

# The Ordering Source and Graded Modality in Gitksan Epistemic Modals

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## Abstract

Gitksan represents a class of languages with epistemic modals that appear to have variable modal force. This presents a challenge to the standard analysis of modality that treats modal force as quantification over possible worlds. The claim pursued here is that epistemic modals in languages such as Gitksan have fixed quantification over an epistemic modal base, but that a contextually-determined ordering source is responsible for deriving the variability in modal force. This approach is compared to another recent proposal which treats the same phenomena as deriving from a choice function over the modal base.

## 1 Introduction

A Gitksan speaker faced with the task of translating an epistemic modal statement, encoded by the modal =*ima*, from Gitksan into English, will use a variety of sentences that express varying degrees of modal strength from *might* to *must*, and paraphrases of these in between.<sup>1</sup> This can be observed in (1):

- (1) *yukw=ima=hl tim iixw-t*  
PROG=MOD=CN.DET FUT fish-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.” “It seems he’s fishing.”

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<sup>1</sup>Gitksan is the easternmost member of the Tsimshianic language family, spoken in north-western British Columbia, Canada.

Within a possible worlds semantics, modal force is encoded by quantification over a modal base, and in many languages such as English, quantification is lexically encoded by the modal verbs *might* and *must* (Kratzer 1991, 2002):

- (2) a.  $\llbracket \textit{might}(B)(w)(p) \rrbracket = 1$  iff  $\exists w' \in B(w) : p(w') = 1$   
 b.  $\llbracket \textit{must}(B)(w)(p) \rrbracket = 1$  iff  $\forall w' \in B(w) : p(w') = 1$

Thus, the leading question is: if modal force is encoded by quantification, how do variable force modals in languages such as Gitksan fit into the universal-existential dual? I approach this question by relating the Gitksan data to two other separate, yet similar phenomena involving the expressions of gradable modal force in two unrelated languages: Bulgarian, and St'át'incets. Research on variable modal force in these languages has resulted in two different technical refinements that can be applied to the denotations in (2): the ordering source (Kratzer 1991; Izvorski 1997), and the choice function (Rullmann et al 2008). Both of these approaches attribute variable modal force not to the choice of the quantifier, which is uniformly universal, but in a parameter of interpretation that determines the value of a second function – an ordering source or choice function – operating on the modal base. Both of these contextually determined functions restrict the modal base in different ways, the effect of which determines the interpretation of modal force.

Both of these analyses can be applied to the Gitksan epistemic modal *=ima* in sentences such as (1). However, in this paper I claim that these various degrees of modal force correspond to (at least) two different types of ordering sources in Gitksan, and that a choice function analysis can be reduced to an ordering source one. Specifically, the weak/strong interpretations of the *=ima* correspond to empty/non-empty ordering sources which order an existentially quantified epistemic modal base. §2 presents the relevant data showing the variable modal force interpretations of *=ima*, and §3.1 examines in detail how different ordering sources function to derive variable modal force in Bulgarian (Izvorski 1997), and how this can be modified to account for not only the variable modal force of *=ima*, but also its default existential reading. This analysis is then extended to St'át'incets in §3.2, where the weak/strong interpretations of modals in that language also correspond to empty/non-empty ordering sources, but over a universally quantified modal base. What this gives us is a unified account and a theoretical typology of languages in which modal forces vary under a fixed quantifier. §4 concludes by briefly discussing some of the potential implications of this analysis.

## 2 The variable modal force of epistemic *=ima*

The modal enclitic *=ima* is restricted to epistemic contexts: example (3) contrasts epistemic *=ima* in a. with the deontic modal *dim* in b., and the circumstantial modal verb *da'akhlxw* in c.:

- (3) a. *yukw=ima ts'ilyaxw-(t)=s sim'oogit*  
 PROG=MOD visit-TR-(3)=PN.DET chief  
 “He might/must be visiting the chief.”  
 [because his truck is parked outside the chief’s house.]
- b. *dim ts'ilyaxw-i-n=t sim'oogit*  
 FUT visit-TR-2=PN.DET chief  
 “You must go visit the chief.”  
 [because you need his/her permission to camp here.]
- c. *da'akhlaxw=hl miits'ok' tim limxs-t go'osun*  
 CIRC=CN.DET choke.cherries FUT grow-3 here  
 “Choke cherries might/will grow here.”  
 [because the climate and soil are ideal here.]

While *=ima* belongs to the evidential system in Gitksan, which includes the reportative enclitic *=kat* and perceptual evidential *n'akw*, Peterson (*to appear a, b*) shows that *=ima* semantically belongs to the category of epistemic modals: it introduces quantification over possible worlds. However, *=ima* differs from English modal auxiliaries in two respects: first, whereas the conversational of a modal in English is determined by the context, *=ima* lexically encodes an epistemic conversational background. Secondly, unlike modals in English, *=ima* does not lexically encode modal force, rather, it is determined by the context. This is ‘reversed’ arrangement is summarized in Table 1:

	Modal Base	Modal force
English	CONTEXT	LEXICAL
Gitksan	LEXICAL	CONTEXT

Table 1: Lexically vs. contextually determined modal base and force

However, it is important to clarify what it means for a modal to have ‘variable force’. We can observe the variable modal force effect of *=ima* by refining a context in such a way that restricts the use of either *might* as possibility or *must* as necessity in any given language. We can then test this against the distribution of *=ima* in these contexts, where we find that *=ima* is felicitous in both contexts where possibility and necessity is required. For example, in (4), a speaker concludes that, based on the fact that her father was frequently away when she was a child, it must’ve been her mother who fed her:<sup>2</sup>

<sup>2</sup>For any two sentences  $S_1$  and  $S_2$ , the relation ‘ $\succ$ ’ means that a consultant judges a translation  $S_1$  to be more felicitous than  $S_2$  given the context, without  $S_2$  being necessarily infelicitous.

- (4) *naa'a=ima*                      *'an*    *yookxw-in-ȳ*  
 mother(informal)=MOD S.REL eat-CAUS-1sg  
 “It **must've** been mother who fed/cooked for me.”  
 > “It **might've** been mother who fed/cooked for me.”

The above context relies on a logical deduction a speaker is making in order to reconstruct a past event she trying to recall. This same kind of deduction can be used in order to retrace a recent sequence of events and explain an outcome of those events. For example, in (5), deduction leads the speaker to conclude that, given the fact everyone else who ate the bad fish and got sick, Gwen must also be sick because of the fish. The necessity modal *must* (or some equivalent phrase) is more felicitous in English than the weaker *might*, and *=ima* is also felicitous:

- (5) *xsit-in-(t)=hl*                      *fish=t*                      *nit*  
 vomit-CAUS-3=CN.DET fish=PN.DET nit  
 “The fish **must've** made her sick.” > “The fish **might've** made her sick.”

We can apply the same methodology and examine the felicity of *=ima* in contexts where the expression of necessity is less felicitous than possibility. In the context given in (6), there is no reason why the speaker's uncle *must* know the people he's talking to; they could just be strangers asking for directions:

- (6) *wilaa-i-(t)=ima=s*                      *nipip-ȳ*                      *nititit*  
 know-TR-3=MOD=PN.DET mother's.brother-1sg 3pl  
 “My uncle **might** know them.” > “My uncle **must** know them.”

In (7), two people are speculating on why someone in the news (like a politician or movie star) passed away. In the absence of any concrete information or personal familiarity with the situation, there is so reason why the person *must've* been sick a long time: it could've been a heart attack, or an accident:

- (7) *nakw=ima=hl*                      *sipxw-t*  
 DIST=MOD=CN.DET sick-3sg  
 “S/he **might've** been sick.” > “S/he **must've** been sick.”

These contexts are crucial in showing the variable modal force of epistemic *=ima*, just as we can observe the effect they have on the felicitous use of *might* or *must* in English. The next section shows how we can formally model the information that makes up these contexts to derive the variable modal force of *=ima*.

### 3 Analysis

By way of review, the prevalent analysis of modality is that of Kratzer (1991, 2002): modals are treated as quantifiers over possible worlds, which are then related to an embedded proposition. Modals also introduce two types of CONVERSATIONAL BACKGROUNDS: a MODAL BASE and ORDERING SOURCE, and modalized sentences are evaluated based on these two parameters. A modal base determines the set of worlds accessible from the world of utterance. For example, a phrase like *in view of what we know* gives us a set of worlds epistemically accessible from the world of utterance. Quantification encodes what we interpret as *might* and *must*: necessity modals are treated as universal quantifiers, and possibility modals as existential. Thus a sentence of the form *must(p)*, as in (8)a., states that the embedded proposition *p* ‘John is fishing’ is true in all epistemically accessible worlds, while in (8)b. *might(p)*, *p* is true in some epistemically accessible world:

- (8) a. “John **must** be fishing.”  
 b. “John **might** be fishing.”

In English, the modal base *B*, or the set of accessible worlds available for quantification, is contextually determined by a conversational background. There is a second conversational background, the ordering source *O*, which imposes a particular evaluative ordering of the *B*-worlds. The general idea is that the modal base *B* contains propositions representing facts or knowledge about the world as assessed by the speaker in a given scenario, while the ordering source contains propositions representing beliefs, ideals, norms, intentions, and universally-held assumptions about normal courses of events in the world. These two conversational backgrounds interact: the propositions that comprise the ordering source impose an ideal ordering on those that comprise the modal base. For example, a modal statement such as *may(p)* is interpreted as meaning that *p* is the case in some *B*-worlds (for some contextually-determined *B*) ranked as best by some salient *O*. Likewise, *must(p)* is interpreted as meaning that *p* is the case in all *B*-worlds ranked as best by *O*.

To see how this works, consider an epistemic reading of (8)a.: this sentence has an epistemic modal base, containing a set of propositions that make up our knowledge in the actual world, and a STEREOTYPICAL ordering source, which represents a normal course of events in this context. We know that John’s rubber boots are missing, and his truck is gone, so he is either fishing or berry picking. (8)a. is not true in all the worlds compatible with what we know: given this modal base it’s entirely plausible he went berry picking instead of fishing. But in the ordering source is a proposition which says ‘rubber boots are used for fishing’. Using this ordering source proposition, all the worlds in which the missing boots are used for fishing are going to count as better than worlds in which they are not.

Recall from the previous section that there are two features that distinguish the epistemic modal *=ima* in Gitksan from an English epistemic modal. First, a presupposition of available indirect evidence is what supplies the epistemic modal base that is lexically associated with *=ima*. Second, whereas quantification is lexicalized in the English modals *must* and *might*, modal *=ima* admits both necessity and possibility readings. It is shown in this section that the interaction between the two conversational backgrounds, the modal base and ordering source, provides us with the technical resources for accounting for this variation in modal force readings. The basic thrust of the analysis in §3.1 is that the quantification of *=ima* is fixed as existential, while the ordering source is what actually modulates what is translated as modal force in English. More specifically, the interpretation of strong/weak modals in Gitksan is not a function of the universal/existential dual, but whether the ordering source is empty (weak) or non-empty (strong). §3.2 shows how this analysis can be extended to another language that also displays the same type of variable force modality, and how we can also capture default readings in a straightforward way using the ordering source.

### 3.1 Ordering sources with fixed quantification

I will start with the assumption that the value of a quantifier is not determined by a parameter of interpretation: there is no contextually determined function that fixes the value of quantification over the modal base as existential in one context and universal in another. The quantification associated with *=ima* is fixed, just as it is with lexical modals in English. This leaves two other formal options within the system: both the modal bases and ordering sources are independent conversational backgrounds, which are determined by the context. They are functions that map to any world a set of propositions known in the actual world. In English both the modal base and ordering source are determined by a parameter of interpretation. In Gitksan the modal base of *=ima* is not determined by the context: it is restricted to epistemic conversational backgrounds (cf. (3)) through the presupposition lexically associated with *=ima*. However, as in English, the value of the ordering source in Gitksan is determined through a parameter of interpretation. This gives us a formal way in for explaining why context plays a role in determining the force of a modal statement in Gitksan. More specifically, I begin by grounding the following analysis in the basic notion that the belief state of the speaker, and what a speaker considers a normal course of events, play a formal role in modulating what we interpret as modal force (Kratzer 2002).

As shown above, a stereotypical ordering source involves the kinds of propositions representing the normal course of events, or relatively fixed ideas about the uses of things like rubber boots. A speaker's beliefs can also condition the interpretation of an epistemic modal, and can form a DOXASTIC ordering source. Thus, a doxastic modal statement is one in which the epistemic modal quantifies over the worlds of a modal base ordered by an ideal determined by the belief state of a

speaker. The effects of doxastic and stereotypical ordering sources, and the contrast they draw out between Gitksan and English, can be observed in (9). Here, the context illustrates the kinds of propositions that comprise the modal base:

- (9) *yukw=ima=hl*                    *ixw-(t)=s*                    *John*  
 PROG=MOD=CN.DET fish-3=CN.DET John  
 “John **must** be fishing.”  $\succ$  “John **might** be fishing.”

$B(w)$  EPISTEMIC: {John’s rubber boots are missing; his truck is not in the driveway; it’s fishing season}

$O(w)$  STEREOTYPICAL: {Rubber boots are used for fishing; rubber boots are not ideal for hunting}

Given the fact that John’s rubber boots are missing, and that rubber boots are used for fishing, “John *must* be fishing.” is more felicitous than “John *might* be fishing.” This strong reading is derived from the stereotypical ordering source: the modal base  $B(w)$  contains the proposition that John’s rubber boots are missing and the ordering source  $O(w)$  concerns the typical use of rubber boots. If the world of evaluation  $w$  is such that rubber boots are typically used for fishing, the ordering source  $O$  is such that worlds in which John uses his boots for fishing are ranked more highly than worlds in which he uses them for some other purpose (other things being equal). (9) will assert that the worlds in which John uses his boots for fishing, are worlds in which ‘John is fishing’ is true. Since the speaker believes  $w$  to be such a world, it follows that the speaker believes ‘John is fishing’ is true in  $w$ . Because of this belief in the typical use of rubber boots, the interpreted modal force is strong, translated as *must*. If, however, the speaker does not believe that rubber boots are used solely for fishing – the boots could be used for berry picking – the set of accessible worlds where it is true that John is fishing because his rubber boots are missing, and that rubber boots are used for fishing will be smaller. This leads to the resulting interpretation that ‘John is fishing’ is only a slight possibility in  $w$ .

This analysis is based on Izvorski (1997), who shows that this variable modal force effect is present in the perfect in Bulgarian, which has a modal (and evidential) interpretation in addition to its aspectual one:

- (10) *az*    *sâm*                    *došâl*  
 1sg be-1sg.PRES come.P.PART  
 “I have come.” “I have apparently come.” (Izvorski 1997: 228)

Izvorski claims there is a covert evidential operator (EV) in sentences such as (10) that has a modal semantics. The force of this modal in  $EVp$  sentences is determined by the speaker’s belief or trust in the evidence. In its report reading,

(10) can mean “I may have come”, “I probably came”, or “I must have come”, given what a person X says. In other words, the more trustworthy X is, the closer to a universal interpretation the modal has. Under an inferential reading  $Ev p$  sentences like (10) can be interpreted along the lines of “I must have come” because in stereotypical contexts, the speaker bases her reasoning considering a highly reliable source of (indirect) evidence. These effects are captured by the ordering source, as the actual domain of quantification is restricted by the ordering source. A sketch of Izvorski’s analysis is given in (18):

$$(11) \quad \begin{aligned} B(w) &= \{u \in W : \forall p[(p \text{ is indirect evidence in } w) \rightarrow u \in p]\} \\ O(w) &= \{p : \text{a speaker believes } p \text{ with respect to the indirect evidence in } w\} \\ \forall w_1, w_2 \in W : w_1 \leq_{O(w)} w_2 &\text{ iff } \{p \in O(w) : w_2 \in p\} \subseteq \{p \in O(w) : w_1 \in p\} \end{aligned}$$

(11) also includes the technical implementation of the ordering source, where  $O(w)$  is a set of propositions that determines a partial order  $\leq_{O(w)}$  on  $B(w)$ : a world  $w_1$  comes closer to the ideal set up by  $O(w)$  than a world  $w_2$  iff  $w_1$  makes more ideal propositions true than  $w_2$  does. This enables us to define what it means for a world to be among the  $O(w)$ -best worlds in a given set of worlds: for all  $w \in V$  such that  $V \subseteq W : w$  is among the  $\leq_{O(w)}$ -best worlds in  $V$  iff there is no  $u \in V$  such that  $u \leq_{O(w)} w$ . In other words, an  $Ev p$  statement is true in a world  $w$  with respect to the conversational background provided by  $B(w)$  and  $O(w)$ , iff  $p$  is true in all worlds accessible from  $w$  which come closest to the ideal represented by the speaker’s beliefs regarding the available indirect evidence in  $w$  (Izvorski 1997: 9). Thus a denotation for modal/evidential sentences of the form  $Ev(\phi)$  in Bulgarian is given in (12):

$$(12) \quad \begin{aligned} \llbracket Ev \rrbracket^{c,w} &\text{ is only defined if } c \text{ provides a modal base } B \text{ such that for all worlds } \\ &w' \in B(w), \text{ the inferential evidence in } w \text{ holds in } w' \\ \llbracket Ev(\phi) \rrbracket^{c,w} &= 1 \text{ iff for } \forall w' \in O_w(B(w)) : \llbracket \phi(w') \rrbracket^{c,w} = 1. \end{aligned}$$

The reason for universal quantification in (12) comes from the observation that these kinds of modal/evidential statements in Bulgarian tend towards a default strong reading. A universal modal statement is then pragmatically weakened by the ordering source, the effect being a *might*-like translation. However, in Gitksan,  $=ima$  tends towards a weak *might*-like reading by default. This is built into the denotation of  $=ima$ , given in (13), where quantification is existential:

$$(13) \quad \llbracket =ima \rrbracket^{c,w} \text{ is only defined if } c \text{ provides a modal base } B \text{ such that for all worlds } w' \in B(w), \text{ the inferential evidence in } w \text{ holds in } w'.$$

$$\text{If defined, } \llbracket =ima(\phi) \rrbracket^{c,w} = 1 \text{ iff } \exists w' \in O_w(B(w)) : \llbracket \phi(w') \rrbracket^{c,w} = 1.$$

At face value, it would seem counterintuitive to attribute a strong, *must*-like reading to a modal with existential quantification. However, we can find a similar



effect of semantic strengthening in the nominal domain in the entailment patterns with existentially quantified DPs. For example, restricting an existential statement leads to strengthening: an expression like “some male students” is semantically stronger than the expression “some students” since a sentence of the form “some male students smoke” is true in a subset of situations in which “some students smoke” is true (i.e., the former asymmetrically entails the latter), so the former is semantically stronger. We can derive the same strengthening effect from the ordering of an existentially quantified modal base: in example (9), a world where John’s boots are missing, and boots are used for fishing is a more restricted world than one in which only John’s boots are missing. Note that the opposite parallel can be drawn with Izvorki’s universal analysis in (12): restricting a universal quantifier leads to weakening, as “all male students smoke” is weaker than “all students smoke”. Both the strengthened existential and weakened universal are achieved by a non-empty ordering source.

This analysis accounts for the strong, *must*-like reading of *=ima*, and also puts us in a position to derive its default weak reading. Whereas a non-empty ordering source restricts the modal base to a subset of *O*-ideal words, an empty ordering source would logically remove this restriction by mapping every possible world to the empty set. Kratzer (1991: 645) characterizes this as ALETHIC modality. Epistemic modality has an epistemic modal base with an ordering based on doxastic reasoning or stereotypicality, alethic modality kind of purely logical modality: it does not relativise the modal to any particular kind of facts, rather, our epistemic reasoning is based solely on the facts that comprise the modal base. Thus a weak reading of (9) is obtained in (14), where the unordered modal base is simply existentially quantified over:

- (14) *yukw=ima=hl*                      *iixw-(t)=s*                      *John*  
 PROG=MOD=CN.DET fish-3=CN.DET John  
 “John **might** be fishing.”  $\succ$  “John **must** be fishing.”

$B(w)$  EPISTEMIC: {John’s rubber boots are missing; his truck is not in the driveway; it’s fishing season}

$O(w)$  EMPTY:  $\{\emptyset\}$

This basically resembles a standard *might*-as-existential modal: a speaker of (14) is asserting that in some world where John’s rubber boots are missing, his truck is not in the driveway, and it’s fishing season, John is fishing in that world. This is the locus of the *might*  $\succ$  *must* meaning: the difference between saying that in some world where his boots are missing, he’s fishing (the empty ordering source), and saying that in some world where his boots are missing and boots are used for fishing, he’s fishing (the non-empty ordering source), is claimed to be a big enough difference to the latter gives you a stronger, *must*-like reading.

In sum, the indirect evidence presupposition placed on the modal base ensures the epistemic interpretation of *=ima*. However, the value of the ordering source is contextually determined. By default, the ordering source is empty, but other contextual factors can intervene and provide the ordering source with propositions that order the worlds of the modal base according to some doxastic or stereotypical ideal. Thus, the modal force interpretations of *=ima* can be schematized in (15):

(15) The modal force interpretations of *=ima*

$$B(w) = \{u \in W : \forall p[(p \text{ is indirect evidence in } w) \rightarrow u \in p]\}$$

$$O(w) =$$

- (i.) STRONG:  $\{p: \text{ a speaker believes } p \text{ with respect to the indirect evidence in } w\}$
- (ii.) WEAK (default):  $\{\emptyset\}$

### 3.2 An emerging typology: Modality in St'át'imcets

Matthewson et al (2007) show that evidentials in St'át'imcets (Lillooet Salish) are in fact epistemic modals. As with modal *=ima* in Gitksan, modal *k'a* is restricted to epistemic contexts (through presupposition) and varies in modal force:

- (16) a. *t'ak k'a tu7 kents7á ku m'íxalh*  
 go.along INFER then DIETIC DET bear  
 "A bear **must've** gone around here." (Davis *in prep.*)
- b. *wa7 k'a séna7 qwenúxw*  
 IMPF INFER COUNTER sick  
 "He **may** be sick." (Rullmann et al 2008: 5)

However, St'át'imcets modals differ from Gitksan modals in one key respect: whereas the default modal force of *=ima* is weak, the default interpretation of modals in St'át'imcets is strong. Given this difference, we can extend an ordering source analysis to the St'át'imcets modals in a straightforward way: in the previous section it was shown that *=ima* has fixed existential quantification over a presupposed epistemic modal base; the default weak interpretation comes from the ordering source, which is assumed to be empty by default (cf. (13)). The denotation of St'át'imcets modals such as *k'a* involve the exact same components as in Gitksan, except that they involve universal quantification:

- (17)  $\llbracket k'a \rrbracket^{c,w}$  is only defined if  $c$  provides a modal base  $B$  such that for all worlds  $w' \in B(w)$ , the inferential evidence in  $w$  holds in  $w'$ .

If defined,  $\llbracket k'a \rrbracket^{c,w} = 1$  iff  $\forall w' \in O_w(B(w)) : \llbracket \phi(w') \rrbracket = 1$ .

This analysis can give us a unified account of both Gitksan and St'át'imcets: both involve a presupposed epistemic modal base, and an ordering source, which is empty by default in both languages. This empty ordering source is what derives the default weak interpretation of existential *=ima*, and the default strong interpretation of universal *k'a*, as schematized in (18):

(18) The interpretations of *k'a*

$$B(w) = \{u \in W : \forall p[(p \text{ is indirect evidence in } w) \rightarrow u \in p]\}$$

$$\text{STRONG (default): } O(w) = \{\emptyset\}$$

$$\text{WEAK: } O(w) = \{p : \text{a speaker believes } p \text{ with respect to the indirect evidence in } w\}$$

With an empty ordering source, modal *k'a* is universally quantifying over literally every possible world in the modal base (or the worlds in which the relevant evidence holds), representing the same kind of alethic modality as *=ima* under a default reading. However, a non-empty ordering source has the opposite effect with a universally quantified modal base: whereas a non-empty ordering source has the effect of pragmatically strengthening an existential modal, a non-empty ordering source essentially weakens a universal modal claim.

This approach has its roots in Kratzer's original characterizations of the modal base and ordering source. Whereas the modal base will always contain a consistent set of facts, other sources of information that can make up a potential ordering source may be inconsistent, or inconsistent with these facts (Kratzer 2002: 307). For example, in (16)a., a speaker may be faced with a variety of facts which can include overturned garbage cans, tracks in the mud, apples missing off the tree, stories overheard in the coffee shop etc. This is a set of consistent propositions that comprise the modal base. Given the abundant evidence that a bear was present, it would be true in all stereotypical worlds consistent with the evidence that a bear did in fact go around there. However, a universal modal claim can be weakened if the speaker believes the modal base evidence to be less reliable, or that there are other plausible courses of events. For example, a modal base for (16)b. could be the symptoms or evidence typical of having a cold (i.e. a red face, runny nose etc.), and the doxastic ordering source would concern the speaker's belief in the applicability of this kind of evidence. If the world of evaluation  $w$  is such that this kind of evidence is normally right in indicating that someone is sick, we will consider those accessible worlds where this evidence holds, and that this is evidence for being sick. Thus, (16)b. will assert that all those worlds are  $p$ -worlds, and the interpreted modal force is strong. However, if these symptoms are considered unreliable or inconclusive as evidence for being sick – coming in from a cold winter day would produce the same symptoms – the set of accessible worlds where this evidence holds and that this indicates an illness will be very restricted; hence, the resulting interpretation that  $p$  is only slightly possible in  $w$ .

Doxastic ordering sources contain information characterizing a speaker’s belief state. An empty ordering source clearly differs in this respect, involving reasoning purely from accepted, speaker-external facts rather than considering the belief state of the speaker. To get a feel for the difference between the doxastic and empty ordering sources, consider example (19) uttered by a speaker in isolation upon hearing a knock at the door:

- (19) *niłh k’a kw s-Henry waʔ pegwpegwtsám’*  
 FOC MOD DET NOM-Henry IMPF knock.repeatedly  
 “That’ll be Henry knocking.” (Rullmann et al 2008: 7)

In such a situation, one could as felicitously utter (19). This can be understood as simply saying something about the speaker’s beliefs, specifically that it’s compatible with her beliefs that the person at the door is Henry. In contrast to this doxastic reading, consider (19) again, but this time uttered to a hearer in the following context in (20):

- (20) Henry said he would come tonight, so if he isn’t here yet it follows that (19).

Here the speaker is not simply commenting on her belief state. She is rather making a statement of general fact, specifically that the evidence provided by the modal base leads to the following conclusion: that it is compatible with all known facts that the person at the door is Henry. She is not claiming that her belief state follows from the evidence (see Tancredi 2007 for a similar discussion and Lakoff 1972: 233 for similar examples and explanations). This kind of ‘pure’ modality does not involve identification of an ideal in any sense, and so does not involve an ordering source either. Thus, under its default reading – which is (20) – modal *k’a* only involves quantification over a modal base.

Rullmann et al (2008) take an alternative approach to the variable force effects of St’át’imcets modals. They maintain a standard Kratzerian analysis of modality, but also innovate it in the following way: St’át’imcets modals have the semantics of specific indefinites, akin to those in the nominal domain. In addition to a presupposition that restricts the modal base to epistemic worlds, St’át’imcets modals such as *k’a* also introduce a choice function (CF) which selects a subset of the modal base worlds. The value of the choice function is determined by the context, and picks out a specific subset of worlds. The appearance of variability in modal force arises because the choice function can select a larger or smaller subset of accessible worlds, which is universally quantified over. Rullmann et al give the following semantics for the modal *k’a*:

- (21) ... If defined,  $\llbracket k'a \rrbracket^{c,w} = 1$  iff  $\forall w' \in f_w(B(w)) : \llbracket \phi(w') \rrbracket = 1$ .

The appearance of variability of modal force is attributed to the size of the subset of the modal base, and not in the variability of the quantifier, which is

uniformly universal: The larger the subset selected by  $f$ , the stronger the modal force expressed. Likewise, if  $f$  selects a proper subset of modal base, the resulting reading is weaker, although that subset is still universally quantified over. In its strongest reading,  $f$  is simply the identity function, thus picking out all the worlds in the modal base.

Could a CF analysis be extended to Gitksan  $=ima$ ? There are a variety of issues that suggest not. The first consideration is theoretical: what distinguishes a choice function from the ordering source in deriving the effect of variable modal force? Both the CF and ordering source involve parameters of interpretation to determine their value. Using this parameter, an ordering source analysis provides a truth-conditional way of picking out an ideal modal base world, which is then quantified over. However, exactly what kinds of modal base worlds are picked out by the choice function? Additionally, if we maintain a dual conversational background treatment of modality, how does the ordering source interact with  $f$ ?

Another consideration is empirical: St'át'imcets modals such as  $k'a$  have a universal as default interpretation, which under a CF analysis means that  $f$  is by default the identity function. Given the fact that the default reading of  $=ima$  is weak, a straightforward option would be to replace universal with existential quantification. This faces the same problem: how do we know or assess which worlds are picked out by  $f$  that would give a strong reading of  $=ima$ ? Another option would be to maintain universal quantification for  $=ima$ , giving it the same denotation as St'át'imcets  $k'a$ . However, given the default weak reading of  $=ima$ , we would then need some way of explaining why some languages have identity (St'át'imcets) vs. non-identity (Gitksan) function readings by default.

By attributing variability of modal force to an effect of empty vs. non-empty ordering sources, a typology of modality emerges that captures not only the variable modal force readings of modals in Gitksan and St'át'imcets, but also the default readings these modals have, which are uniformly treated as the effect of an empty ordering source, as Table 2 shows:

	Gitksan ( $\exists$ )	St'át'imcets ( $\forall$ )
<b>Strong</b>	NON-EMPTY	EMPTY (default)
<b>Weak</b>	EMPTY (default)	NON-EMPTY

Table 2: Empty vs. Non-empty Ordering sources in Strong/Weak modals

## 4 Conclusion

Gitksan represents a class of languages in which an epistemic modal can be translated as having variable modal force, while lexically encoding an epistemic conversational background. Assuming that modals are quantifiers over possible worlds, it

was shown that the modal *=ima* is uniformly existential, and variability of modal force can be derived from the ordering source. The strong/weak interpretations of *=ima* correspond to non-empty vs. empty ordering sources. This in turn predicted a theoretical typology. In St'át'incets, this arrangement is reversed: quantification is fixed as universal, but the strong/weak interpretations of the epistemic modal in that language correspond to empty vs. non-empty ordering sources.

This analysis is directly rooted in Kratzer's original (1991) analysis of graded modality, and how the the modal paraphrases in (22) which encode finer distinctions of possibility and necessity, correspond to different ordering sources:

- |      |   |                    |
|------|---|--------------------|
| (22) | a. <i>Es kann gut sein, dass...</i><br>"There is a good possibility that..."                      | HUMAN POSSIBILITY  |
|      | b. <i>Es besteht eine geringe Möglichkeit, dass...</i><br>"There is a slight possibility that..." | SLIGHT POSSIBILITY |
|      | c. <i>Es ist wahrscheinlich, dass...</i><br>"It is probable that..."                              | HUMAN NECESSITY    |

Gitksan and St'át'incets simply represent languages where the grades of modality as expressed in the various paraphrases in (22) are admitted by a single lexical item, or a many-to-one relation between ordering sources and an epistemic modal.

On a final note, Palmer (2001: 25) makes the generalization that languages which lexically distinguish degrees of modal strength do not encode an evidential source for an epistemic claim, while languages that lexically distinguish different sources of evidence typically do not encode modal strength. The former characterizes languages which have epistemic modal such as English: the modal auxiliaries *must* and *might* lexically encode a speaker's certainty level about the proposition expressed, while not indicating a speaker's evidence or source of information for an epistemic claim. The latter characterizes an evidential system. Matthewson et al (2007) claim that these two differences are non-coincidental: an epistemic modal must choose either to distinguish source (information source) or force (quantificational strength). However, the translation of epistemic modals such as *=ima* into English reveal that a speaker's certainty level about the proposition is still underlyingly present. This is not about distinguishing different sources of evidence, but how a speaker's world knowledge, beliefs and experiences condition their attitude towards the propositions in the modal base. This is invoked by context, and the ordering source is a contextually determined function which provides the formal means to truth-conditionally capture the effects this knowledge and/or beliefs has on the modal base.

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