

The Future of Hindi Modality

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Abstract The Hindi future marker *gaa* is employed to convey Future meanings or to make epistemic claims, similar to English *will*. I offer a unified, modal account of *gaa* on its Future and Epistemic readings in the spirit of Kratzer (1981,1991) and Condoravdi (2002). In addition, I show that the interpretation of *gaa* correlates with its structural position. It has long been noted that a modal's position correlates with whether it receives a *root* or *epistemic* interpretation. The data contained herein show that a similar height-interpretation correlation exists within the non-root domain: whether *gaa* takes an Epistemic or Metaphysical Modal Base (Condoravdi 2002, Thomason 1984) depends on the height of its attachment site. On the theory proposed modal flavor is indirectly constrained by the *semantic type of the modals prejacant* instead of being solely determined via contextual assignment. I argue that the Metaphysical Modal Base is comprised of world-time pairs, whereas the Epistemic Modal Base is simply a set of worlds. The height restriction falls out as a consequence of the different types of alternatives the Modal Bases make available for semantic computation.

Keywords Modality · Epistemic · Future · Hindi

1 Introduction

The Hindi future morpheme *gaa* displays interpretive possibilities similar to English *will*. *Gaa* can be used in sentences that convey Future meanings or make epistemic claims (this latter use is often referred to by traditional grammarians as the *presumptive* use). To my knowledge, no proposal has been offered in the formal literature that unifies the future and epistemic uses of *gaa*. The goal of this paper is to give such an account. The basic premise is that *gaa* is a Kratzerian modal with an unspecified modal base (MB) parameter.

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Following Condoravdi's (2003) treatment of *will* I assume that Future readings arise when the MB is *Metaphysical*, Epistemic readings when it is *Epistemic*.

Treating *gaa* as a modal has interesting empirical and theoretical implications. Researchers have long noted that a correlation exists between a modal's structural position and its interpretation (Jackendoff 1972, Piccolo 1990, Palmer 2001, inter alia). It is a very reliable empirical generalization that root modals seem to scope low, whereas epistemic modals appear to scope high (above Tense - cf. Cinque 1990). Apart from the root-epistemic split, Condoravdi (2002) has argued there exist constraints on the availability of non-root flavors (Epistemic and Metaphysical) given a modal's structural position.

Assuming that *gaa* is a modal, I show that its position in the syntactic/semantic tree correlates with the interpretation it receives. This is a novel empirical contribution that stands independent from the particulars of the proposal put forward later in the paper.

The formal account proposed herein, which has conceptual antecedents in work on the root-epistemic distinction by Butler (2003), Brennan (1993) and Hacquard (2006), seeks to explain the height-meaning correlation. I propose that selection of the appropriate MB is indirectly determined by the *semantic type of the modal's prejacent*. This is superficially similar to the accounts of Brennan (1993) and Butler (2003), both of whom argued for a kind of determination procedure sensitive to the modal's syntactic sister. Though Butler and Brennan's accounts featured height-relative determination, the correlations were either explicitly encoded into the semantics, or were highly stipulative. Like Hacquard (2006), I will argue that the mapping from position to interpretation is not explicitly encoded anywhere in the grammar. Unlike Hacquard's event-relative determination procedure, I argue that the mapping falls out from the properties of MBs themselves. I claim that the Metaphysical MB returns future-oriented (w, t) pairs (possible futures) as the alternatives the semantics manipulates. Forward-shifting is not part of the semantics of *gaa* itself (as has been argued for *will* by Abusch 1998, among others), but rather of the Metaphysical MB. Unlike the Metaphysical MB, the epistemic only manipulates worlds (not (w, t) pairs). The difference in alternative types provided by MBs is exploited to derive restrictions on *gaa*'s interpretation in different structural positions.

2 The Primary Data

In English, the auxiliary *will* is ambiguous. In certain contexts it appears to function like a tense, forward-shifting the instantiation time (IT) of the VP it composes with. In other contexts it seems to give an epistemic modal meaning, similar to *must*, where the evaluation time (ET) of the modal is the utterance time. The former reading is illustrated in (1a), the latter in (1b).

- (1) a. Amitabh will do work (tomorrow).

- b. Amitabh will have done work by now.
 ≈ Amitabh must have done work by now.
 ≈ ‘It’s consistent with my knowledge that Amitabh has done work by now.’

The question of how to handle this interpretive ambiguity has spurred a voluminous debate (Condoravdi 2003, Hornstein 1990, among many others - see Sarkar 1998 for a nice discussion of the issues).

The Hindi future-marker *gaa* displays very similar interpretive ambiguities to *will*. However, there are clearer restrictions on when a particular reading is available for *gaa* than for *will*. An illustration of the basic phenomena follows.

Gaa is a bound morpheme that suffixes to a verbal host. In (2a) *gaa* is attached to a subjunctive-marked main verb and it contributes a future-orientation; the event of Amitabh working happens subsequent to the utterance time. In (2b) *gaa* attaches to the auxiliary *ho* and the main verb bears the imperfective aspectual suffix *-taa*. In this configuration, *gaa* contributes an ‘Epistemic’ reading. That is, (2b) is interpreted as a claim about the speaker’s epistemic state. In glossing such sentences, English epistemic *must* is the most appropriate choice for a translation of *gaa*¹. As we will discuss at greater length later, the possible interpretations of *gaa* exhibit a complementarity conditioned on what the modal attaches to. (2a) cannot have an Epistemic reading, nor can (2b) be given a Future reading.

- (2) a. Amitabh kaam kar-e-gaa
 Amitabh work do-Subj-gaa
 ‘Amitabh will do work.’
 # ‘Amitabh must do work.’
 b. Amitabh kaam kar-taa ho-Ø-gaa
 Amitabh work do-IMPF aux.Subj-gaa
 ‘Amitabh must_{EPIST} do work.’
 # ‘Amitabh will work (in the future).’²

We see above that modal flavor seems to correlate with structural position; when *gaa* is ‘high’ (i.e. on a Tense auxiliary), an Epistemic reading is required, when *gaa* is ‘low’, a Future reading is obligatory. The intent of the paper, in

¹ The tinge of future orientation that many English speakers report for similar sentences with *will* is not felt with *gaa*.

² Subjunctive morphology appears on either the verb root in (2a) or on the auxiliary. In (2b) we do not see this morphology, but we should not conclude that it is absent. In all conjugations except the 3sg, subjunctive morphology does appear on the epistemic *gaa*-marked auxiliary, as evidenced by the nasalization observed on *ho*.

i) [*Spoken to an Englishman*]
 Aap cricket khel-tee ho-N-gee.
 You cricket play-IMPF aux-Subj-gaa
 ‘You must play cricket.’

For the purposes of this paper I will treat this subjunctive morphology as semantically vacuous. I assume it’s presence is a morphological reflex of having the modal *gaa* in the sentence.

a nutshell, is to derive these distributional facts while maintaining a univocal modal semantics for *gaa*. Similar to the accounts of the root-epistemic split made by Butler (2003), Brennan (1993) and Hacquard (2006, 2010), the account exploits differences in structural position to determine modal flavor - *gaa* above Tense yields an Epistemic reading, while Future readings arise when *gaa* scopes directly over AspP - but does so without explicitly encoding modal flavor, modal syntax, or directly encoding the relationship between position and interpretation. Such an approach is superior to purely pragmatic approaches to modal determination because it gives us an explanation for the conspicuous absence of particular readings that do not follow straightforwardly under traditional theories that rely on purely contextual determination (Kratzer 1981) and/or pragmatic felicity conditions (Condoravdi 2003) to restrict the set of possible interpretations.

Before delving into the interpretive restrictions any further, it will be useful to have a primer on some relevant facts about Hindi morphology.

2.1 Hindi Morphology

Because I will argue that *gaa*'s interpretation is constrained by its structural position, having diagnostic tools for determining its structural position is crucial. Aspectual morphology gives us this diagnostic ability. Because of its rich aspectual inventory Hindi offers us a more transparent look into the interaction of modality, tense and aspect than is possible in a language like English where the paucity of aspectual morphology obscures the contribution of individual elements.³

There are three overt aspectual operators in Hindi: the progressive, the perfective and the imperfective. Examples are given below.

- (3) a. Amitabh so *rahaa* hai.
 Amitabh sleep PROG aux.PRES
 'Amitabh is sleeping.'
- b. Amitabh so-*yaa*.
 Amitabh sleep-PFV
 'Amitabh slept.'
- c. Amitabh so-*taa* hai.
 Amitabh sleep-IMPF aux.PRES
 'Amitabh sleeps.'

The progressive morpheme *rahaa* is a free morpheme that must be accompanied by a tense-specifying auxiliary. The perfective affixes directly to the verb

³ I believe that the analysis made here for Hindi could be straightforwardly ported over to English, but I am not in a position to make this argument thoroughly. So, for the purposes of this paper, the scope of the claims made about tense-modality interaction should be interpreted as applying mainly to Hindi, though the tantalizing possibility of crosslinguistic application is undeniable.

and requires no auxiliary. The imperfective also affixes directly to the verb, but must be accompanied by a tense-bearing auxiliary.

In line with uncontroversial assumptions that an aspectual operator is required in every clause to quantify over the VP-denoted event (see e.g. Bhatt and Pancheva 2003), a fourth operator is needed to handle future constructions. This operator must be phonologically null. I assume that Hindi has an operator, the *neutral* (following Smith 1991, Iatridou et al. 2001), that is present in these cases.⁴ The *neutral* (by hypothesis) sits between verb and *gaa*.⁵

- (4) Amitabh so-Ø-e-gaa
 Amitabh sleep-NEUT-SUBJ-gaa
 ‘Amitabh will sleep.’

The second relevant aspect of Hindi verbal/inflectional morphology is the auxiliary *ho*, which can be seen in (3a,c). As noted above, this auxiliary is required to set Tense in progressive and imperfective constructions. In this regard it is analogous to the English auxiliary *be*. A complication is that the auxiliary is potentially ambiguous between a simple tense-hoster and a perfect (analogous to English *have*). This ambiguity is illustrated using the progressive. (5a) shows the past form of the auxiliary (*thaa*) functioning solely as a tense-hoster. Similar to the English gloss, this sentence requires that the dancing event was ongoing when the speaker entered the room. (5b) shows that the auxiliary can be compatible with *since* adverbials, a hallmark of perfect constructions.

- (5) a. Jab maiN-ne kamre me pravesh ki-yaa, Amitabh nach
 When 1sg-ERG room in enter do-PFV, Amitabh dance
 rahaa thaa.
 PROG aux.PAST
 ‘When I entered the room, Amitabh was dancing.’
 b. Amitabh do baje se nach rahaa thaa.
 Amitabh 2 o’clock from dance PROG aux.PRES
 ‘Amitabh had been dancing since 2 o’clock.’

This ambiguity, however, is not observed with all aspectual morphemes. Unlike the progressive, the auxiliary is unambiguous when it immediately scopes over the imperfective. It can only be a tense hoster, not a perfect. The following tests show that the auxiliary cannot have a universal perfect reading (see Iatridou et al 2001).

⁴ Cross-linguistically these operators tend to be phonologically null (cf. Bulgarian, Iatridou et al. 2001) and are consistent with open-ended temporal intervals lacking rightward-bounds.

⁵ To keep down the clutter, I will not gloss the neutral aspectual marker in any of the coming examples.

- (6) a. Amitabh yeh baat (#hamesha) jaan-taa hai.
 Amitabh this thing (#always) know-IMPF aux.PRES.
 ‘Amitabh knows that.’ ≠ ‘Amitabh has always known that.’
- b. #pichhle saaloN me, Amitabh mumbai me reh-taa hai.
 Last years in, Amitabh Bombay in live-IMPF aux.PRES.
 #‘For the last few years, Amitabh has been living in Bombay.’

Iatridou et al. (2001) show that individual-level predicates can only take the adverb *always* in the perfect. We see that *always* is ungrammatical in such sentences. Languages, like Bulgarian, that do allow perfect-imperfective pairings allow *always* in such environments. The second test uses an adverbial similar to *late*, another adverb that forces a perfect reading (Iatridou et al 2001), and shows its use is ungrammatical. We can conclude that when the auxiliary surfaces with the imperfective it signals the presence of tense, and does no additional semantic work.

- (7) *[V-taa H_{OPERF}]
 Auxiliary *ho* is a tense auxiliary, *never a perfect*, when used in conjunction with an imperfective-marked Verb.

This will be important in coming sections.

Having familiarized the reader with the relevant bits of Hindi morphology, I turn back to the semantic restrictions on *gaa*’s interpretation.

2.2 More on the Interpretive Restrictions

We saw above that there are restrictions as to when certain readings of *gaa* are available. First, (2a), reprinted below, can only have a Future reading, not an Epistemic one. A useful description of the phenomenon is that an Epistemic reading is unavailable in the absence of a tense auxiliary. Lest one think lexical aspect is somehow responsible for the restriction in (2a), we see that the same restriction holds with verbs of all classes of aktionsart.

- (8) Amitabh kaam kar-e-gaa.
 ‘Amitabh will do work.’
 # ‘Amitabh must_{EPIST} work.’
- (9) a. Amitabh dilli me rah-e-gaa.
 Amitabh delhi in live-Subj-gaa
 ‘Amitabh will live in Delhi.’
 # ‘Amitabh must_{EPIST} live in Delhi.’
- b. Amitabh jawaab jaan-e-gaa.
 Amitabh answer know-Subj-gaa
 ‘Amitabh will know the answer.’
 # ‘Amitabh must_{EPIST} know the answer.’

To get the Epistemic readings that are unlicensed in the sentences above, one must apply imperfective morphology to the verb. This triggers use of the auxiliary *ho*.

- (10) a. Amitabh dilli me rah-taa ho-gaa.
 Amitabh delhi in live-IMPF aux-Subj-gaa
 ‘Amitabh must_{EPIST} live in Delhi.’
 b. Amitabh jawaab jaan-taa ho-gaa.
 Amitabh answer know-IMPF aux-Subj-gaa
 ‘Amitabh must_{EPIST} know the answer.’

In sum, these data suggest that *gaa*’s interpretive range is constrained by the structural position in which *gaa* finds itself.

The second restriction that we will be concerned with is that imperfective-marked verbs cannot have a forward-shifted IT. We see in (11) that habitual actions can either have a past or present IT, depending on the tense of the auxiliary. However, this shiftability is only observed with the present and past, an auxiliary bearing *gaa* cannot future-shift the IT, seen in (11b).

- (11) a. {pichhle | yeh} saal, Japan me chef ban-ke, Amitabh
 last | this year Japan in chef having-become, Amitabh
 chaaval bana-taa {thaa | hai}.
 rice make-IMPF AUX- $\{PAST \mid PRES\}$
 ‘Last/this year, having become a chef in Japan, Amitabh used to
 cook/cooks rice (habitually)’
 b. *Agle saal Japan me chef ban-ke, Amitabh chaaval
 next year Japan in chef having-become, Amitabh rice
 bana-taa ho-gaa.
 make-IMPF AUX-gaa
 →‘Next year, having become a chef in Japan, Amitabh will cook
 rice (habitually)’

Observe that there is nothing *conceptually incoherent* about talk of habitual actions in the future, so this phenomenon appears to be a candidate for receiving a *grammatical*, rather than conceptual explanation.

To sum up this section, *gaa* exhibits the following restrictions.

- (12) a. In the absence of *ho*, **gaa*_{EPIST}
 b. In conjunction with an Imperfective-marked Verb, **gaa*_{FUT}

The analysis laid out in the subsequent sections will seek primarily to give an account of these two restrictions. My contention is that these two restrictions fall out of a height-relative modal analysis of *gaa*.

3 What’s in a Modal?

Kratzer (1981,1991) presented a unified analysis of modals with variable interpretations. Essentially, her insight was that despite the interpretive variability, the *mays* in both of the sentences below are instantiations of one and the same lexical item.

- (13) a. John *may* play alone all day in the basement, if that is what he wants.
 b. John *may* play alone all day in the basement, for all I know. I never see him anymore.

(13a) is read as though the speaker is granting permission to John to indulge his solitary streak. (13b) is an epistemic claim; the speaker is asserting that it isn't incompatible with her knowledge of the world that John has the habit of playing alone in the basement. According to Kratzer a modal's lexical entry must contain, (i) specification of modal force (quantificational strength), (ii) an underspecified MB parameter that provides the set of worlds the modal quantifies over, and (iii) an under-specified parameter for ordering source (OS) which imposes an ordering on the set of worlds in the MB such that the modal ends up quantifying over the best worlds therein. In her system various permutations of the contextually supplied MB and the OS produce the range of modal flavors. To illustrate using the examples in (13), the variability can be explained as follows. In (13a), the MB is circumstantial. The possible worlds that are quantified over are compatible with the circumstances or facts at the utterance time (t^*) and the real world (w^*) and with a deontic OS. It states that there is at least one possible world that is compatible with the state of the world as it is now and which best obey the speaker's orders in which John plays alone all day in the basement. For (13b) the MB changes to an epistemic one, while the ordering source changes to one that is 'totally realistic'. Rather than worlds that are compatible with the circumstances, the speaker is quantifying over worlds that are compatible with her beliefs or knowledge at the utterance time.

This type of analysis is what I propose for *gaa*. In her original work on modals, Kratzer abstained from analyzing their temporal properties, but recent work has extended the Kratzerian program into the temporal-modal domain (see, for example, Condoravdi 2002). The idea remains the same, variety in interpretation is linked to variety in kinds of MBs. I follow the spirit of this recent work and suggest it is one and the same *gaa* that contributes either Future or Epistemic readings, the only difference being what MB the modal takes. One problem facing such a Kratzerian account, though, stems from the mechanism by which MBs are selected. According to Kratzer, MBs are determined contextually/pragmatically, without appeal to grammatical licensing conditions. In principle this predicts that a modal can take any MB. This freedom leads to overgeneration.

3.1 Future-shifting Modals

Abusch (1998) outlined an approach to what she referred to as 'forward-shifting' modals. Her claim was that certain modals, such as *will* and *would*, have future-orientation hardwired into their denotations. For Abusch this meant that these modals supplied the open-ended interval (t^*, ∞) as the temporal argument for whatever prejacent proposition they combined with. Con-

doravdi (2002,2003) adopts a very similar position. These analyses place the modal directly in the scope of a tense, which sets the left-hand boundary of the open-ended interval. The analysis works well for deriving the desired future readings. However, when the same denotations are used for epistemic meanings, matters get more complicated. To illustrate, take (a simplified version of) Condoravdi’s denotation for *woll*, which she argues is the operator responsible for future-shifting with English *will* and *would*, as well as for Epistemic readings of *will*.

$$(14) \quad \llbracket \textit{woll} \rrbracket = \lambda t. \lambda P. \lambda w. \forall w' \in \text{MB}(w,t) \rightarrow P(w')(t,\infty)$$

The formula above takes a property P and passes it a world and a temporal argument. The world argument (w') is a world variable that is universally bound. The formula says that for all worlds in the MB (accessible from the world w and the evaluation time t), the property P holds in that world. The temporal argument that is passed to P is the open-ended interval (t,∞) , where t is a time provided by tense. *Woll* is, by definition, always evaluated with respect to some open-ended interval.

When the modal scopes under Present tense, the lefthand boundary of the time interval provided *woll* is set to t^* (the utterance time). This means that a sentence *present + woll ϕ* can be judged true as long as there is an event of ϕ -ing at some point in the interval (now,∞) -that is, either the present or the future. In conjunction with the traditional Kratzerian pragmatic MB-determination, we see that Epistemic modality and future orientation should, in principle, be possible at the same time. While this does not seem too problematic for *will*, a similar account cannot be given to *gaa*. Sharma (2008) has an extensive discussion of the temporal interpretation of Epistemics, in which he notes that Epistemic and Future readings are in (near)⁶ complementary distribution. For example, (15) shows that the epistemic perfect cannot get a future IT. That is, (15) cannot be used to talk about presumptions made about some future action of Amitabh’s that will be completed in the future.

- (15) Amitabh (#kal) venis me ghum gayaa ho-gaa
 Amitabh (tomorrow) Venice in walk go-PFV AUX-gaa
 ‘Amitabh must have gone to Venice (# tomorrow)’⁷

⁶ The qualification ‘(near)’ is required above because a kind of future-orientation and Epistemic reading can co-occur when the clause contains a progressive operator (cf. Sharma 2008). Sharma does not analyze them as such, but I assume that these sentences are actually Epistemic *futurates* (cf. Copley 2002, among others), where the future-orientation is provided by aspectual morphology and not *gaa*. An example:

- (ii) Ramu kal venis me ghuum rahaa ho-gaa.
 Ramu tomorrow Venice in walk PROG aux-gaa.
 ‘Ramu must be walking in Venice tomorrow.’ (Sharma 2008: example 7)

⁷ ‘Future perfect’ readings require use of a compound verb construction. I set such sentences aside, though I do not think they are problematic for the account sketched here.

An account that decouples the forward-shifting ability of the modal from its MB specification will not be able to handle this fact.

I now present a unified Kratzerian analysis of *gaa* that does not fall victim to this problem of overgeneration. Such an account can be given provided we modify our assumptions about the nature of MBs. Specifically, what I will argue is (i) MB selection is constrained by the position of the modal and (ii) future orientation comes from the Metaphysical MB itself, not the modal.

4 The Analysis

In this section I lay out my treatment of *gaa*. I posit only one lexical entry for *gaa*, on both its Future and Epistemic readings. As stated before, I take *gaa* to be a Kratzerian modal, which, recalling Kratzer's take on modals, means there are three things I must discuss. First, I assume that the differences in the interpretation of *gaa* is determined by the MB that *gaa* takes. The MB may be epistemic, or, in the case of future orientation, *Metaphysical* (Condoravdi 2003, Thomason 1984). The role of the Metaphysical MB will be discussed in later sections. As for quantificational force, I assume that *gaa* is a necessity/universal modal. That epistemic uses of *gaa* have universal force is easily shown.

- (16) Amitabh aam khaa-yaa ho-gaa, (#par ho sak-taa hai
 Amitabh mango eat-PFV aux-gaa, but be can-IMPF aux.PRES
 ki us-ne aisaa nahii ki-yaa).
 C 3sg-ERG so NEG do-PFV.

‘Amitabh must have eaten mango, (# but it's possible that he didn't).’

Following the tradition of modal accounts of future *will*, I assume that future *gaa* involves universal quantification as well - just over possible futures, not epistemically accessible worlds. When one makes a statement with future *gaa*, one makes a statement about all (relevant) possible futures, not just one.⁸ Finally, while I have nothing more to say about it here, *gaa* may select an ordering source. Presumably, the ordering source would be required to restrict the set of futures considered, and to rank them (see Werner 2007 for a discussion of the need for ordering sources with future-oriented *will*). As a foretaste, below is a rough template for the lexical entry I will assign to *gaa*. This entry draws heavily on the analysis of *woll* in Condoravdi (2003).

- (17) $\llbracket gaa \rrbracket^{g,c} = \lambda P. \lambda t. \lambda w. \forall \alpha \in \text{MB}(w,t) \rightarrow P(\alpha)$ ⁹

⁸ A contextual restriction similar to that observed with interpretations of the past, as discussed by Partee (1973) is required for restricting the relevant time interval for future claims. Were there no such restriction, we would expect the following sentence to be grammatical.

(iii) #John will turn off the stove and John will not turn off the stove.

⁹ I am assuming that semantic evaluation is done relative to an assignment function, *g* and a context *c*.

I have used α as a metavariable to stand in for types of alternatives. In Condoravdi's definition for *woll*, the modal quantifies solely over possible worlds, so this type of notation is not used. I will argue that *gaa* is capable of quantifying over different types of alternatives, not just worlds. I will return to this issue but for now the entry above should suffice.

What remains to be discussed in this section is how *gaa* interacts with Tense, both structurally and in terms of the division of semantic labor. As briefly alluded to in the previous section, standard modal theories of future-shifting *will* treat it as an operator in the scope of Tense. Condoravdi (2003) extends this treatment to epistemic *will* as well. I argue that this is not the appropriate way to treat *gaa*, on either of its readings. I present an argument that epistemic *gaa* cannot sit in the scope of T, but must scope above it. I also argue that in the case of future-oriented *gaa* no Tense operator exists in the clause: Future orientation comes not from Tense, but from the Metaphysical MB itself. On this analysis, the different interpretations of *gaa* correlate with difference in structural position.

4.1 Structural Position and Tense

To begin fixing ideas about *gaa* and its interactions with Tense, let's consider how the ET of *gaa* is set. When *gaa* appears in the matrix clause, its evaluation time is always the utterance time (t^*), irrespective of whether it is Epistemic or Future. For the Epistemic reading, this means the modal claim is evaluated with respect to the speaker's present beliefs/knowledge. For Future readings, this means that the possible futures considered are those that emanate from the present.

Sharma (2008) shows that Epistemic imperfective constructions can have a back-shifted IT when paired with past-oriented temporal adverbials, seen in (18a,b). (18a) is originally due to Sharma, (18b) is an example of my own devising. While there is some inter-speaker variation with respect to the judgment of (18a), all speakers I have consulted accept (18b). What is especially interesting about these examples, though Sharma does not mention this, is that the modal's ET in both of the sentences below is immune to the back-shifting influence, as shown in (19). (19) cannot be taken to be a claim made from the speaker's prior epistemic state.

- (18) a. Raamu pichhle saal bahut aam khaa-taa ho-gaa.
 Ramu last year many mango eat-IMPF aux-gaa
 \approx 'It must be the case that Raamu used to eat a lot of mangoes.'
 (data from Sharma 2008)
- b. (*After coming across a CD on which Ramu, a man who lost both of his hands in a tragic accident, is credited as a jazz pianist.*)
 Haath katne se pehle, Raamu piano bajaa-taa ho-gaa.
 Hand cut from before, Ramu piano play-IMPF aux-gaa
 'Before losing his hands, Ramu must have played piano.'

- (19) Raamu pichhle saal bahut aam khaa-taa ho-gaa, (#par maiN
 Ramu last year many mango eat-IMPF aux-gaa, but 1sg
 abhi jaan-taa huN ki us-ne aisa nahiiN ki-yaa).
 now know-IMPF aux.PRES C 3sg-ERG so NEG do-PFV
 ≠ ‘It must have been the case that Raamu used to eat a lot of mangoes,
 (#but now I know that’s not true).’

When embedded under an attitude verb, *gaa*’s ET may be back-shifted to the internal now of that attitude.¹⁰ This is shown for both Epistemic and Future readings of *gaa*.

- (20) a. Amitabh-ne soc-aa thaa ki Saif aam pasand
 Amitabh-ERG think-PFV aux.PAST C Saif mango like
 kar-taa ho-gaa, par abhi woh jan-taa hai ki yeh
 do-IMPF aux-gaa, but now 3sg know-IMPF aux.PRES C this
 galat thaa.
 wrong aux.PAST
 ‘Amitabh thought that Saif must eat mangoes, but now he know’s
 that’s wrong.’
- b. Amitabh-ne parson soc-aa thaa ki Saif kal
 Amitabh-ERG 2.days.ago think-PFV aux.PAST C Saif tomorrow
 dukaan jaa-e-gaa.
 store go-Subj-gaa
 ‘Amitabh thought 2 days ago that Saif would go to the store yes-
 terday.’

I take these data to warrant the conclusions:

1. Epistemic constructions require tense specification.
2. Epistemics do not sit in the scope of the tense operators, contra Condoravdi (2003).

Here is how we arrive at conclusion 1. Given that a perfect is not licensed with imperfective morphology, as shown in section 2 - (7), we can conclude that the backshifting observed in the previous examples is due to Tense. This entails that in (18b) the backshifted IT of the modal is set by *past*. If this is correct, specification of ET and IT are dissociated in the lexical entry of *gaa*, unlike Condoravdi’s (2003) entry for *woll*.

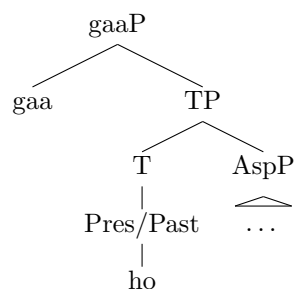
As for conclusion 2: We see that the an Epistemic modal’s ET stays fixed at the utterance time in matrix contexts, regardless of the IT of the predicate. Yet (20) shows that Epistemic *gaa*’s ET can be shifted when it is scopes under an attitude verb (and by extension the tense of the superordinate clause). I take this to mean that Epistemic *gaa*’s ET is syntactically set (as in denotation

¹⁰ Interestingly, this back-shifting is only possible in the presence of an overt tense auxiliary in the matrix clause. If the embedding attitude verb is a bare perfective, the back-shifting is not possible.

17). Given this, were Epistemic *gaa* to sit below the tense operator, we would wrongly expect back-shifted ETs in matrix environments.¹¹

If epistemic *gaa* is to sit above Tense, it must be of the right type to compose with TPs/propositions (type $\langle st \rangle$). This is a relatively uncontroversial assumption supported by cross-linguistic evidence. Cinque (1999), Stowell (2003) and many others have argued that epistemic modals sit above Tense, while Polletto and Zanuttini (2003) show that various modal operators sit at a similar level in the clause.¹² Given the argument above, I assume epistemic *gaa* surfaces in the following structural configuration.

(21) EPISTEMIC



The relationship with Future *gaa* and Tense is a different matter. Above we saw motivation for tense operators with Epistemics. Here I offer morphological evidence that tense operators are not present in Future constructions.

With Futures *gaa* does not appear attached to a tense auxiliary. Anand & Nevins (2006) and Davison (2002) have argued that the non-perfect auxiliary *ho* is the obligatory spell-out of the T head.¹³ If this is correct, we can conclude that the auxiliary's absence in future constructions like (22a) indicates the absence of a T head. If T were in the clause, we might expect (22b-e) as possible structures, contrary to fact.

(22) a. Amitabh kaam kar-e-gaa.
Amitabh work do-Subj-gaa

¹¹ Condoravdi (2003) avoids backshifted ETs for epistemics with the stipulation that epistemic modals cannot scope directly below PAST. This stipulation is avoided on my proposal that Epistemics do not fall in their direct scope.

¹² There is additional morphological evidence for *gaa* sitting above Tense, based on the linear order of morphemes. In Epistemic constructions, the auxiliary is what *gaa* attaches to. In Hindi, there is a relatively straight-forward mapping from linear to hierarchical order in the T domain. Roughly speaking, the more right-lying an affix or head appears in the linear string, the higher it is in the tree. *Gaa* consistently surfaces to the right of the tense auxiliary.

¹³ The sequence of tense facts discussed in relation to the ET of *gaa* offer suggestive support for the idea that tense specification is predicated on the presence of the auxiliary. Recall that back-shifting the ET of *gaa* to the internal now of the predicate is only possible when an auxiliary is present in the embedding clause. Demonstrating the exact role of Tense in those constructions, however, is beyond the scope of this paper, so I leave the discussion of such facts for later work.

- ‘Amitabh will do work.’
- b. *Amitabh kaam kar ho-gaa
 - c. *Amitabh kaam kar-e-gaa ho
 - d. *Amitabh kaam kar-gaa ho
 - e. *Amitabh kaam kar-e ho-gaa

Therefore, I conclude that in Future sentences like (2a) above, Tense is not present: *gaa* composes with AspP directly, as shown below.



The reader may wonder what precludes a tense from immediately scoping over *gaa* in future constructions. I assume this is due to a syntactic restriction in Hindi that prevents *gaa* from appearing in a position immediately dominated by a T head. This restriction will hopefully become clear as I now lay out my assumptions regarding the semantics of Tense in order to show how the ET of *gaa* is set.

In order to formalize the relationship between *gaa* and Tense, I will adopt Kratzer’s (1998) system of tenses as pronouns. Nothing crucial for my analysis hangs on this assumption - I have chosen to work with this theory largely for its simplicity. The theory makes three tenses available: *past*, *pres* and a *zero* tense. Unlike *past* and *pres*, zero tenses must be bound to be interpreted.

- (24) a. $[[pres]^{g,c} = t$, only defined if c provides an interval that includes the utterance time
- b. $[[past]^{g,c} = t$, only defined if c provides an interval that precedes the utterance time
- c. $[[\emptyset_n]^{g,c} = g(n)$

I assume that the non-perfect auxiliary *ho*, observed in most of the examples above, is the overt spell-out of either *pres* or *past*. This is in line with proposals made by Anand & Nevins (2006) and Davison (2002). Zero tenses in Hindi do not have overt exponents, nor do they function as syntactic T heads the way *pres* and *past* do.

We have seen that *gaa*’s ET must be set syntactically (by a Tense), but I have argued that Epistemic *gaa* sits above Tense in its clause, and that clauses containing Future *gaa* lack Tense morphology, and hence, a T head. How, then, are the ETs to be set? The basic idea is simple. I will assume that unbound temporal arguments default to the utterance time, making of zero tenses to saturate unbound time arguments at the matrix level. Kratzer (1998) assumes that binders are present in embedded contexts to bind zero tenses. Porting Percus’ (2000) proposal for representing worlds syntactically over to tenses, I assume that a default binder, represented as λ_θ , sits at the top of every sentence. The only real difference between this account and Kratzer’s is

that we simply assume binders are also present in matrix environments. The difference between matrix and embedded binders is that embedded binders receive their index from a c-commanding tense. I assume that matrix binders bear the index 0, which automatically defaults to the utterance time. In the event that the matrix clause returns a phrase of type $\langle i, wt \rangle$, I assume that a zero tense is inserted below the binder, as shown below.



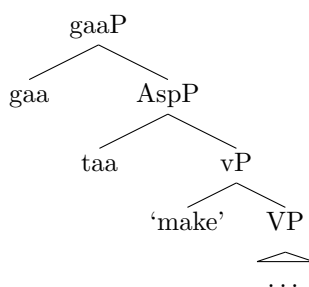
It should be stressed that the viability of the general argument of this paper does not rest on the particular technical implementation of default binding. The choice to use zero tenses and default binders to track the utterance time and bind unsaturated time arguments was made for reasons of convenience and consistency. Other possible implementations include having Kusumoto's indexical t^* scoping over the matrix clause, or Lin's (2006) rule that saturates all unbound temporal arguments of sentence-level phrases with the utterance time.

Before wrapping up this section, let's consider some of the implications of this account of Tense. The absence of (non-zero) Tense in future constructions prompts us to question the existence of a future tense in Hindi. Adopting Kratzer's system led to positing only three semantic tenses, to the exclusion of a tense such as *fut*. I believe that this is the correct analysis. That is, there is no reason to posit a future tense, *fut*, on par with *past* or *pres* (cf. Klecha 2009, Kratzer 1998, Lin 2006, Matthewson 2006). This analysis has a welcome consequence. If there is no *fut* in Hindi, a very simple morphological explanation offers itself for the second semantic restriction, that we set out to explain (12b). The lack of a Future-oriented reading of imperfective constructions follows from the lack of *fut*. Recall that imperfective-marked verbs cannot have a future IT, shown again in (26b):

- (26) a. {pichhle | yeh} saal, Japan me chef ban-ke, Amitabh
 last | this year Japan in chef having-become, Amitabh
 chaaval bana-taa {thaa | hai}.
 rice make-IMPF AUX- $\{PAST | PRES\}$
 'Last/this year, having become a chef in Japan, Amitabh used to
 cook/cooks rice (habitually)'
- b. *Agle saal Japan me chef ban-ke, Amitabh chaaval
 next year Japan in chef having-become, Amitabh rice
 bana-taa ho-gaa.
 make-IMPF AUX-gaa
 \rightarrow 'Next year, having become a chef in Japan, Amitabh will cook
 rice (habitually)'

Recall that auxiliaries scoping directly over Impf-V complexes are only Tense auxiliaries, that is, the spell out of T heads. The absence of *fut* entails the absence of a tense auxiliary. On my account, the Future imperfective counterpart (26) would be the impossible string (27a) and structure (27b).

- (27) a. *Agle saal Japan me chef ban-ke, Dev chaaval
 next year Japan in chef having-become, Dave rice
 bana-taa -gaa.
 make-IMPf -gaa
- b. *!



In Hindi overt aspectual morphology prevents the verb root to which it affixes from bearing additional suffixes. As a bound morpheme *gaa* must affix to a verbal/auxiliary host. Without the tense auxiliary, *gaa* is left stranded, blocked from affixing to the verbal root by the imperfective morphology.¹⁴

4.2 No *gaa* but *gaa*

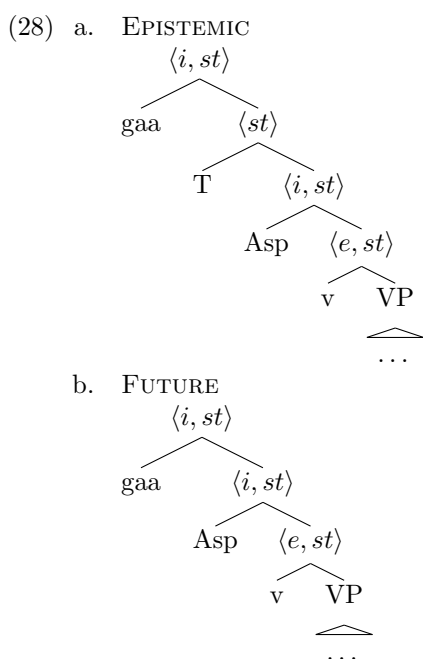
From a syntactic or descriptive point of view, it seems that the Epistemic interpretation arises when *gaa* scopes high, and the Future reading arises when *gaa* scopes low. One option for accounting for varied the interpretive (and apparent syntactic) behavior of *gaa* would be to posit two *gaas* -one an epistemic modal, the other a future-shifting tense operator. However hardwiring the desired interpretations into two separate lexical items would fail to provide a satisfying explanation for at least two facts. The first is the crosslinguistic generalization that future markers often do double duty as modal operators (see Condoravdi 2003 for some examples). The recurrent crosslinguistic connection between modals and future markers suggests a deeper connection between future reference and modality. Positing two lexical entries treats the phenomenon as nothing more than a morphological accident. The second fact that a two-*gaa* account would be hard-pressed to explain is the reliable correlation between height and modal flavor. Any such theory would require auxiliary assumptions to explain the apparent complementary distribution of interpretations.

Instead of positing two separate *gaas*, I propose that there is only one *gaa* in the lexicon - and that its structural position constrains its interpretation. This kind of strategy is most similar to the work of Hacquard (2006,

¹⁴ An alternative way of deriving the same result is to assume that Imperfective morphology requires a local T head in order to be licensed.

2010) who used an event-relative system to derive the root-epistemic split, in that it seeks to explain the apparent association of modal flavor and modal syntax exploiting independent properties associated with syntactic position to constrain what MB-choice. While similar in spirit, the account proposed here differs from Hacquard in important details.¹⁵ Where Hacquard's account is *event-relative*, the system outlined here makes no reference to events, only *types* of alternatives.

In the foregoing section, I sketched the different structural configurations that gave rise to each interpretation. These diagrams are repeated below, with the phrasal category from the previous diagrams replaced with the semantic type of each phrase. I argue that the epistemic interpretation arises when *gaa* takes a tensed proposition (type $\langle st \rangle$) as its sister, whereas future orientation comes when *gaa* merges with a property of times ($\langle i, st \rangle$) - directly above Aspect phrase (AspP).



This type of analysis necessitates giving *gaa* a flexible type, since it can take complements of two different types (either $\langle \langle i, st \rangle, \langle st \rangle \rangle$ for Epistemics, or $\langle \langle i, st \rangle, \langle i, st \rangle \rangle$ for Futures). This problem does not arise in Butler's (2003) structural-determination system or Hacquard's, because both accounts assume the two places modals can attach are above TP or v/VP, which are both 'propositional'. Recall the template for *gaa*'s lexical entry discussed earlier (17). We can now fill in one of the parameters of that underspecified entry, namely the type(s) of arguments *gaa* takes.

¹⁵ The current proposal is not necessarily incompatible with Hacquard's account, nor is it intended as an alternative to hers.

$$(29) \quad \llbracket gaa \rrbracket^{g,c} = \lambda P_{\langle i, st \rangle} / p_{\langle st \rangle} . \lambda t . \lambda w . \forall \alpha \in MB(w, t) \rightarrow P(\alpha)$$

Having established this much, we are now in a position to fill in the metavariable α . Previous research has shown root modals scope above VP, and Epistemics above TP. These analyses have treated these modals as type $\langle st, st \rangle$. What is important about this treatment of modals is that they take propositional prejacent. It seems to implicitly assume that the types of alternatives a modal quantifies over is linked to the unsaturated arguments of its prejacent. Propositions have unsaturated world arguments; the modals that combine with them only quantify over worlds. I propose to treat this codify this as a more general condition on modals.

$$(30) \quad \text{TYPE-ALTERNATIVE CORRESPONDENCE}$$

A modal, \mathcal{M} , quantifies over alternatives that are tuples (a, b, \dots) , where the sister of \mathcal{M} is of type $\langle a, \langle b, \langle \dots, t \rangle \rangle \rangle$

With this in mind, I propose that there are two ways to fill the metavariable α in, yielding two denotations for gaa . These are given below.

$$(31) \quad \llbracket gaa \rrbracket^{g,c} = \begin{cases} \lambda p_{\langle st \rangle} . \lambda t . \lambda w . \forall (w) \in MB(w, t) \rightarrow P(w) & \text{(when sister is TP)} \\ \lambda P_{\langle i, st \rangle} . \lambda t . \lambda w . \forall (w, t) \in MB(w, t) \rightarrow P(w, t) & \text{(when sister is AspP)} \end{cases}$$

Though this may seem like a bit of technological legerdemain amounting to lexical ambiguity, it is not. I do not propose that both of these versions of gaa are stored in the lexicon. Rather, one gaa is stored, and its type (either $\langle \langle i, st \rangle, \langle i, st \rangle \rangle$ or $\langle \langle st \rangle, \langle i, st \rangle \rangle$) is determined by the context of insertion. When circumstances call for gaa of a different type than the one stored, we simply change the type of gaa . Regardless of its type gaa retains its force specification, as well as its unspecified MB parameter. Gaa remains a lexical item that quantifies over possible alternatives. Whether those alternatives are world-time pairs, or just worlds is (as far as the identity of gaa is concerned) immaterial. The semantic and syntactic core of gaa remain constant. More importantly, the actual *denotations* themselves are silent about the *flavors* of modality allowed. As yet, neither of the denotations is prohibited lexically from taking either an epistemic or Metaphysical MB. So we're left with this question: *Why must Epistemics compose with tensed complements, while Futures must compose with properties of times?* I will argue that this is a consequence of the type of alternatives provided by the MBs that gaa can key to.

4.3 The Role of Modal Bases

In Kratzer's original conception, all MBs range over worlds that conform to a particular accessibility relation. For example, the Circumstantial MB is a collection of worlds consistent with the circumstances in the actual world. The Epistemic MB is the set of worlds consistent with an agent's knowledge.

$$(32) \quad \text{CIRCUMSTANTIAL}$$

$\{ w' : w' \text{ is a world consistent with the circumstances in } w^* \text{ (at } t^*) \}$

EPISTEMIC

$$\{ w': w' \text{ is a world consistent with what is known in } w^* \text{ (at } t^*) \}$$

A view of the future as unsettled or open is the foundation of modal approaches to the future. Time is seen as a ‘frayed rope’ or a ‘broomstick’ (Werner 2007), with a single, settled past and multiple futures issuing forth from the present. Modals can quantify over these future branches. The Metaphysical MB has been characterized as the set of worlds that are historical alternatives to one another (Condoravdi 2003, Kissine 2008). This means that it is the set of worlds which share the same history up to the ET of the modal.¹⁶ The worlds in the set differ from one another with respect to the series of events that take place in each world following the evaluation time.

While the Metaphysical MB is the dedicated MB for future readings in accounts like Condoravdi’s, its association with future orientation is often arrived at indirectly. In the Condoravdian system present- and past-oriented uses of modal expressions keyed to the Metaphysical MB are ruled out by a *Diversity Condition* on modal utterances. Despite the fact that the use of the MB is restricted to future-oriented utterances, the modal itself is the locus of future-orientation (as the open-ended interval is part of its denotation).

I propose that we treat the Metaphysical MB differently than the epistemic MB. Epistemic modality is dissociable from temporal perspective. As we’ve seen the temporal orientation of an epistemic modal’s prejacent can either be past- or present-oriented. Metaphysical modals are restricted to *future*-orientation.

(33) As far as I know, John must {eat | have eaten} mangoes.

(34) a. John will go to the store (*yesterday).
 b. John said on Friday that he would go to the store (last {*Thursday | Saturday})

Epistemic and Metaphysical MBs differ in the role of a modal’s ET vis-a-vis its IT. An Epistemic modal’s ET is distinct from its IT, whereas a Metaphysical modal’s ET determines, in part, the modal’s IT. All of this is to say that Metaphysical modality and future temporal reference are inextricably linked. I propose that we should make this interdependence explicit, and separate the Metaphysical MB from other MBs in terms of the *types of alternatives* it ranges over. I suggest that, rather than a world, each branch represents a world-time pair (w,t), where the temporal argument is some time on the future branch.¹⁷ To characterize the set:

¹⁶ For an earlier, and more technical, discussion of Metaphysical modality and future reference, see Thomason (1984) and Thomason (1970).

¹⁷ It is also possible that the time argument supplied by the MB as the open-ended interval (t^*, ∞) . The analysis chosen will have obvious consequences for the denotations of aspectual operators, but these consequences are largely irrelevant to the point of the current paper.

- (35) METAPHYSICAL MB
 $\{(w',t'): (w',t') \text{ is a Metaphysical alternative to } (w^*,t^*), \text{ where } t' > t^*\}$ ¹⁸

I propose that the t' supplied by the MB is used to saturate the time argument of the preajacent *gaa* takes as its complement. Unlike Epistemic sentences, which receive their temporal specification from Tense, Futures receive their temporal argument from the Metaphysical MB.

The distinction between the types of alternatives that the MBs quantify over is the crux of my analysis and its explanation for the interpretive restrictions discussed in section 2. By definition, the Metaphysical MB quantifies over future-oriented alternatives. By quantifying over Metaphysically accessible alternatives, the modal obtains its future orientation. It is unnecessary to hardwire future orientation into the denotation of the modal. We saw that Epistemics require their complement to have Tense specification. Were there a future Tense in Hindi, future-oriented Epistemics would be possible. As it is, the only method for obtaining future-orientation is via the Metaphysical MB. This explains the complementarity of Future and Epistemic readings in Hindi. When *gaa* composes with a property of times (AspP) Epistemic modality is blocked by type-mismatch. The only version of *gaa* suitable for merger with TP is the version that quantifies over worlds, not world-time pairs. A Future reading requires that the modal quantify over (w,t) pairs, so it will be excluded in the higher position. *Gaa* cannot key to a Metaphysical MB when a time is already specified by Tense. The converse is true when *gaa* scopes low, attaching directly above Asp. In such cases, *gaa* is forced to quantify over (w,t) pairs, which only Metaphysical alternatives are.

To return briefly to the correlation between modal-position and possible interpretation: On our analysis the correlation is not arbitrary. Future readings arise when the modal is lower because the Metaphysical MB requires manipulation of (w,t) pairs, not worlds alone. I commit to the strong prediction that the inverse of the restriction discussed in (2, repeated below) is not possible in natural language. We expect not to find a language where the Epistemic, but not the Future, reading is licensed in a configuration like this.

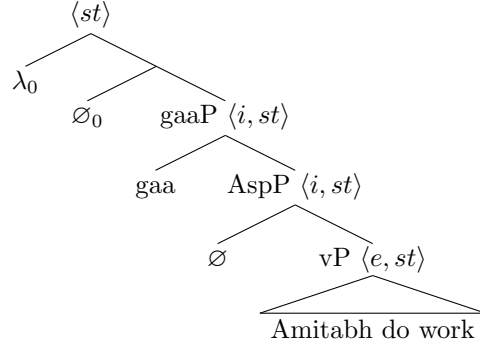
- (36) Amitabh kaam kar-e-gaa.
 Amitabh work do-Subj-gaa
 ‘Amitabh will work.’ OK Metaphysical MB
 # ‘Amitabh must_{EPIST} work.’ * Epistemic MB

¹⁸ While I have explicitly included the future orientation in the definition, it's also possible to view the future orientation as a presupposition or a precondition on felicitous use (such as Condoravdi's 2003 *Diversity Condition*).

5 Examples

I now provide example derivations of (2a) and (2b). I begin with (2a). Following the template sketched in section 4 we can assign the LF in (37a) to (2a).

(37) a. Amitabh kaam kar-e-gaa.



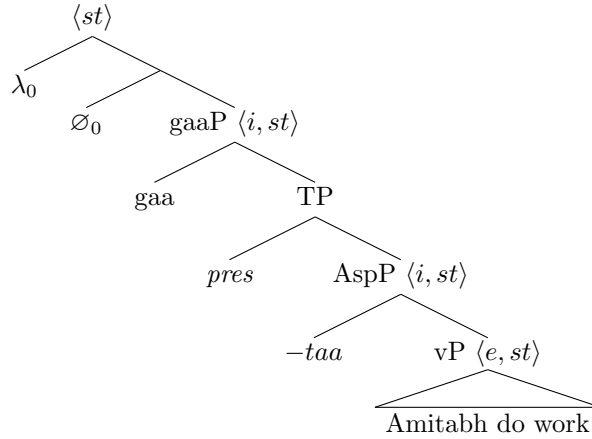
- b. $[[vP]]^{g,c} = \lambda e. [\text{doing}(e, \text{Amitabh}, \text{work}) \text{ in } w]$
 $[[AspP]]^{g,c} = \lambda t. \lambda w. \exists e. [\text{doing}(e, \text{Amitabh}, \text{work}) \text{ in } w \ \& \ \tau(e) \subseteq t]$
 $[[gaaP]]^{g,c} = \lambda t. \lambda w. \forall (w', t') \in MB(w, t) \rightarrow \exists e. [\text{doing}(e, \text{Amitabh}, \text{work}) \text{ in } w'] \ \& \ \tau(e) = t'$

Despite the lack of overt aspectual morphology (2a), I assume the phonologically null *neutral* operator (discussed earlier) to head AspP in (37a).¹⁹ Following standard assumptions I assume that the Asp head is necessary for existential closure of the event introduced by the VP and for introducing the time variable for the run time of the event. We merge *gaa* directly to the property of times. The only compatible type for *gaa* in this position is $\langle \langle i, st \rangle, \langle i, st \rangle \rangle$. At the end of the derivation, the zero tense saturates the open slot and, when bound, provides the utterance time as *gaa*'s ET. In this derivation we see why the epistemic MB is precluded. Given its position in the tree, the only compatible type for *gaa* was $\langle \langle i, st \rangle, \langle i, st \rangle \rangle$. When that is *gaa*'s type, it is only compatible with the MB that provides (w,t) alternatives - the Metaphysical. Future orientation comes from the MB, which requires t' to be subsequent to t^* .

Now to give a derivation of the Epistemic (2b).

(38) a. Amitabh kaam kar-taa ho-gaa.

¹⁹ Use of the *neutral*, it seems, is predicated on the Absence of a T head.



- b. $\llbracket vP \rrbracket^{g,c} = \lambda w. \lambda e. [\text{doing}(e, \text{Amitabh}, \text{work}) \text{ in } w]$
 $\llbracket AspP \rrbracket^{g,c} = \lambda w. \lambda t. \exists e. [\text{doing}(e, \text{Amitabh}, \text{work}) \text{ in } w \ \& \ \tau(e) \circ t \ \& \ e \text{ is non-atomic}]$
 $\llbracket TP \rrbracket^{g,c} = \lambda w. \exists e. [\text{doing}(e, \text{Amitabh}, \text{work}) \text{ in } w \ \& \ \tau(e) \circ t \ \& \ e \text{ is non-atomic}]$
 $\llbracket gaaP \rrbracket^{g,c} = \lambda t'. \lambda w. \forall w \in MB(w, t') \rightarrow \exists e. [\text{doing}(e, \text{Amitabh}, \text{work}) \text{ in } w' \ \& \ \tau(e) \circ t \ \& \ e \text{ is non-atomic}]^{20}$

The denotation for the vP in this example is the same as the one given above. Differences between the two structures emerge at the level of $AspP$. Following (and brutally simplifying the work of) Ferreira (2005), I assume that the imperfective morpheme *taa* existentially quantifies over a non-atomic event (hence producing the generic or habitual reading). Merger of the *present* tense pronoun follows.²¹ Subsequently, it is possible to merge *gaa* with the tensed proposition. The only version of *gaa* possible in this position is that of type $\langle \langle st \rangle, \langle i, st \rangle \rangle$. The version of *gaa* used in this construction only permits manipulation of worlds, so the Metaphysical MB is ruled out. So, we see that the account proposed can both derive the observed meanings, and exclude the unattested ones.

6 Remaining Issues

6.1 Future Perfects

So far, the majority of the cases considered in this paper were either simple Future or Imperfective constructions. When one takes Future Perfects into consideration, the picture initially appears more muddled than I have made it

²⁰ I have used t' in the example derivation to distinguish the abstracted time variable that serves as the ET in the denotation of the modal from the temporal pronoun (t) provided by *pres* Tense. It should not be confused with the use of t' in the previous example.

²¹ In the case of (18) with back-shifted IT, Tense would be *past*, instead of *present*.

out to be. Upon closer scrutiny though, Future Perfect constructions, in fact, lend support to the analysis proposed here.

Take the Future Perfect construction below.

- (39) Amitabh-ne kal tak apnaa kaam puraa kar li-yaa
 Amitabh-ERG tomorrow by self's work all do take-PFV
 ho-gaa.
 aux-gaa
 'Amitabh will have finished his work by tomorrow.'

In (39) we see *gaa* attached to the perfect auxiliary and perfective aspectual morphology on the (compound) verb. (39) clearly has a future orientation, shown by the felicity of the adverb *kal tak* (by tomorrow). This example is interesting for at least two reasons. First, it militates against an analysis that places the locus of future orientation in the neutral aspectual morpheme, as opposed to *gaa* itself. The *neutral* is not present in the structure, yet future orientation is nevertheless available. Second, while the example at first blush appears to undermine the correlation between attachment height and modal flavor, it does not. As formulated, the generalization was not that *gaa* was prohibited from receiving a future interpretation when attached to *any* auxiliary, but rather it was stated more narrowly. The prohibition was on future orientation when attached to a *Tense* auxiliary. The perfect auxiliary is not a *Tense* auxiliary, so it does not run afoul of our generalization. Future Perfects can be analyzed on par with simple Futures in not allowing a T head. If we treat the perfect auxiliary as type $\langle\langle i, st \rangle, \langle i, st \rangle\rangle$, Future Perfects conform to our analysis. The phrase headed by the Perfect operator is of type $\langle i, st \rangle$; when *gaa* composes with the Perfect phrase directly, Metaphysical flavor is predicted.

6.2 Future Imperatives

One question is whether the account sketched above can handle so-called Future imperatives. Forming the polite future imperative requires affixing *gaa* to the base imperative. Application of *gaa* makes the order incompatible with immediate realization. The following examples are due to Rajesh Bhatt (p.c.).

- (40) Amitabh-ji, yeh miThaai khaa-iyе/#-gaa.
 Amitabh-HON these sweets eat-2pl.IMP-#gaa
 'Amitabh, please eat these sweets.'
- (41) Agle saal jab aap Greece jaa-en-ge, to aap vahaan
 Next year when you Greece go-Subj-gaa, EMPH you there
 baklaavaa zaruur khaa-iyе-#(gaa)
 baklava sure eat-2pl.IMP-gaa
 'When you go to Greece next year, be sure to eat baklava.'

Here it seems that we have a legitimate case of future-orientation, contributed by *gaa*, above and beyond the ordinary forward-shift associated with deontic modality. If future-orientation with *gaa* must come from the Metaphysical MB, we are committed to analyzing these constructions as doubly-modal. This is not necessarily problematic. Consider the conditions under which an imperative must be uttered. The action must be able to be fulfilled. That is, deontic modality seems to presuppose or entail some kind of Metaphysical modality. If this is true, Metaphysical modality is compatible with deontic modality, and it's not *prima facie* incoherent to talk of the two potentially co-occurring in the same utterance. We can see the Metaphysical modal flavor contributed by *gaa* as essentially redundant since Metaphysically accessible worlds will be in a superset relation with those specified by the deontic MB. *Gaa*'s only (discernible) contribution would be the explicit specification of a future event time. I leave demonstrating this argument in any detail and following up on its implications to future work.

7 Conclusion

I have argued that a modal analysis of *gaa* on its Future and Epistemic readings can be given. The semantic type of *gaa*'s syntactic sister constrains the flavor of (non-root) modality that *gaa* can receive. Epistemic MBs were taken to be sets of worlds, whereas Metaphysical MBs were argued to be comprised of (w,t) pairs. When merged directly above AspP *gaa* takes complements of type $\langle i, st \rangle$ and is limited to quantifying over (w,t) pairs. As the Metaphysical MB is the only MB that yields over (w,t) pairs, Future orientation is the only possible flavor when *gaa* is merged in that position. When scoping over Tense, *gaa* is restricted to quantifying over worlds, limiting the choice of appropriate MBs to the Epistemic. The analysis fits in with recent work on structural-determination of MBs in that it argues for a direct mapping between modal height and flavor, however, it differs in that the MB selection procedure exploits the difference in types of alternatives that each MB quantifies over to derive the height-flavor correlation.

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