- Laca, Brenda 2008. On modal tenses and tensed modals. Ms., Université Paris 8 / CNRS.
- Lassiter, Daniel 2011a. Gradable epistemic modals, probability, and scale structure. In N. Li and D. Lutz (eds.), *Proceedings of Semantics and Linguistic Theory XX*. Cornell University: CLC Publications, 197-215.
- Lassiter, Daniel 2011b. Measurement and modality: The scalar basis of modal semantics. PhD dissertation, New York University.
- Laturnus, Rebecca 2012. Future modals in Ktunaxa. Poster presented at the Modality @ Ottawa U. Workshop.

- Lee, Jungmee 2011. Evidentiality and its Interaction with Tense: Evidence from Korean. PhD dissertation, The Ohio State University.
- Lekakaou, M. and Ø. Nilsen 2008. What aspect can tell us about the future of MUST. *Proceedings of ICGL 8*.
- Lewis, David 1973. *Counterfactuals*. Cambridge, MA: Harvard University Press.
- Lewis, Davis 1986. On the Plurality of Worlds. Oxford: Blackwell.
- Liu, Tianhan 2013. Modal Concord in Mandarin. MA thesis, University of British Columbia.
- Louie, Meagan 2012. Report on past epistemic readings. Ms., University of British Columbia.
- Mari, Alda 2010. Temporal reasoning and modality. Paper presented at the Temporality: Typology and Acquisition Workshop, Paris VIII.
- Mari, Alda and Fabienne Martin 2007. Tense, abilities and actuality entailment. In M. Aloni, P. Dekker and F. Roelofsen (eds.), *Proceedings of the 16th Amsterdam Colloquium*, 151-156.
- Martin, Fabienne 2011. Epistemic modals in the past. In Berns, J., H. Jacobs and T. Scheer (eds.), *Romance Languages and Linguistic Theory*. Oxford: Benjamins, 185-202.
- Matthewson, Lisa 2005. *When I Was Small - I Wan Kwikws: A Grammatical Analysis of St'át'imcets Oral Narratives*. Vancouver, BC: UBC Press.
- Matthewson, Lisa 2012a. Evidence about evidentials: Where fieldwork meets theory. In B. Stolterfoht and S. Featherston (eds.), *Empirical Approaches to Linguistic Theory: Studies of Meaning and Structure*. Berlin: De Gruyter, 85-114.
- Matthewson, Lisa 2012b. On the (non-)future orientation of modals. *Proceedings of Sinn und Bedeutung* 16, Vol. 2. Cambridge, MA: MIT Working Papers in Linguistics, 431-446.
- Matthewson, Lisa 2013a. Gitksan modals. *International Journal of American Linguistics* 79:349-394.
- Matthewson, Lisa 2013b. On how (not) to uncover cross-linguistic variation. *Proceedings of the North East Linguistic Society* 42. Amherst, MA: GLSA, 323-342.
- Matthewson, Lisa, Henry Davis and Carrie Gillon 2012. Towards a scientific approach to linguistic typology: Lessons from the Pacific Northwest. Ms., Univ. of British Columbia.
- Matthewson, Lisa, Henry Davis and Hotze Rullmann 2007. Evidentials as epistemic modals: Evidence from St'át'imcets. *The Linguistic Variation Yearbook* 7:201-254.
- Matthewson, Lisa, Heidi Quinn and Lynsey Talagi 2012. Notes on the Niuean perfect. In T. Graf, D. Paperno, A. Szabolcsi and J. Tellings (eds.), *Theories of Everything: In Honor of Ed Keenan*. UCLA Working Papers in Linguistics, Vol. 17, 222-233.
- Matthewson, Lisa, Hotze Rullmann, Sihwei Chen, Vera Hohaus, Becky Laturus, Meagan Louie, Ori Simchen, Claire Turner and Jozina Vander Klok 2013. On the interaction of modality and temporality: Evidence from 15 languages. Paper presented at the L&P Workshop, Johann Wolfgang Goethe-Universität.
- McCormack, A. and N. Smith 2002. Modals and negation in English. In S. Barbiers, F. Beukema and W. van der Wurff (eds.), *Modality and its Interaction with the Verbal System*. Amsterdam and Philadelphia: John Benjamins, 133-163.
- McCready, Eric 2010. Evidential universals. In T. Peterson and U. Sauerland (eds.), *Evidence From Evidentials*. Vancouver, BC: UBC Working Papers in Linguistics, Vol. 28, 105-127.
- McCready, Eric and Nicholas Asher 2006. Modal subordination in Japanese: Dynamics and evidentiality. In A. Eilam, T. Scheffler and J. Tauberer (eds.), *U. Penn. Working Papers in Linguistics* 12, 237-249.
- McCready, Eric and Norry Ogata 2007. Evidentiality, modality and probability. *Linguistics and Philosophy* 30:147-206.

- McDowell, Joyce 1987. Assertion and Modality. PhD dissertation, University of Southern California.
- Menzies, Stacey 2010. Kwak'wala modality. Honours thesis, University of British Columbia.
- Menzies, Stacey 2012. Nsyilxcen modality: Semantic analysis of epistemic modality. MA thesis, University of British Columbia.
- Murray, Sarah 2009. Evidentiality and the structure of speech acts. PhD dissertation, Rutgers.
- Nauze, Fabrice 2008. *Modality in Typological Perspective*. PhD Dissertation, Amsterdam University.
- Ninan, Dilip 2005. Two puzzles about deontic necessity. In J. Gajewski, V. Hacquard, B. Nickel and S. Yalcin (eds.), *New Work on Modality*. Cambridge, MA: MIT Working Papers in Linguistics, Vol. 51.
- Palmer, Frank 2001. *Mood and Modality* (2nd edition). Cambridge: Cambridge University Press.
- Partee, Barbara 1988. Many quantifiers. In J. Powers and K. de Jong (eds.), *Proceedings of the Fifth ESCOL*. The Ohio State University.
- Peterson, Tyler 2010. Epistemic modality and evidentiality in Gitksan at the semantics-pragmatics interface. PhD dissertation, University of British Columbia.
- Picallo, M. Carme 1990. Modal verbs in Catalan'. *Natural Language and Linguistic Theory* 8:285-312.
- Portner, Paul 2009. *Modality*. Oxford: Oxford University Press.
- Rullmann, Hotze, Lisa Matthewson and Henry Davis 2008. Modals as distributive indefinites. *Natural Language Semantics* 16: 317-357.
- Reis Silva, M. Amélia 2009. Circumstantial Modality in Blackfoot. Paper presented at Chronos 9, International Conference on Tense, Aspect and Modality. Université Paris-Diderot.
- Reis Silva, M. Amélia in prep. Blackfoot Modality. PhD dissertation, University of British Columbia.
- Rubinstein, Aynat 2012. Roots of modality. PhD dissertation, University of Massachusetts, Amherst.
- Rullmann, Hotze and Lisa Matthewson 2012. Epistemic modals with a past temporal perspective. Paper presented at the Modality @ Ottawa U. Workshop.
- Seiter, William 1980. *Studies in Niuean Syntax*. New York: Garland Press.
- Sloman, Aaron 1970. 'Ought' and 'better'. *Mind* 79:385-394.
- Speas, Margaret 2008. On the syntax and semantics of evidentials. *Language and Linguistics Compass* 2:940-965.
- Stalnaker, Robert 1984. *Inquiry*. Cambridge, MA: The MIT Press.
- Stephenson, Tamina 2008. Judge dependence, epistemic modals, and predicates of personal taste. *Linguistics and Philosophy* 30:487-525.
- Stowell, Tim 2004. Tense and modals. In J. Guéron and J. Lecarme (eds.), *The Syntax of Time*. Cambridge, MA: MIT Press, 621-636.
- Swanson, Eric 2006. Interactions with context. PhD dissertation, MIT.
- Swanson, Eric 2008. Modality in language. *Philosophy Compass* 3:1193-1207.
- TFS Working Group 2011. <http://www.totemfieldstoryboards.org>.
- Thomas, Guillaume 2013. On the temporal orientation of certain circumstantial modals. Paper presented at the Institut Jean Nicod, Paris.
- Thomason, Richmond 2002. Combinations of tense and modality. In D. Gabbay and F. Guenther (eds.), *Handbook of philosophical logic*, Volume 7. Dordrecht: Kluwer, 205-234.
- Tonhauser, Judith 2011. Temporal reference in Paraguayan Guaraní, a tenseless language.

- Linguistics and Philosophy* 34:257-303.
- Turner, Claire 2013. Tense and type of modality in Northern Straits and Halkomelem. Ms., University of British Columbia.
- Van de Vate, Marleen 2011. Tense, Aspect and Modality in a Radical Creole: The Case of Saamáka. PhD dissertation, University of Tromsø.
- Vander Klok, Jozina 2008. Modality in Javanese. Paper presented at CLA Annual Conference Proceedings, University of British Columbia.
- Vander Klok, Jozina 2012. Tense, aspect, and modality in Paciran Javanese. PhD dissertation, McGill University.
- Vander Klok, Jozina 2013. On a formal typology of modality. Ms., University of British Columbia.
- Watkins, Laurel (with the assistance of Parker McKenzie) 1984. *A Grammar of Kiowa*. Lincoln, NE: University of Nebraska Press.
- Yalcin, Seth 2007. Epistemic modals. *Mind* 116: 983-1026.
- Yalcin, Seth 2010. Probability operators. *Philosophy Compass* 5: 916-937.
- Waldie, Ryan 2012. Evidentiality in Nuu-chah-nulth. PhD dissertation, University of British Columbia.
- Werner, Thomas 2003. Deducing the future and distinguishing the past: Temporal interpretation in modal sentences in English, PhD dissertation, Rutgers University.
- Werner, Thomas 2006. Future and non-future modal sentences. *Natural Language Semantics* 14:235-255.