

An Ordering Semantics for Gitksan Modal Evidentials*

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Abstract

Gitksan represents a class of languages with epistemic modals that 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 variable modal force is the result of empty vs. non-empty ordering sources. This approach is compared to another recent proposal which treats the same phenomena as the effects of a choice function over the modal base, and also applied St'át'imcets – a languages with similar, yet crucially different properties. The outcome is a theoretical typology based quantification and empty vs non-empty ordering sources, and confirmed by other unrelated languages such as Bulgarian and Cuzco Quechua.

1 Introduction

Under the standard theoretical view of modality, modals (minimally) consist of three components (cf. Kratzer 1991; a.o.). The first is the *modal base*, which is a set of worlds $B(w)$ that represent a set of facts about the world, rules, or different kinds of individual-level knowledge. The second component is *quantification* over the modal base worlds: languages such as English lexically encode quantification as *might* (existential) and *must* (universal). The third component is the *prejacent*, or the proposition embedded under the modal. Thus, at the propositional level there are two general types of modals, sample denotations for which are given in (1) using the prejacent ‘John be at home’:

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- (1) a. “John *must* be at home.”
 $\llbracket \text{must}(B)(w)(\text{John be at home}) \rrbracket^c = 1$ iff $\forall w' \in B(w) : \llbracket \text{John be at home} \rrbracket^c(w') = 1$
- b. “John *might* be at home.”
 $\llbracket \text{might}(B)(w)(\text{John be at home}) \rrbracket^c = 1$ iff $\exists w' \in B(w) : \llbracket \text{John be at home} \rrbracket^c(w') = 1$

Also under the standard view, the ‘meaning’ of a modal in English is provided by the context, which in turn determines what kinds of worlds make up the modal base. For example, an epistemic modal base $B(w)$ contains worlds where what we know holds true, a deontic modal base contains worlds where laws holds, and a circumstantial modal base contains worlds where certain physical laws hold. The modal base in languages such as English is provided by the context, and this is what provides the contextual backdrop that modal statements such as (1), are evaluated against. A sample of different kinds of modal bases are given in (2):

- (2) EPISTEMIC (experience) $B(w) = [\text{Because he’s always at home by now.}]$
 EPISTEMIC (report) $B(w) = [\text{Because a friend told me.}]$
 EPISTEMIC (visual) $B(w) = [\text{Because I can see his lights on.}]$
 DEONTIC (parent’s rules) $B(w) = [\text{Because John has a curfew.}]$

Unlike English, evidential modals in Gitksan lexically encode this contextual knowledge.¹ The three different kinds of modal bases in (2) correspond to three different morphemes in example (3):

- (3) a. $t'a=ima=t$ John
 at.home=MOD=PND John
 “John **must/might** be at home.
 EPISTEMIC (experience) $B(w) = [\text{Because he’s always at home at this time.}]$
- b. $t'a=kata=t$ John
 at.home=REP=PND John
 “[I heard] John **must/might** be at home.’
 EPISTEMIC (report) $B(w) = [\text{Because a friend told me.}]$
- b. $n'akw=hl t'a=s$ John
 EVID at.home=PND John
 “John **must** be at home.’
 EPISTEMIC (visual) $B(w) = [\text{Because I can see his lights on.}]$

¹Tsimshianic languages are spoken in northwestern British Columbia and consist of the three languages: S̓malgyax, Nisgha'a, and Gitksan. Examples are given in the Gitksan practical orthography: $\underline{k} = [q]$; $\underline{g} = [G]$; $\underline{x} = [\chi]$; $j = [dz]$.

- c. *tim* t'a=s John
 FUT at.home=PND John
 “John **must** be at home.”
 DEONTIC (parent’s rules) $B(w)$ = [Because John has a curfew.]

The translations in (3) a. and b. also reveal another difference between Gitksan and English: a Gitksan speaker faced with the task of translating a modal sentence from Gitksan into English will use a variety of sentences that express varying degrees of modal strength from *might* to *must*, and other forms expressing modal force. This can be observed in the translations using the Gitksan evidential modal =*ima* in (4):

- (4) t'a=*ima*=t John
 at.home=MOD=PND John
 “John **must** be at home.”
 “John **might** be home.”
 “John’s probably at home.”
 “John’s likely at home.”
 “Maybe/perhaps John’s at home.”
etc.

There is similar variability in translations of sentences in Gitksan using the reportative =*kat*, which also has a modal semantics. Sentences of the form =*kat*(*p*) are typically translated into English as “I hear/heard that *p*”, often given when the speaker considers the source of the report to be reliable. However, there is another translation given to =*kat*(*p*) sentences when a speaker is neutral or considers the report to be less reliable, as shown in (5):

- (5) *xsta*=*kat* John *ko'*=hl bingo *kaxxw*
 win=REP John LOC=CND bingo last.night
 RELIABLE REPORT: “I heard that John won at bingo last night.”
 NEUTRAL RELIABILITY: “Apparently, John won at bingo last night.”

These two translations can be considered to represent a kind of variable modal force reflecting the belief in the truth of the prejacent, where “I heard that *p*” is akin to *must*, and “Apparently *p*” is somewhat weaker, resembling *might*.

Variable modal force of the Gitksan type is not an isolated phenomenon, and is found in other unrelated languages with evidentials, such as the Salish languages St’át’imcets and Nt̓eʔkepmxcín, and Cuzco Quechua:

(6) St’át’imcets (Rullmann et al 2008)

- a. t’ak k’a tu7 kents7á ku míxalh
 go.along INFER then DIETIC DET bear
 “A bear **must’ve** gone around here.”
- b. wa7 k’a séna7 qwenúxw
 IMPF INFER COUNTER sick
 “He **may** be sick.”

(7) Nłeʔkepmxcín (Littell et al 2010)

y’e-mín-s=*nke* e=Meagan e=ti
 good-REL-3.sub=INFER DET=Meagan DET=tea

‘Meagan **must** like the tea.’ ‘**Apparently**, Meagan likes tea.’

(8) Cuzco Quechua (Faller 2011)

Mana=n para kan=chu. Kunan wata=qa mana=*chá* allin=chu
 not=BPG rain be=NEG now year=TOP no=CONJ good=NEG
 kuhichu ka-nqa!
 harvest be-3.FUT

‘There is no rain. I **guess/suppose/surely**, the harvest this year will be bad!’

Comparing the core components of modality – the modal base and modal force – between English and Gitksan leads to the definition of two classes of language based on which component is determined by the context, and which is lexically encoded. In Gitksan modal force is determined by the context while the modal base is lexically encoded through the individual evidentials. Languages such as English are a ‘mirror image’ to Gitksan, as the modal base in English is provided by the context, and modal force is lexicalized. This is summarized in Table 1 (adapted from Rullmann et al 2008):

	Modal Base	Modal Force
English	CONTEXT	LEXICAL (<i>might, must</i>)
Gitksan	LEXICAL (=i <i>ma</i> , = <u>k</u> <i>at</i>)	CONTEXT

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

The typology in Table 1 drives the following question, which is the central focus of this paper: if modal force is encoded by quantification, how does a variable force modal of =i*ma* and =k*at* fit into the universal-existential dual in (1)?

The next section reviews the analysis of Peterson (2010), which shows how the Gitksan modal-evidentials =i*ma* and =k*at* semantically belong to the category of epistemic modals: both =i*ma* and =k*at* introduce quantification over

possible worlds. The evidential interpretations of $=ima$ and $=\underline{k}at$ are the result of a presupposition that restricts the modal base to worlds where evidence of the inferential or reportative type holds. Section 3 examines the variable modal force of $=ima$ and $=\underline{k}at$ from an empirical perspective. This is done through looking at the kinds of contextual factors that draw out their strong and weak interpretations, including what it means for a reportative evidential to have a variable modal force.

In section 4 I relate the Gitksan data to two other separate, yet similar phenomena involving the expression of variable 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 denotation of a modal: 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 to a parameter of interpretation that determines the value of a second function operating on the modal base. Here I argue that an ordering source analysis can be applied to the evidential modals $=ima$ and $=\underline{k}at$ in sentences such as (4) and (5). This captures the various degrees of modal force, which correspond to (at least) two different types of ordering sources. Specifically, the weak/strong interpretations of $=ima$ correspond to empty/non-empty ordering sources which order an existentially quantified epistemic modal base. This analysis is then extended to St’át’incets – which has similar but crucially different properties from Gitksan – and connected to similar work in Faller (2011) for Quechua. What this gives us is a unified account and a theoretical typology of languages in which modal forces vary under a fixed quantifier. Section 5 concludes by summarizing the analysis, and presenting the theoretical typology that is generated by this approach.

2 A Modal Analysis of $=ima$ and $=\underline{k}at$

2.1 Evidentiality in Gitksan

Evidentials are linguistic markers which uniquely encode the speaker’s type of evidence or source of information for a statement they make (cf. Palmer 2006; Aikhenvald 2006; Willett 1988; a.o.). There are three lexical evidentials in Gitksan, given in Table 2:

Evidential	Gloss	Evidence type
$=ima$	MODAL (MOD)	Inferential
$=\underline{k}at$	REPORTATIVE (REP)	Reportative
$\acute{n}akw$	EVIDENTIAL (EVID)	Inferential – Sensory

Table 2: The Evidentials in Gitksan (Peterson 2010; see also Matthewson 2012)

Example (9) is a minimal set using a typical stative/intransitive verb, and

provides a sample of the typical translations of these evidentials given by consultants:

- (9) a. mukw=*kat*=hl maa[̣]
 ripe=REP=CND berries
 “[I heard] the berries are ripe.”
- b. mukw=*ima*=hl maa[̣]
 ripe=MOD=CND berries
 “The berries might/must be ripe.”
 “Maybe the berries are ripe.”
- c. *nakw*=hl mukw=hl maa[̣]
 EVID=CND ripe=CND berries
 “The berries must be ripe.”
 “Looks like the berries are ripe.”

Both reportative =*kat* and modal-inferential =*ima* are verbal enclitics, while *nakw* is a fully-fledged verb that take a sentential complement (see Peterson 2010 for more details on the morphosyntax). The meaning of =*kat* supports the standard definition of a reportative: in example (9)b., a speaker infers that the berries are ripe based on the evidence in the form of a report from another source. That source could be anonymous or unknown (perhaps from the radio), or from someone who was actually out berry picking (e.g. a family member who was there earlier).

There are a number of features that distinguish =*ima* and *nakw*. The first involves what can be interpreted as modal force: =*ima* can express either epistemic possibility or necessity, while *nakw* can only express necessity. The second difference regards evidence: =*ima* is compatible with any type of indirect evidence, including a simple speculative judgment about the present or future with little or no observable evidence, or a recollection of a past event where the details are no longer clear. The distribution of *nakw* is more restricted: its interpretation requires the speaker to have some type of perceptual evidence for the assertion. The context in (10) brings out this difference:

- (10) Context: You’re sitting at home talking about going berry-picking. It’s August, and the berries are usually ripe this time of year on the Suskwa (a traditional picking grounds).

This context involves inferential evidence from speculation, general knowledge or experience. Example (9)c. using =*ima* is felicitous with this type of evidence, while *nakw* in (9)d. is infelicitous – it cannot be used when the speaker is only speculating or inferring from general knowledge. In a related context, given in (11), where there is some kind of physical evidence available to the speaker – in this case, purple hands – both *nakw* and =*ima* are felicitous:

- (11) Context: People are arriving home after a day of berrypicking up in the Suskwa. They're carrying buckets of berries, and their hands are all purple.

This physical evidence interpretation is supported by the frequent translation of *ḥakw* as “It looks like ...”. Thus, *ḥakw* is felicitous with a specific subset of the inferential evidence types that =*ima* is. Or in other words, =*ima* is felicitous in both inferring from physical and reasoning contexts, while *ḥakw* is felicitous only when inference is from physical evidence.

2.2 =*ima* and =*kat* are epistemic modals

There is a line of research emerging in the literature that shows that evidentials in some languages have a modal semantics (Faller 2002; Matthewson et al 2007; McCready and Ogata 2007; Rullmann et al 2008; Peterson 2010). This claim is supported by the fact that evidentials in languages such as St'át'imcets and Gitksan pass the tests for being propositional operators: they contribute to the truth-conditional content of an assertion, they can be embedded, and the modal claim they are a part of can be assented to and dissented from. These properties make them amenable to a modal analysis. For example, Matthewson et al (2007) claim that the individual evidentials *k'a* and *ku7* in St'át'imcets in (12) are semantically epistemic modals:

- (12) a. Inferential *k'a*: The speaker came to believe the sentence by means of inference based on perceived evidence, or general facts about the world.

plan *k'a* tu7 wa7 tsu7c na máq7-a
 already INFER then IMPF melt(INCH) DET snow-DET

“The snow must've already melted.”

- b. Reportative *ku7*: The speaker came to believe the sentence by means of a report.

wa7 *ku7* ku sts'éts'qwaz' l-ta stswáw'cw-a
 be REP DET trout in-DET creek-DET

“[I heard] There are trout in the creek.”

Following Izvorski (1997), Matthewson et al (2007) adapt a presupposition analysis for the evidential modals in St'át'imcets where the individual evidential in (12) place a presupposition on the modal base which is specialized to include different subtypes of evidence. (13) gives the semantics of the inferential evidential *k'a*:

- (13) Semantics of *k'a* (inferential) (Matthewson et al 2007, p. 245)
 $\llbracket k'a \rrbracket^{c,w}$ 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' , and f is a choice function such that $f(B(w)) \subseteq B(w)$.

If defined, $\llbracket k'a \rrbracket^{c,w} = \lambda f. \lambda p. \forall w' [w' \in f(B(w)) \rightarrow p(w') = 1]$.

The evidential modal *ku7* involves a more specialized sub-type of evidence than *k'a*. As such, the presupposition of *ku7* requires that the modal base contain all those worlds in which the reported evidence in w holds, as defined in (14):

- (14) Semantics of *ku7* (reported)
 $\llbracket ku7 \rrbracket^{c,w}$ is only defined if c provides a modal base B such that for all worlds $w', w' \in B(w)$, the **reported evidence** in w holds in w' , and f is a choice function such that $f(B(w)) \subseteq B(w)$.

If defined, $\llbracket ku7 \rrbracket^{c,w} = \lambda f. \lambda p. \forall w' [w' \in f(B(w)) \rightarrow p(w') = 1]$.

These denotations involve another contextually determined parameter, a choice function f which picks out a subset of $B(w)$. Matthewson et al claim that this function is the locus of the variable modal force of the modal evidentials in St'át'imcets (cf. (6)): the larger the subset of the modal base selected by f , the stronger the modal force expressed. Where f is simply the identity function, the result is a universal *must*-like reading. If f selects a proper subset of the modal base, the resulting reading is weaker, although that subset is still universally quantified over. I return to the issue of the choice function and modal force in section 4.2.

Peterson (2010) shows that a modal analysis, coupled with the presupposition which encodes the individual evidential meanings, makes the right predictions for the semantic properties of $=ima$ and $=kat$. Modal $=ima$ is similar to the inferential *k'a* in St'át'imcets, as $=ima$ requires the modal base contain only those worlds in which the inferential evidence in w holds. Thus, a preliminary semantics for $=ima$ and $=kat$ is given in (15) and (16):

- (15) A Preliminary Semantics for $=ima$ (to be revised)
 $\llbracket =ima \rrbracket^{c,w}$ 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' , and f is a choice function such that $f(B(w)) \subseteq B(w)$.

If defined, $\llbracket =ima \rrbracket^{c,w} = \lambda p. \exists w' [w' \in B(w) \rightarrow p(w') = 1]$.

- (16) A Preliminary Semantics for $=kat$ (to be revised)
 $\llbracket =kat \rrbracket^{c,w}$ is only defined if c provides a modal base B such that for all worlds $w' \in B(w)$, the **reported evidence** in w holds in w' , and f is a choice function such that $f(B(w)) \subseteq B(w)$.

If defined, $\llbracket =kat \rrbracket^{c,w} = \lambda p. \exists w' [w' \in B(w) \rightarrow p(w') = 1]$.

Given the similarities between Gitksan and St’át’imcets, the denotations in (15) and (16) also capture a key empirical difference between the evidentials in these languages: whereas the modals in St’át’imcets have universal quantification, $=ima$ and $=kat$ are existential. This is intended to reflect the default interpretation of the individual evidential modals in these languages. Whereas St’át’imcets modals have a universal *must*-like reading by default, Gitksan evidentials differ in having an existential, *might*-like reading by default. Matthewson et al. locate this variability in the choice function. However, in section 4 I propose that the ordering source, can replace this function and make the right predictions for the variability found in both Gitksan and St’át’imcets evidential modals. Thus, the denotations in (15) and (16) are ultimately not appropriate for $=ima$ and $=kat$.

3 The variable modal force of $=ima$ and $=kat$

The evidentials $=ima$ and $=kat$ semantically belong to the category of epistemic modals: they introduce quantification over possible worlds. However, Table 1 showed how both $=ima$ and $=kat$ differ from English modal auxiliaries in two respects: first, whereas the conversational background of a modal in English is determined by the context, both $=ima$ and $=kat$ lexically encode an epistemic conversational background through a presupposition restricting the modal base worlds. Secondly, unlike modals in English, neither $=ima$ nor $=kat$ lexically encode modal force, rather, it is determined by the context. Given this, it is important to clarify what it means for a modal to have ‘variable force’. This can be approached as an empirical matter, and begins by exploring through observing the variable modal force effect of $=ima$ and $=kat$ by refining the contexts in such a way that restricts the use of either *might* as possibility or *must* as necessity. We can then test this against the distribution of $=ima$ and $=kat$ in these contexts, where we find that both $=ima$ and $=kat$ are felicitous both in contexts where possibility and necessity is required.

3.1 The Variability of $=ima$

The variable modal force of $=ima$ can be conditioned by both the context it occurs in, and the type of evidence a speaker has for an $=ima$ -assertion.

3.1.1 Context-Conditioned Modal Force

The type of information available to a speaker and what they can infer from it naturally influences the strength of belief in the truth of the proposition. However, the fact that a person has inferential evidence for the truth of a proposition does not determine a certain strength of belief in this proposition. In (17) the context is simple enough that both *must* and *might* are felicitous translations in English: depending on a speaker’s previous experiences with John and his rod and tackle box, John might be fishing, or he must be fishing:

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

yukw=*ima*=hl tim iixw-t
 PROG=MOD=CND 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.”

In (18), 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:²

- (18) Context: The speaker’s father was away frequently when she was a child.

naa’a=*ima* ’an yookxw-in-ŷ
 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 is used in (19) in order to retrace a recent sequence of events and explain an outcome of those events. In (19), deduction leads to the speaker to conclude that, given that everyone else who ate the bad fish 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:

- (19) Context: There was a bad can of fish: everyone at the dinner got sick, and Gwen was there too.

xsit-in-(t)=hl fish=t Gwen
 vomit-CAUS-3sg=CND fish=PND Gwen

“The fish **must’ve** made her sick.” > “The fish **might’ve** made her sick.”

In another case, the speaker concludes that, upon hearing that Alvin’s new truck broke down recently, (20) is an appropriate response to the suggestion that the fuel pump is responsible for the breakdown:

²For any two (or more) sentences S_1 and S_2 , I define the relation $>$ to mean that a consultant judges a translation S_1 to be more felicitous than S_2 given the context, without S_2 being *necessarily* infelicitous.

- (20) Context: You hear that Alvin’s truck broke down on the way up to the Suskwa. It’s a very reliable truck, but someone suggests that the problems he’s having starting it indicate a problem with the fuel pump.

ñit=*ima*=hl kan wil-t
 3sg=MOD=CND COORD do.something-3sg

“That **must’ve** been why it happened.”
 > “That **might’ve** been why it happened.”

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 (21), 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:

- (21) Context: You see your uncle stopped at the intersection talking to some people through the window of his pickup. You and your friends don’t recognize the people.

wilaa-i-(t)=*ima*=s nipip-ý (ñitiit)
 know-TR-3=MOD=PND mother’s.brother-1sg 3pl

“My uncle **might** know them.” > “My uncle **must** know them.”

Likewise, in a story told by B in (22), the destination of the group in this passage is not a central part of the story and is likely not determined, thus it is not necessarily the case that they went to their hunting grounds, only a logical possibility:

- (22) A: ii nda=hl w’a-tiit?
 CONJ where=CND arrive-3pl
 “And where did they get to?”

B: pakw-tiit=*ima* an-si-lin-sxw-tiit
 arrive.pl-3pl=MOD GEO.LOC-CAUS-trap-ANTIPASS-3pl
 “**Maybe** they got to their hunting grounds.”
 > “They **must’ve** gotten to their hunting grounds.”

In (23), 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, there is no reason why the person *must’ve* been sick: it could’ve been a heart attack, or an accident:

- (23) Context: You see on TV that someone in the news passed away.

ñakw=*ima*=hl siipxw-t
 DIST=MOD=CND sick-3sg

“S/he **might’ve** been sick.” > “S/he **must’ve** been sick.”

In another conversation fragment in (24), a speaker weakens the potential universal modal force of *=ima* by explicitly stating that they forget. This causes the second translation of (24) to sound infelicitous:

- (24) Context: Alvin’s wife asks B when Alvin is getting back from shopping in Smithers. Alvin told you the night before, but you forget.

A: *ka_xkwi=hl wixw=s Alvin?*
 when=CND arrive=PND Alvin
 “When is Alvin arriving?”

B: *ṭak-ý, wixw=*ima* ṇit silkwsax*
 forget-1sg arrive=MOD 3sg at.noon
 “I forget, he **might** arrive around noon.”
 > “I forget, he **must** arrive around noon.”

3.1.2 Evidence Type and Modal Force

There is one way the *must vs. might* modal force readings of *=ima* can be teased apart: this involves examining contexts where there is some kind of observable physical evidence available to the speaker. Recall example (9), repeated in (25) for convenience: in a context where a speaker is making an inference based on general knowledge or similar previous experiences, *=ima* displays its variable force. On the other hand, the evidential *ṇakw* is infelicitous: it requires the speaker to have observable evidence:

- (25) Context: You’re sitting at home talking about going berry-picking. It’s August, and the berries are usually ripe this time of year on the Suskwa.

a. *mukw=*ima*=hl maay*
 ripe=MOD=CND berries
 “The berries **might/must** be ripe.”
 “Maybe the berries are ripe.”

b. *#ṇakw=hl mukw=hl maay*
 EVID=CND ripe=CND berries
 “The berries **must** be ripe.”
 “Looks like the berries are ripe.”

When the context is adjusted to include observable evidence, as in in (26), the use of *ṇakw* is felicitous, which is typically translated by consultants as a necessity modal *must*, and very rarely the weaker *might*:

(26) Context: People are arriving home after a day of berrypicking up in the Suskwa. They're carrying buckets of berries, and their hands are all purple.

a. mukw=*ima*=hl maay̓
 ripe=MOD=CND berries
 “The berries **might** be ripe.”

b. *nakw*=hl mukw=hl maay̓
 EVID=CND ripe=CND berries
 “The berries **must** be ripe.”
 “Looks like the berries are ripe.”

Modal =*ima* is also felicitous in observable evidence contexts as in (26); however, in these observable evidence contexts where both =*ima* and *nakw* are felicitous, =*ima* is interpreted as the weaker *might*, while *nakw* takes over the stronger *must* interpretation. Looking at it from another angle, given an observable evidence context such as in (27), a speaker is faced with a choice of making an epistemic claim using =*ima* or *nakw*. Upon observing some money on the floor, by using =*ima*, a speaker is claiming that it's *possible* but not *necessary* that the money was dropped by the person standing ahead in line. By using the evidential *nakw*, a speaker is making a stronger inference from this same physical evidence: the money *must've* been dropped by the person:

(27) Context: You and a friend are at the store and you see a dollar coin on the ground. It could be yours, your friend's, or the person in front of you in line may've dropped it.

a. kʷoo-T-in-t=*ima*=hl daala-t
 drop-t-CAUS-3sg=MOD=CND money-3sg
 “S/he **might've** dropped his/her money.”

b. *nakw*=t kʷoo-T-in-t=*ima*=hl daala-t
 EVID=3sg drop-t-CAUS-3sg=MOD=CND money-3sg
 “S/he **must've** dropped his/her money.”

This is where the modal properties of =*ima* clearly emerge. Assuming the standard notions of epistemic modality, the use of *must* over *might* is rooted in the speaker's certainty level about the proposition expressed. Thus, a speaker who uses a possibility modal is less certain about the truth of the embedded proposition than a speaker who uses a necessity modal. This distinction is reflected in the translations of =*ima* and *nakw* in the observable evidence contexts: by asserting (27)a. when b. is also felicitous, a speaker is conveying that s/he only *might've* dropped their money. This is because b. can unambiguously mean that they *must've* dropped their money. I return to the interaction between =*ima* and *nakw* in encoding modal force in section 4.

3.2 The Variability of =kat

Unlike =*ima*, sentences with =kat are not translated using epistemic modals such as *must* and *might*, rather, =kat(*p*) sentences are typically translated as “I hear/heard *p*”, as in (28):

- (28) Context: The speaker is telling her friends at the coffee shop that Mary had her long hair cut recently. She hasn’t seen Mary’s hair herself yet, but knows because the speaker’s sister is the hairdresser who did it.

kwin-kots-i-(t)=kat=s Mary=hl kes-t
 CAUS-cut-TR-3=REP=PND Mary=CND hair-3

“[I hear] Mary had her hair cut.”

However, =kat is frequently translated with modal adverb *apparently*, as in (29) (see also Hunt 1993 for several examples):

- (29) mats-i-(t)=kat=hl ha-nii-kuypax ’a=hl lo’op
 hit-TR-3=REP=CND INSTR-in-light LOC=CND rock

- (i.) “I hear he hit the window with a rock (and broke it).”
 (ii.) “Apparently, he hit the window with a rock.”

With translation (i.), the speaker is transmitting the report of an adult who happened to be working across the street in their yard when they saw the window of the speaker’s house being broken. The speaker judges this to be a reliable source, and this sentence receives a “I hear/heard *p*” translation. However, in translation (ii.), the speaker either holds a neutral attitude towards the report, or has less confidence in the report. This would be the case if the speaker receives the report from one of the children who were there and wanted to avoid punishment or blame. We see the same contrast in (30):

- (30) lumakt-i-(t)=kat=s John=hl daala
 donate-TR-3=REP=PND John=CND money

- (i.) “I heard John put in money (for the feast).”
 (ii.) “Apparently, John put in money.”

A group of people are counting up the contributions after a feast, and speculating about the different contributions people made that night. A speaker may translate (30) as (i.) if they overheard the information from one of the people who are responsible for the final accounting, thus normally a reliable source. On the other hand, if someone simply overheard from an unknown source in a crowded room that John also contributed, the translation in (ii.) is felicitous. However, it is important to note that this is not necessarily an unreliable source: by using *apparently* a speaker is conveying a neutral attitude towards the proposition – maybe the report is reliable, maybe it isn’t.

We can generalize the kinds of contexts and interpretations of (i.) and (ii.) in the examples above in the following way: in both (29) and (30) speaker judgments vary in the use of the translation “I hear/heard p ”, which can mean that a speaker either believes the source of the report to be reliable, or is neutral towards the source. Translations with *apparently* can also mean a neutral attitude towards the source, but more often used only when a speaker views the source as less reliable.

The variable modal force of $=ima$ is transparent in its translations as *must* or *might*. However, examples such as (29) and (30) illustrate that the modal force of $=kat$ reveals itself in the difference between universal and existential force, which would correspond to a difference between the paraphrases of (i.) and (ii.) above in (31):

- (31) (i.) “[Given what I’ve heard], p *must* be true”
(ii.) “[Given what I’ve heard], p *may* be true”

Because the existence of the report is presupposed and crucially not asserted, the truth conditions of reportative sentences depend not on whether there was a report, but on whether the report was true in the speaker’s view. The speaker asserts that it is at least possible that the report was true (Izvorski 1997; Fallor 2002; Matthewson et al. 2007). More specifically, under a modal semantics, the modal force of a reportative evidential equates to how reliable the source of the report is. If we assumed that a reportative evidential necessarily has universal force, then we would predict that it could only be used in cases where the report comes from a reliable source. A reportative evidential with existential force would be used in cases where the report does not come from a perfectly reliable source, since the embedded proposition would only be true in some of the worlds where the report is made.

4 The Ordering Source and Variable Modal Force

The central claim of this paper is that we already have a tool on hand for handling variable modal force: the ordering source. Kratzer (1991) applied ordering semantics to explain a number of phenomena involving natural language modality such as the weak readings of necessity modals, different interpretations involving circumstantial possibilities, counterfactual conditionals, and graded modality. It is the last of these that relates to the issue facing us with the variable modal force of $=ima$ and $=kat$.

Using modality in English as an illustration, in addition to the modal base B there is a second contextually-determined conversational background, the ORDERING SOURCE O , which imposes an evaluative ordering of the B -worlds. The general idea behind Kratzer’s technical innovation is that an epistemic 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) which are 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 .

Like the modal base B , the ordering source g is also a function from worlds to sets of propositions. If g is applied to a world w , the resulting set of propositions $g(w)$ induces a partial order $\leq_{g(w)}$ on the modal base worlds. This is defined as follows in (32):

- (32) (i.) $\forall w_1, w_2 \in X : w_1 \leq_{g(w)} w_2$ iff $\{p \in g(w) : w_2 \in p\} \subseteq \{p \in g(w) : w_1 \in p\}$
- (ii.) For a given partial order $\leq_{g(w)}$ on worlds, define the selection function $O_{g(w)}$ that selects the set of $\leq_{g(w)}$ -best worlds from any set X of worlds:
 $\forall X \subseteq W : O_{g(w)}(X) = \{w \in X : \neg \exists w' \in X : w' \leq_{g(w)} w\}$
 adapted from von Fintel and Heim (2007)³

Given the partial order as defined, $w_1 \leq_{g(w)} w_2$ means that w_1 is equally close to or closer to the ‘ideal’ than w_2 is with respect to $g(w)$, iff among the propositions in $g(w)$, those that are satisfied in w_2 are a subset of those that are satisfied in w_1 . Thus, the meaning of $w_1 \leq_{g(w)} w_2$ with an epistemic modal base can be paraphrased as ‘ w_1 is at least as desirable or in accordance with what we know at w than w_2 ’. It may also be noted that ordering does not technically give us degrees of conformity with the ordering source.

To get a feel for how this works with epistemic modality, consider an epistemic reading of (4): 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.

- (33) John **must** be fishing.

Suppose we know that John’s rubber boots are missing, and his truck is gone. The prejacent of (4) 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.

³In von Fintel and Heim’s notation, the ordering source is notated as MAX. I have used O simply for mnemonic reasons, following Portner (1997).

4.1 Ordering Sources with Fixed Quantification

I begin with the assumption that quantification is not determined by a parameter of interpretation: there is no contextually determined function that fixes the value of a quantifier 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: both the modal bases and ordering sources are independent conversational backgrounds; either can be determined lexically, or determined by the context. In English both the modal base and ordering source are contextually determined. In contrast, in Gitksan the modal base is restricted to indirect evidence (through the presupposition lexically associated with *=ima*). However, the value of the ordering source in Gitksan is entirely contextually determined. I claim that this gives us a formal way for explaining why context plays a role in determining the force of a modal statement in Gitksan. Following Kratzer (1991), 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 (see also Peterson (2008)).

As shown above, a stereotypical ordering source involves propositions representing the normal course of events, or relatively fixed ideas about the uses of things like rubber boots. The interpretation of an epistemic modal can also be conditioned by a speaker’s beliefs, characterizing a DOXASTIC ordering source. A doxastic modal statement is one in which the modal quantifies over the worlds of a modal base ordered by an ideal determined by the belief state of a speaker. The effects of a doxastic and stereotypical ordering sources, and the contrast they draw between Gitksan and English, are schematized in (34):

- (34) yukw=*ima*=hl iixw-(t)=s John
 PROG=MOD=CND fish-3=CND 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}
- $g(w)$ STEREOTYPICAL: {Rubber boots are used for fishing; rubber boots are not ideal for hunting, or berry picking}
- $g(w)$ DOXASTIC: {Knowing how much John likes fishing}

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 $g(w)$ concerns the 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 $O_{g(w)}$ 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). (34) 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 proportion of accessible worlds where it is true that John is fishing because his rubber boots are missing, will be smaller. This is because the set of worlds in $g(w)$ also contains worlds where he didn’t go fishing (beside the ones where he did). This leads to the resulting interpretation that ‘John is fishing’ is only a slight possibility in w . The doxastic reading functions in the same way, only instead of evaluating the normal course of events or uses of items such as boots, the speaker is evaluating a modal statement based on their beliefs, such as their prior experience with John’s likes or activities.

The analysis presented so far has its roots in Izvorski (1997), who shows that a similar variable modal force effect is arises in the perfect in Bulgarian, which has a modal and evidential interpretation in addition to its aspectual one:

- (35) 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 (35) that has a modal semantics. The force of this modal in $EV(p)$ sentences is determined by the speaker’s belief or trust in the evidence. In its report reading, (35) 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 (35) can interpreted along the lines of “I must have come” because in stereotypical contexts, the speaker bases her reasoning on 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 schema of Izvorski’s analysis is given in (36):

- (36) $B = \{p: \text{a speaker considers } p \text{ indirect evidence in } w\}$
 $B(w) = \{u \in W : \forall p[(p \text{ is indirect evidence in } w) \rightarrow u \in p]\}$
 $g(w) = \{p: \text{a speaker believes } p \text{ with respect to the indirect evidence in } w\}$

In words, an EVp statement is true in a world w with respect to the conversational backgrounds provided by $B(w)$ and $g(w)$, 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 suitable denotation is given in (37):

- (37) $\llbracket EV \rrbracket^{c,w}$ 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'
 $\llbracket EV(p) \rrbracket^{c,w} = 1$ iff for $\forall w' \in O_{g(w)}(B(w)) : \llbracket p(w') \rrbracket^{c,w} = 1$.

The ordering source orders the set of accessible worlds under either an inferential or reportative interpretation of PE, as in (38):

- (38) Ivan izpil vsičkoto vino včera
 Ivan drunk-PE all.the wine yesterday
 “Ivan apparently drank all the wine yesterday.” (Izvorski 1997: 228)

(i.) Inferential interpretation:

$$B(w) = \{\text{There are empty wine bottles in Ivan's office}\}$$

$$g(w) = \{\text{If there are empty wine bottles in someone's office, that person has drunk the wine}\}$$

(ii.) Reportative interpretation:

$$B(w) = \{\text{Mary said that Ivan drank the wine}\}$$

$$g(w) = \{\text{Normally, Mary is reliable as a source of information}\}$$

The reason for universal quantification in (37) comes from the observation that PE 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 (39), where quantification is existential:

- (39) The Semantics of =*ima* (Final) (revised from (15))
 $\llbracket =ima \rrbracket^{c,w}$ 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' .

$$\text{If defined, } \llbracket =ima \rrbracket^{c,w} = \lambda p. \exists w' [w' \in O_{g(w)}(B(w)) \wedge p(w') = 1].$$

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 “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). We can derive the same strengthening effect from the ordering of an existentially quantified modal base: in example (34), a set of worlds where John’s boots are missing, and boots are used for fishing is a more restricted set of worlds than one in which only John’s boots are missing. If you assert that in some possible world where John’s boots are missing, he’s fishing, that is a weaker claim than asserting that in some possible world where John’s boots are missing and boots are used for fishing, he’s fishing. However, we need the connection to the actual world to make the latter statement stronger: assuming that the actual world is a world in which the ordering source propositions are true. Therefore, asserting that in some of the smaller set of worlds, John is fishing, is a stronger

claim than asserting that in some of the larger set of worlds, John is fishing. Note that the opposite parallel can be drawn with Izvorki’s universal analysis in (37): restricting a universal quantifier leads to weakening, as “all male students smoke” is weaker than “all students smoke”. Both the strengthened existential and the weakened universal are achieved by a non-empty ordering source.

This analysis accounts for the strong, *must*-like reading of *=ima*, and also allows us 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. Whereas epistemic modality has an epistemic modal base with an ordering based on doxastic reasoning or stereotypicality, alethic modality is a kind of purely logical modality: it does not relativize 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 (34) is obtained in (40), where the unordered modal base is simply existentially quantified over:

- (40) yukw=*ima*=hl iixw-(t)=s John
 PROG=MOD=CND fish-3=CND John
 “John **might** be fishing.”

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

$g(w)$ EMPTY: \emptyset

This basically resembles a standard *might*-as-existential modal: a speaker of (40) 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, and assuming that the actual world is such a world), is claimed to be a big enough difference so that 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*, while 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 as in (41):

- (41) The modal force interpretations of *=ima*:

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

$$g(w) = \left\{ \begin{array}{l} \text{STRONG: } \{p : Bel(s, p) \text{ w.r.t. the evidence in } w\} \\ \text{WEAK: (default): } \emptyset \end{array} \right\}$$

Turning to the variable modal force of $=\underline{k}at$, we can apply an ordering source analysis to the reliability of the reported evidence. As with $=ima$, we can build into the denotation the default weak interpretation of $=\underline{k}at$ in (42):

- (42) The Semantics of $=\underline{k}at$ (Final) (revised from (16))
 $\llbracket =\underline{k}at \rrbracket^{c,w}$ is only defined if c provides a modal base B such that for all worlds $w' \in B(w)$, the reported evidence in w holds in w' .

If defined, $\llbracket =\underline{k}at \rrbracket^{c,w} = \lambda p. \exists w' [w' \in O_{g(w)}(B(w)) \wedge p(w') = 1]$.

Consider again the case of the feast contributions in (43):

- (43) $lumakt-i-(t)=\underline{k}at=s$ John=hl daala
donate-TR-3=REP=PND John=CND money
- (i.) “I heard John put in money (for the feast).”
(ii.) “Apparently, John put in money.”

Faller observes in Quechua that if the reliability of the source is unknown, only an existential analysis predicts a reportative sentence to be true (2002: 109): if the reliability of a source is unknown, then the set of worlds in which that report is heard will include both worlds where the report is true, and worlds where it is false. Both translations in (43) can reflect this kind of neutrality, and I claim that this is derived from an empty ordering source, as in (44):

- (44) Modal base and Ordering source for a weak interpretation of (43):
- $$B(w) \text{ REPORTATIVE: } \{\text{a conversation was overheard in the feast hall}\}$$
- $$g(w) \text{ EMPTY: } \emptyset$$

However, if a speaker views the source of the report as reliable, then the ordering source reflects this and is non-empty, as in (45):

- (45) Modal Base and Ordering Source for a strong interpretation of (43):
- $$B(w) \text{ REPORTATIVE: } \{\text{The accountant was discussing John's contribution}\}$$
- $$g(w) \text{ NON-EMPTY: } \{\text{Normally, accountants are reliable sources in these matters}\}$$

The ordering source analysis for $=ima$ applies *mutatis mutandis* to $=\underline{k}at$: an existentially quantified modal base is given a stronger interpretation through a non-empty ordering source. This is schematized for $=\underline{k}at$ in (46):

- (46) The modal force interpretations of $=\underline{k}at$:

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

$$g(w) = \left\{ \begin{array}{l} \text{STRONG: } \{p : Bel(s, p) \text{ w.r.t. the evidence in } w\} \\ \text{WEAK: (default): } \emptyset \end{array} \right\}$$

4.2 An Emerging Theoretical Typology

An ordering source analysis can be applied straightforwardly to the St’át’incets inferential evidential *k’a*, which also has the same kind of variable force as *=ima*:⁴

- (47) St’át’incets (Rullmann et al. 2008: 5)
- a. t’ak *k’a* tu7 kents7á ku míxalh
go.along INFER then DIETIC DET bear
“A bear **must’ve** gone around here.”
 - b. wa7 *k’a* séna7 qwenúxw
IMPF INFER COUNTER sick
“He **may** be sick.”

However, St’át’incets 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’incets is strong. Recall from the denotation given in (13) for *k’a* in the previous section that Rullmann et al (2008) locate the variability in modal force in a contextually-determined choice function *f*. The choice function picks out a subset of the modal base, which is universally quantified over. The larger the subset of the modal base selected by *f*, the stronger the modal force expressed. *f* may simply be the identity function, which results in a universal *must*-like reading. If *f* selects a proper subset of the modal base, the resulting reading is weaker, although that subset is still universally quantified over. The denotation of inferential *k’a* is repeated below in (48) for convenience:

- (48) Semantics of *k’a* (inferential) $\llbracket k'a \rrbracket^{c,w}$ 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' , and *f* is a choice function such that $f(B(w)) \subseteq B(w)$.

If defined, $\llbracket k'a \rrbracket^{c,w} = \lambda f. \lambda p. \forall w' [w' \in f(B(w)) \rightarrow p(w') = 1]$.

However, given the difference in default quantification between Gitksan and St’át’incets, we can extend the ordering source analysis to the St’át’incets modals in a straightforward way: in the previous subsection 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. (39)). The revised denotation of St’át’incets modals such as *k’a* given in (49) can involve the exact same components as in Gitksan, except that it has universal quantification:

⁴Portner (2009) also discusses how the ordering source could replace the choice function in St’át’incets.

- (49) $\llbracket k'a \rrbracket^{c,w}$ 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, $\llbracket k'a \rrbracket^{c,w} = \lambda g.\lambda p.\forall w'[w' \in O_{g(w)}(B(w)) \rightarrow p(w') = 1]$.

This analysis provides a unified account of variable modal force found in Gitksan and St'át'imcets: modal evidentials in these languages 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 (50):

- (50) The interpretations of $k'a$
 $B(w) = \{u \in W : \forall p[(p \text{ is indirect evidence in } w) \rightarrow u \in p]\}$
 STRONG (default): $g(w) = \emptyset$
 WEAK: $g(w) = \{p: \text{the speaker believes } p \text{ with respect to the indirect evid. in } w\}$

With an empty ordering source, modal $k'a$ is universally quantifying over literally every possible world in the modal base (the worlds in which the relevant evidence holds), representing alethic modality, just as $=ima$ does 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 implementation 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 1991). For example, in (47)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 (47)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 beliefs regarding 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. Thus, (47)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 is 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 in St’át’imcets, consider example (51) uttered by a speaker in isolation upon hearing a knock at the door:

- (51) nilh k’a kw s-Henry wa7 pegwpeg’wtsám’
 FOC INFER DET NOM-Henry IMPF knock.repeatedly
 “That’ll be Henry knocking.” (Rullmann et al. 2008: 7)

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 (51) again, but this time uttered to a hearer in the following context in (52):

- (52) Henry said he would come tonight, so if he isn’t here yet it follows that (51).

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 Lakoff 1972; Tancredi 2007; Faller 2011 for a similar discussions and other examples). 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 (52) – modal $k’a$ only involves quantification over a modal base.

Could a choice function 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 choice function and ordering source rely on context to determine their value. An ordering source analysis provides a truth-conditional way of picking out a set of ideal modal base worlds, which is then quantified over. However, exactly what kinds of modal base worlds are picked out by the choice function? In other words, the ordering source is principled because it orders worlds according to propositions which are believed or stereotypical, whereas f could be totally random in the set of worlds which it picks out. 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 strong, *must*-like reading by default, which under a choice function analysis means that f is by default the identity function. We could apply a choice function to the existentially quantified modal base of =*ima*. This faces the same theoretical 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 have universal quantification for $=ima$, giving it the same denotation as St'át'incets $k'a$. However, given the default weak reading of $=ima$, we would then need some way of explaining why some languages have identity (St'át'incets) 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'incets, but also the default readings these modals have, which are treated as the effect of an empty ordering source, as Table 3 shows:

	Gitksan (\exists)	St'át'incets (\forall)
Strong	NON-EMPTY	EMPTY (default)
Weak	EMPTY (default)	NON-EMPTY

Table 3: Empty vs. Non-empty Ordering Sources in Strong/Weak Modals

In recent related work Faller (2011) claims that inferential evidentials in Cuzco Quechua rely on an ordering source, which may be empty, as “a stronger sense of an inference being performed when [the modal base is] used in conjunction with an ordering source (675)”. This observation is very similar to what we find with $=ima$. Faller claims that the conjectural $=chá$ in Quechua allows, but does not require a non-empty doxastic ordering source, which orders an existentially quantified modal base, as is shown in (53):⁵

$$(53) \quad \llbracket =chá(p) \rrbracket^{c,w} = 1 \text{ iff there exists an epistemic modal base } B \text{ and a doxastic ordering source } g \text{ such that } \exists w' \in O_{g(w)}(B(w)), \llbracket p \rrbracket(w') = 1$$

$$g(w) = \left\{ \begin{array}{l} \text{STRONG: } \{p : Bel(s, p) \text{ w.r.t. the indirect evid. in } w\} \\ \text{WEAK: } \emptyset \end{array} \right\}$$

Also similar to modal evidential $=ima$ in Gitksan, a ‘strong’ reading of the conjectural $=chá$ is obtained when the ordering source is non-empty, as in (54):

$$(54) \quad \text{Mana=n para kan=chu. Kunan wata=qa mana=chá allin=chu} \\ \text{not=BPG rain be=NEG now year=TOP no=CONJ good=NEG} \\ \text{kuhichu ka-nqa!} \\ \text{harvest be-3.FUT}$$

‘There is no rain. I guess/suppose/surely, the harvest this year will be bad!’

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

$$g(w) = \{p : Bel(s, p) \text{ w.r.t. the indirect evidence in } w\}$$

⁵I have modified Faller’s original denotations for ease of comparison with the ones in this paper.

Accordingly, a ‘weak’ reading of $=chá$ is obtained with an empty ordering source in the exact same way as $=ima$. Compare the Quechua example in (55) with a similar Gitksan example in (56) with $=ima$, both of which would have the same modal base and ordering source in (57):

- (55) A: Iné-cha=qa hamu-nqa
 Inés-DIM-TOP come-3.FUT
 “Will Inés come?”
 B: Ichapas=*chá*, mana-pas=*chá*.
 maybe=CONJ, not=ADD=CONJ
 “Maybe, maybe not.”
- (56) A: gaxgu=hl witxw=s Alvin?
 when=CND arrive=PND Alvin
 “When is Alvin arriving?”
 B: silkwsax=*ima*
 at.noon=MOD
 “Maybe noon.”
- (57) $B(w) = \{u \in W : \forall p[(p \text{ is inferential evidence in } w) \rightarrow u \in p]\}$
 $g(w) = \emptyset$

Faller describes the complex evidential Perceived Evidence Inferential (PEI) $=chu-sina$ as requiring a more specialized modal base than conjectural $=chá$. The modal base of PEI $=chu-sina$ must contain propositions describing events perceived by the speaker, plus a non-empty doxastic ordering source that contains assumptions that links these events to likely causes, as the semantics of $=chu-sina$ in (58) shows:⁶

- (58) $\llbracket =chu-sina(p) \rrbracket^{c,w} = 1$ iff there exists an non-empty perceptual modal base B and a **non-empty** doxastic ordering source g such that $\exists w' \in O_{g(w)}(B(w)), \llbracket p \rrbracket(w') = 1$.

The presupposed non-empty ordering source of $=chu-sina$ has the effect of giving $=chu-sina$ an inherently stronger modal force than $=chá$:

⁶Faller also includes a presupposed doxastic ordering source for both conjectural $=chá$ and $=chu-sina$ (the former of which can be optionally empty). I assume this is not the case in Gitksan, as other kinds of ordering sources are allowed with an epistemic modal base. Nonetheless, Faller’s ordering source presupposition is follows from a modal analysis and predicts that there are languages that not only presuppose different types of modal base, but also ordering sources.

- (59) Unqu-sqa=*chu-sina* ka-sha-n-man. Mana-pas=*chá*
sick-PRT=PEI be-PROG-3-COND not-ADD=PEI=chá.

“She appears to be sick. (But) maybe she isn’t.”

$$B(w) = \{u \in W : \forall p[(p \text{ s perceived/-s the event described by } p \text{ in } w) \rightarrow u \in p]\}$$

$$g(w) = \{p : Bel(s, p) \text{ w.r.t. the inferential evidence in } w\}$$

4.3 Modal Force and Lexical Blocking

The ordering source analysis presented above for Gitksan and St’át’imcets rests on the assumption that the modals in these languages have a default force. However, there are certain empirical challenges in claiming that a language has a default interpretation in terms of modal force. Rullmann et al. (2008) note that in both textual examples and elicitation contexts, the universal is preferred. I have found the opposite tendency in the translations of observed conversations in Gitksan, where there is a preponderance of the weaker existential interpretations.

In this subsection I look at additional supporting evidence for the default quantificational force in both Gitksan and St’át’imcets, as summarized in Table 3. To begin with, we can view variable modal force and default values in terms of strengthening and weakening a quantifier. The two possibilities for this are given in (60):⁷

- (60) (i.) \exists **plus strengthening:** Modals (in some languages) are uniformly existential and are strengthened though some mechanism.
(ii.) \forall **plus weakening:** Modals (in some languages) are uniformly universal and are weakened though some mechanism.

Options (i.) and (ii.) appear to be borne out by Gitksan and St’át’imcets, respectively. Secondly, we have a theory-internal mechanism for strengthening or weakening the modal interpretation of a quantifier by adding another function over its domain: the ordering source orders the domain of the quantifier according to some ideal.

There are also pragmatic and paradigmatic considerations: both Gitksan and St’át’imcets have other modal-type words that are not ambiguous with regards to modal force. In example (61) St’át’imcets has the adverb *szek* which is translated as ‘maybe’:

⁷This is adapted from Rullmann et al. 2008, who also identify two other possibilities. One is *Ambiguity*: Modals can be lexically ambiguous between existential and universal readings. The other is *Underspecification*: Quantificational force is underspecified and requires setting through some mechanism. They also note that it is unclear what kind of theoretical mechanism could fix the value of a quantifier in these two options.

- (61) St'át'imcets (Rullmann et al 2008)

nihl ku cw7aoy-s kw s-k'úl'-em múta7 ku pála7 k'a
 FOC DET NEG-3.poss DET NOM-make-MID again DET one INFER
 sʒek xetspásq'et
 maybe week

“So she wouldn't have to make more for about a week maybe.”

This can be considered as a disambiguation strategy: Whereas *k'a* has a default universal reading, there is a morpheme dedicated to an unambiguously weaker modal force reading. The opposite arrangement of this occurs in Gitksan: whereas =*ima* has a default existential reading, the evidential *ṅakw* can only be translated as a strong, *must*-like modal:

- (62) Context: You and a friend are at the store and you see a dollar coin on the ground. It could be yours, your friend's, or the person in front of you in line may've dropped it.

a. k'woo-T-in-t=*ima*=hl daala-t
 drop-t-CAUS-3sg=MOD=CND money-3sg
 “She **might**'ve dropped her money.”

b. *ṅakw*=t k'woo-T-in-t=*ima*=hl daala-t
 EVID=3sg drop-t-CAUS-3sg=MOD=CND money-3sg
 “She **must**'ve/**#might**'ve dropped her money.”

- (63) Context: You and a friend are going fishing. You notice blood on the rocks ahead of you where your friend is walking.

a. k'ots-i-n=*ima*=hl 'oñ-n
 cut-TR-2sg=MOD=CND hand-2sg
 “You **may**'ve cut your hand.”

b. *ṅakw*=mi k'ots=hl 'oñ-n
 EVID 2sg cut=DET hand-2sg
 “You **must**'ve/**#might**'ve cut your hand.”

Recall from section 2 that there are restrictions on the distribution of *ṅakw*: it is only felicitous in contexts in which the speaker can make an inference from observable evidence. When =*ima* appears in these contexts, it is almost always translated as a possibility modal. Peterson (2009) analyzes this effect as a case of *pragmatic blocking*: *ṅakw* is more specialized for the strong reading, and blocks =*ima* from that reading.⁸ This is relevant because when a speaker

⁸See Peterson (2009, 2010) for the details on the formal implementation of the blocking relationship between =*ima* and *ṅakw*. Unlike the evidentials =*ima* and =*kat*, *ṅakw* does not have a modal semantics. Rather, *ṅakw* operates above the propositional level. Whereas =*ima* and =*kat* have semantic presuppositions that restrict the modal base worlds, *ṅakw* carries a pragmatic presupposition which places a condition on its use in a conversation: the felicitous use of a *ṅakw*(*p*) sentence requires that sensory evidence is entailed by the Common Ground. See Peterson (2010) for details.

chooses to use $=ima$ in a context where $\acute{n}akw$ is felicitous, they are essentially expressing that they don't believe the evidence they have warrants a stronger statement. This would again amount to existential quantification over a set of worlds that is restricted by the ordering source: There is a proposition that is a part of the ordering source that would say that, normally, when you see blood at a person's feet (and they are using a knife), that person cut themselves.

Additionally, there is no 'weaker' epistemic modal in Gitksan other than $=ima$. The Gitksan equivalent of the St'át'imcets adverb $sxek$ is the word $\acute{n}idima$, which is common in Gitksan discourse and is frequently translated as 'maybe'. It is morphologically complex, composed of the 3sg independent pronoun, $\acute{n}it$, and modal $=ima$. (64):

- (64) A. $nee=ima=hl \quad ihleetxwt=a$
 NEG=MOD=CND be.red=INTERROG
 "Is it maybe red?"
- B. $ee'e, \acute{n}it=ima$
 yes, 3sg=MOD
 "Yes, maybe."

I take this paradigmatic relationship found in both St'át'imcets and Gitksan to be supporting evidence for default quantificational force in these languages, as summarized in Table 3.

In sum, languages may have modal-like elements which can be used to lexically disambiguate modal force (see also Deal (2011) for additional perspective on this). I take this blocking relationship found in both St'át'imcets and Gitksan to be supporting evidence for default quantificational force in these languages. A similar observation can be made for the Quechua evidentials, where the unambiguous form $=chu-sina$ (i.e. obligatory non-empty ordering source) blocks the less specialized $=chá$, which has the optionally non-empty ordering source. This is summarized in Table 4:

	<i>Gitksan</i>	<i>St'át'imcets</i>	<i>Quechua</i>
Strong	$\acute{n}akw$	$k'a$	$=chu-sina$
Weak	$=ima$	$sxek$	$=chá$

Table 4: Blocking effects between evidentials and modal force.

5 Conclusion

Gitksan represents a class of languages, which includes St'át'imcets and Cuzco Quechua, that have lexical evidentials that are semantically epistemic modals. The evidential meaning of the individual evidentials is encoded through a pre-supposed modal base. Given their modal semantics, evidential modals in these

languages are translated as having variable modal force – a challenge for the standard analysis of modality, where the strong/weak dual corresponds to universal/existential quantification over the modal base. Gitksan and Quechua modals are uniformly existential, and the variability of modal force is located in the ordering source: the strong/weak interpretations of the modal evidentials in Gitksan and Quechua correspond to non-empty vs. empty ordering sources. Using these parameters, St’át’incets and Bulgarian evidentials are a mirror image: quantification is fixed as universal, but the strong/weak interpretations correspond to empty vs. non-empty ordering sources. Table 5 shows the theoretical typology of languages that emerges based on quantification and non-empty vs. empty ordering sources:

	\exists languages:	\forall languages:
	Gitksan, C. Quechua	St’át’incets, Bulgarian
Strong	NON-EMPTY	EMPTY
Weak	EMPTY	NON-EMPTY

Table 5: A Typology of \exists - and \forall -type languages, ordering source, and modal force.

The main advantage of this approach is that no new theoretical mechanisms were required: we already have the tools on hand that can provide a truth-conditional account for variable modal force in these languages. Furthermore, the typology in Table 5 is predicted by the dual-conversational background theory of modality. This analysis also connects these languages to Kratzer’s original (1991) analysis of graded modality, and how the German modal paraphrases in (65) which encode finer distinctions of possibility and necessity, correspond to different ordering sources:

- (65) a. *Es kann gut sein, dass...* HUMAN POSSIBILITY
 “There is a good possibility that...”
 b. *Es besteht eine geringe Möglichkeit, dass...* SLIGHT POSSIBILITY
 “There is a slight possibility that...”
 c. *Es ist wahrscheinlich, dass...* HUMAN NECESSITY
 “It is probable that...”

Gitksan represents languages where the grades of modality as expressed in the various paraphrases in (65) are admitted by a single lexical item. This can also be described as a many-to-one relation between ordering sources and a single modal.

This analysis also raises a number of empirical and theoretical issues, two of which I will briefly discuss. The first is an empirical concern in working with the translation of =*ima* and =*kat*. I’ve been assuming that the various translations of =*ima* and =*kat* into English reveal that a speaker’s level of certainty of the truth of the proposition embedded under an evidential-modal must

be underlyingly present. This is about how a speaker’s individual-level world knowledge, beliefs and experiences condition their attitude towards the propositions that comprise the (evidential) modal base. However, could it be the case we are simply analyzing English translations of Gitksan sentences? From another perspective, is there any way of independently verifying that =*ima* really does translate as a *must*-like modal (cf. (18) and (19))? Could it be the case that =*ima* is simply a weak, existential modal without the ordering source, and consultants are providing their judgments in English? There are two reasons while I believe not: first, the stronger interpretation of =*ima* follows from what I call the ‘secondary inference’ that performed by the ordering source (a similar observation is made in Faller 2011) – an inference that is lacking with an empty ordering source (the weaker interpretation). This could accord with our intuitions that by adding another inference – in addition to the primary inference from the modal base – strengthens our belief in the truth of the prejacent. Secondly the use of =*ima* is felicitous in contexts where a stronger lexical alternative (i.e. *ɲakw*) is not, yet these contexts require a strong modal (also cf. (18) and (19)).

This leads to the second issue, which is a theoretical one concerning exactly how a speaker’s belief and/or knowledge is ‘invoked’ by the context. In other words, while it is clear that the context somehow conditions the propositions that comprise the ordering source, it doesn’t seem to do so in the same manner it does with the modal base. Rather, the context activates the relevant knowledge area of the speaker. From a theoretical standpoint, it is not exactly clear how this is achieved.

Current research in this area suggests that variable modal force may be a more widespread crosslinguistic phenomenon. It is also found in other kinds of modality, such as the case with root modality in Nez Perce (Deal 2011).⁹ It is expected that increased attention on understudied languages will bring new data to bear on these issues.

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⁹Deal (2011) examines a different range of behaviour of the Nez Perce root modal *o’qa*, which also displays the same kind of flexibility in modal force as =*ima*. She approaches the problem in terms of lexical duals and scalar implicatures in upward entailing contexts – which *o’qa* fails to trigger. This does not appear to be applicable to =*ima*, as there is a lexical dual which unambiguously expresses strong modal force (*ɲakw*). However, reportative =*kat* may be amenable to this analysis, as it lacks a lexical dual encoding modal strength. I leave this to future research.

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