Selectional restrictions and tense-aspect in indicative conditionals

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Abstract

Certain indicative conditional devices across languages disallow a similar set of tense-aspect markings in the antecedent. However, these have not yet been examined as a unified phenomenon, and the source of the restrictions is not understood. Focusing on data from Bangla and English conditionals, I suggest that these share a common semantic core *IF-fut* which restricts the modal properties of the antecedent clause. Specifically: *IF-fut* presupposes that the proposition expressed by the antecedent is open in the historical modal base generated at the evaluation time. The interaction of historical modality with time derives the range of restrictions in temporal marking and interpretation in the antecedent, explaining why this specific set of tense-aspect categories across different languages cluster together for the purposes for this restriction. I show that independent properties of the tense-aspect-modal system of the language can interact with the constraint of *IF-fut* in predictable ways to explain observed cross-linguistic differences. This parallels other known divisions within conditionals that contrast primarily in the modal properties of the antecedent, and might constitute a linguistically-relevant divide within the typology of indicative conditionals.

1 Introduction: IF-fut

(1)   a. If he submits his paper to a journal, we will not publish it
      b. If he submitted his paper to a journal, we will not publish it

The indicative conditionals above (from Kaufmann (2005)) are usually taken to be expressed by the same conditional device (here, *if* in English). However, when we consider a different conditional device of English, we find that while (a) is acceptable, (b) is not:

(2)   a. <u>In the event that</u> he submits his paper elsewhere, we will not publish it
      b. ?? <u>In the event that</u> he submitted his paper elsewhere, we will not publish it

The conditional connective *jodi* in Bangla shows a parallel contrast:

(3)   a. jodi o paper-ta journal-e   submit kor-φ-e,   amra publish korbo   na
         if   he paper-CLF journal-GEN submit do-PRS-3, we   publish do.FUT.3 NEG
         If he submits the paper to a journal, we will not publish it

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      b. ?? jodi o paper-ta   journal-e   submit kor-l-o,   amra publish korbo
          ?? if   he paper-CLF journal-GEN submit do-PST-3, we   publish do.FUT.3
          na
          NEG
          Intended: If he submitted the paper to a journal, we will not publish it

In fact, a number of conditional devices across languages evidence a similar pattern of contrasts, including *in the event*; *in case*; conditional use of *and* in English, *jodi* in Bangla, *en cas de* in French, *falls* in German. While the most immediate difference between the sentences in (a) and (b) is the tense of the antecedent clause (present vs past), it is not merely past tense, but also a certain set of present-tensed aspect-marked clauses that are unacceptable with varying degrees of absolute-ness under all the conditional devices above. These include present progressive, present perfect, and present imperfective (habitual/generic) clauses. While tense-aspect restrictions in some of these expressions have been mentioned in the literature (Bagchi, 2005; Klinedinst & Rothschild, 2012), there is no systematic account of how to characterize the relevant difference between (a) and (b), what these conditional devices select for, and why. In this paper, I argue for treating these as a unified phenomenon and propose that these devices express a shared semantic core, informally called *IF-fut*. The immediate empirical goal of this paper is to account for the contrast between pairs like 2(a) and 2(b) in terms of a general constraint on IF-fut, focusing on facts from Bangla and English. I will propose that a subset of indicative conditionals (those that express IF-fut) restrict the modal properties of their antecedent. Specifically, IF-fut requires the truth of its antecedent to depend on times after the evaluation time t. This corresponds to a known (and well-studied) modal property: historical/metaphysical open-ness (Condoravdi, 2002).[1]

> **IF-fut(A)(B)**, when evaluated at a world w and time t, is undefined if either A or $\neg$A is necessary in the historical modal base generated in w at t

This is a lexically-stipulated presupposition, and its presence/absence constitutes a possible divide in the typology of indicative conditionals.

Let us examine the nature of the puzzle– the clearest linguistic indication of the contrast is the tense-aspect of the antecedent, and we want to know what, if anything, the disallowed antecedents have in common. This question is intricately tied to another set of facts that have been of great interest in the linguistic and philosophical literature on conditionals (Kaufmann, 2005; Rumberg & Lauer, 2023; Schulz, 2008; Crouch, 1994, a.o.), but without any consensus about the right account:

  (4)   a. If he submits his paper to a journal, we will not publish it

          b. He submits his paper to a journal

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[1]As elaborated in section 2.4.1, this property invokes historical modality, which models the possible ways that the world could be at a time t <u>given what is objectively the case at t</u>. Historical modality has proven useful for modeling the semantics of a number of modal expressions in natural language, including conditionals (Kaufmann, 2005; Khoo, 2015; Funk, 1985), modal auxiliaries (Condoravdi, 2002; Cariani & Santorio, 2018; Cariani, 2021), evidentials (Bhadra, 2022), etc.

The simple present antecedent in 2(a) has future reference, which is different from the possible interpretations of the unembedded 2(b). What is the right relation between the tense-aspect of the clause and its temporal *interpretation* in the antecedent, that predicts this? Answering this requires making a number of assumptions about the compositional semantics of tense and aspect in conditionals. This is part of a broader inquiry about the link between temporal and modal meaning and their manifestations in the grammars of natural language, which has been of independent interest both from a formal and typological perspective (Condoravdi, 2002; Kaufmann, 2005; Rumberg & Lauer, 2023; Crouch, 1994; Copley, 2008; Dowty, 1977; Matthewson et al., 2022, a.o.) and is an area of active research where many basic assumptions are still open questions. These include: Do both clauses of the conditional have tense? What is the right scopal relation between the tense-aspect and modal elements in the construction? Does the modal expression itself contribute any temporal meaning? Do tense-aspect markers have a uniform semantics inside and outside of modal environments? The answers to these have proven surprisingly elusive (for a sample of current debates see, e.g., Kaufmann (2005); Schulz (2008); Arregui (2007, 2009); Iatridou (2000); Khoo (2015); Ippolito (2004); Mirrazi (2022)). This is relevant to our puzzle because in order to characterize the contrast between 2(a) and 2(b), we must say something about what these tense-aspect markings *mean* in the antecedent, and how they come to have those meanings. A broader aim of this paper to examine how the contrast above fits into this larger picture of what is known about temporal reference in conditional environments.

Examining the semantic components along which conditionals can differ, and the linguistic correlates of these differences, has been a fruitful point of departure in the effort to understand how conditional meaning is built in language. Consequently, this question underlies much of the existing formal research on conditionals (and modal expressions more generally) (Comrie, 1986; von Fintel & Iatridou, 2023; Kratzer, 1981). Some well-studied examples within conditionals are the indicative vs subjunctive and factual vs hypothetical distinctions (Iatridou, 1991; von Fintel & Iatridou, 2023), which contrast primarily in the modal properties of the antecedent. Cross-linguistic facts have shown that such differences are not merely interpretational (multiple ways of interpreting the same expression), but can be encoded in the grammar/lexicon, such that different conditional expressions within and across languages can be specialized for some of these uses (e.g. Farsi: Mirrazi (2022), French: Léard (1985); Dostie (1985), Korean: Jiang (2019), German: Liu (2019); Breindl et al. (2014), Spanish: Montolío (2000); Schwenter (2001); Liu (2019), Romanian: Alexe (2013), Mandarin: Ippolito & Su (2014), Italian: Visconti (1996)). While it is clear that certain divisions among conditionals are fairly ubiquitous across languages, such as the indicative-counterfactual divide, the manifestation of the phenomenon in a given language will invariably interact with the idiosyncrasies of its tense-aspect-modal (TAM) system, generating cross-linguistic differences (von Fintel & Iatridou, 2023). This does not preclude the possibility of a shared semantic core. Moreover, such facts are helpful in clarifying the nature of the broader contrast that is shared across languages. Another broad aim of this work is to examine how the proposed constraint of IF-fut might interacts with independently-known properties of the TAM systems of English and Bangla, focusing on potential sources of cross-linguistic differences.

2 Data

I will first provide some background on the verbal system of Bangla, since this plays an important role in the data examined here.

2.1 Verbal system of Bangla

Verbal clauses in Bangla have the following sequence of morphemes: [verb-aspect-tense-agreement], e.g. *kor-ch-il-am*: do-PROG-PAST-1 'I was doing'. I will omit agreement in the schematic representations that follow.

Present tense (PRES) is morphologically null (ϕ), and past (PAST) *-l-* is perfective by default.[2] Viewpoint aspect is marked by an inflectional system comprising of the progressive marker (PROG: *-ch-*), perfect marker (PERF: *ech*), and imperfective (IMPF: morphologically null with present tense). I assume that these occupy AspP on the tree. In addition to inflectional aspect markers, Bangla also has a set of auxiliaries etc that contribute aspectual meaning. These occupy a different position in the verbal structure (Mitra, 2024), and I will only discuss them to the extent needed as I develop the main argument.

Bangla has a future-marker (*-b-*). This has limited acceptability under *jodi*. Since the oddness of future-markers in conditional antecedents is a cross-linguistically common phenomenon and its cause an open question, I will treat it as an independent fact and not attempt to account for it here. It requires additional assumptions about the meaning of the marker, its modal vs temporal contribution etc which are beyond the scope of this work (for discussions see Cariani & Santorio (2018); Kaufmann (2005), and references therein).

2.2 Assumptions about the conditional LF

Before presenting data about restrictions on the antecedent of IF-fut conditionals, it is necessary to make some baseline assumptions about the LFs of these constructions. The data shows that clauses with certain tense-aspect markings are unacceptable in the antecedent. As discussed in section 1, the compositional semantics of tense-aspect in conditionals (and modal expressions more generally), is an area of active inquiry where even basic assumptions are still open questions. Here, I will assume that the antecedent and consequent of the conditional are both finite clauses with tense and aspect, and that the conditional connective does not by itself make additional temporal contributions. What is the right LF for the conditional antecedent?

While there is no consensus in the literature, one fact that bears on this and has been well-studied is that simple present eventive clauses in the antecedent of indicative conditionals can refer to the future: *If she wins (tomorrow), we will be happy.* Following recent and independently-motivated proposals along these lines, I will assume that the conditional antecedent licenses a future-shifting operator F that is (i) lower than tense, and (ii) responsible for future reference in the antecedent. This is contra accounts that build future-shift into the semantics of the conditional or the non-past-ness of the present tense (e.g. Kaufmann

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[2]Past imperfective is expressed by a single inflectional marker *-t-*. This is obligatory in the antecedents of counterfactual conditionals, and conversely, an antecedent clause with *-t-* can only be interpreted as counterfactual.

(2005); Rumberg & Lauer (2023); Schulz (2008))[3]. I assume the following LF for a simple present antecedent:

(5)   LF: [$_{TP}$ PRES [$_{AspP}$ F [$_{vP}$ *she win*]]]

I assume that F is aspectual, and for concreteness, take it to be akin to prospective aspect (Kratzer, 2011; Matthewson, 2012; Matthewson et al., 2022). F simply requires the constituent embedded under it to be evaluated at some future time. Since the data here only concerns temporal reference in the antecedent, I remain neutral about the LF for the consequent clause, only assuming that it comes with its own tense and aspect.

2.3   Data: restrictions in the antecedent of IF-fut

I limit my focus here to 'one-case' conditionals (Rumberg & Lauer, 2023), ignoring multi-case conditionals that express a meaning akin to 'whenever X, Y', e.g. *If she wakes up early, she goes for a run.* I also focus on eventive predicates, putting aside the more complex issue of how lexical aspect interacts with the temporal interpretation in modal environments (for discussions, see Condoravdi (2002); Copley (2008)). For ease of exposition, I will present the IF-fut facts side-by-side with English *if*.

Simple present: In unembedded clauses, simple present eventive sentences have a habitual-generic meaning in both English and Bangla: *She drinks coffee.* When these appear in the antecedent of an indicative *if*-conditional in English, they can additionally refer to a future eventuality:

(6)   a. If she drinks coffee (in general), she will love this place [habitual-generic reading of antecedent]

      b. If she drinks coffee (tomorrow), she will be jumpy during the meeting [future reading of antecedent]

Under IF-fut, such antecedents can likewise get a future interpretation. However, unlike (a) above, they fail to retain their habitual-generic reading:

(7)   *In the event*

      a. In the event that she leaves before 5 today, please lock the doors [future antecedent]

      b. ?? In the event that she leaves before 5 (habitually), she has great work-life balance [intended: habitual-generic antecedent]

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[3]This choice is based on existing proposals and I do not argue for it separately here. English facts are discussed explicitly in these proposals. While a complete account for future reference in Bangla is beyond the scope of this work, I will note that an LF along the lines proposed here is better suited for Bangla than existing alternatives for two reasons: (i) accounts based on non-past Present tense rely on a close connection between future reference in conditional antecedents and scheduled, futurate uses of the present tense in unembedded contexts: *She leaves at 5 tomorrow.* However, Bangla does not allow futurate uses of the simple present. (ii) If the semantics of the conditional by itself provided future reference, it should apply regardless of the aspectual properties of the antecedent clause. Existing proposals along these lines consciously ignore the contribution of aspect. However, as the data in Section 2.3 shows, the possibility for future reference in the antecedent is modulated by aspect in Bangla. This is better explained by a structure where the source of future reference can interact with aspect, such as the LF I have assumed here.

    c. Compare: If she leaves before 5, she has great work-life balance

(8) *A, and B*

    a. She leaves before 5, and her boss is going to be upset
       = if she leaves before 5, her boss is going to be upset [future antecedent]

    b. ?? She leaves before 5 everyday, and she has great work-life balance[4]
       $\neq$ if she leaves before 5 everyday, she has great work-life balance [intended: habitual-generic antecedent]

(9) *jodi*

    a. future-compatible context

    jodi porer bochhor khub brishti pORe,   rasta-gulo kharap hoye   jabe
    if   next year   much rain   fall–PRS-3, road-COP bad   happen go.FUT.3

    If it rains a lot next year, the roads will wear out

    b. generic-preferring context

    ?? jodi ekhane khub brishti pORe,   tahole (nishchoi) sobar
    ?? if   here   much rain   fall–PRS-3, then   (likely)   everyone-GEN
    onek-gulo kore chhata   ache
    many-CLF   umbrella COP

    Intended: If it rains a lot here, then (I bet) everyone owns multiple umbrellas

These show that under IF-fut, simple present eventive antecedents are unacceptable on their habitual-generic interpretation.

Past tense: Under English *if*, simple past-tensed clauses have a past reading and are acceptable:[5]

(10) If she took the medicine yesterday, she will not take it today

Under IF-fut, past-tensed clauses with a past reading are unacceptable:

(11) *In the event*

    a. (I'm not sure where she is now, but)
       ?? In the event that a war broke out in 1990, she must have left the country

    b. Compare: In the event that a war breaks out, she will leave the country

    c. Compare: If a war broke out in 1990, she must have left the country

(12) *A, and B*

    a. (I don't know what went down yesterday, but)
       ?? They opened the gates, and it was chaos
       $\neq$ if they opened the gates, it was chaos

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[4]The ?? here signals that this sentence fails to get a conditional reading. It is acceptable only on the use where both clauses are asserted.

[5]Recall that we are only concerned with indicative conditionals. English also uses the simple past in counterfactual conditional antecedents. Bangla has dedicated morphology for past imperfective, and uses that in counterfactual antecedents.

    b. Compare: They open the gates now, and it's chaos
       = if they open the gates now, it will be chaos

(13) *jodi*

    a. ?? jodi mini kal   oshudh khe-l-o,   tahole aj   khabe   na
       ?? if   mini yesterday medicine eat-PST-3, then   today eat.FUT.3 NEG
       Intended: If Mini took the medicine yesterday, she will not take it today

Past-tensed clauses under *jodi* are unacceptable with a past reading. In a narrow set of contexts, however, a clause with past-tense marking can appear under *jodi* with a *future* interpretation. This leads to additional inferences and has limited use. I will put this aside for now, and revisit it when I discuss the predictions of the formal analysis.

Progressive and perfect: Under English *if*, present-tensed clauses with progressive or perfect marking are acceptable, and can get either present or future progressive/perfect readings:[6]

(14)   a. If she is working (right now/ when we reach her place), we will not disturb her [present/future progressive antecedent]
    b. If she has finished work (already/ by the time we get there), we can all go out [present/future perfect antecedent]

Under English IF-fut devices, present-progressive and present-perfect clauses are unacceptable. However, they seem to be able to license future-progressive/future-perfect readings given an appropriate context, in which case the unacceptability is less strong:

(15) *In the event*

    a. in the event that she finishes her work before 5, she may leave
    b. ?? in the event that she has finished her work (already), she may leave
    c. ? I'll check back in an hour. In the event that she has finished her work (by then), she may leave

(16) *A, and B*

    a. It rains tonight, and the streets will be flooded tomorrow
    b. ?? It's raining outside (now), and the streets must be wet
    c. ? Let's wait for an hour. It's still raining, and we'll take a cab

The corresponding clauses are unacceptable under *jodi*:

(17) Present progressive/perfect-marked clauses are not acceptable in the antecedent:

    ?? jodi mini phOl kha-ch-φ-e/   khe-ech-φ-e,   tahole ami khuSi hObo
    ?? if   mini fruit eat-PROG-PRS-3/ eat-PRF-PRS-3, then   I   happy be.FUT

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[6]The English progressive also licenses *futurate* uses, which describe planned future eventualities: *She is starting at 5pm tomorrow.* The Bangla progressive licenses futurate uses too. The right analysis for this reading of the progressive is an open question with a rich body of work (see e.g. Copley (2014) and references therein). I will not analyze this reading here.

Intended: If Mini is eating/ has eaten, then I will be happy

These examples show two things: (i) all the IF-fut devices disallow present-tensed progressive/perfect-marked clauses with a *present* progressive/present perfect reading (i.e. reference time = the utterance time, UT); (ii) *jodi* also disallows present-tensed progressive/ perfect-marked clauses with a *future* progressive/perfect reading (i.e. where the reference time is after UT). Given the split between these in English, as well as Bangla-internal facts that will become clear as we proceed, it is helpful to treat these as separate facts.

The broad pattern can be stated as follows: under IF-fut, present-tensed progressive/perfect marked clauses are unacceptable with present-progressive/perfect readings.

Table 1 summarizes the patterns discussed so far. Cells marked with ? differ between English and Bangla: these are acceptable with IF-fut devices in English, but not in Bangla.

Antecedent	Example	Acceptable?
simple present	if she leaves (tomorrow),...	yes
simple present; habitual-generic reading	if she eats fish (in general),...	no
past/perfective	if she took her medicine (yesterday),...	no
present progressive	if she is working (right now),...	no
present progressive; future-prog reading	if she is working (when we get there),...	?
present perfect	if she has eaten (already),...	no
present perfect, future-perf reading	if she has eaten (by then),...	?

Table 1: Constraints on the antecedent under IF-fut devices in English and Bangla

2.4 Generalizations

To draw generalizations from this data, we need to understand exactly *what* is disallowed under IF-fut. This involves three separate but inter-related questions: (i) at what level does the constraint apply— that is, are the restrictions on form, structure, or meaning? (ii) is the constraint global, or local (operates within a specific domain)? (iii) what property does the constraint target? Let us start with the simplest assumption that the disallowed antecedents have some shared property that is incompatible with IF-fut, putting aside for the moment what that is.

I now examine some evidence that bears on (i) and (ii). To anticipate the result, I will argue that the constraint is semantic and local: the restriction applies to the meaning of the VP that is directly under IF-fut. A purely morphological constraint is unlikely given the cross-linguistic data. Specifically, similar patterns are observed in languages that don't share tense-aspect morphology (e.g. English and Bangla), whereas at least some related languages that do share morphological roots with both *jodi* and the inflectional system of Bangla (e.g. Odia, Assamese) do not show the same contrast. Within Bangla, while the progressive and perfect inflectional markings derive from a common morpheme (*ach*), this is not shared by the other disallowed forms (simple present clauses with habitual-generic reading, past/perfective-marked clauses). Thus, a purely morphological account would require positing multiple separate constraints within Bangla, and miss a relevant cross-linguistic generalization. This

suggests that the constraint is not on the morphological forms. On the other end of the spectrum, one might posit that the constraint is on the interpretation of the antecedent, i.e. that an antecedent with past, or present/future progressive and perfect *reading* is not allowed, thus ruling out any form that gives rise to such interpretations. To test this hypothesis, we examine if these meanings can be expressed under IF-fut through any other means. We find this to be the case. Under Bangla *jodi*, perfect readings can be expressed using the auxiliary *thak*:

(18) jodi mini phOl khey-e <u>thak-ϕ-e</u>, or ma khuSi hObe
     if mini fruit eat-*e* <u>thak-PRS-3</u>, her mother happy be.FUT.3
     If (now or at some salient future time) Mini has eaten fruit, her mother will be happy

Just like its English translation, the Bangla antecedent above can be interpreted as either a present perfect (the eating happens before UT) or future perfect (the eating happens before a salient future reference time, but after UT). Since perfect meaning can be expressed using *some* means, it is unlikely that we are dealing with a constraint on the overall interpretation of the antecedent.[7]

I have argued elsewhere on independent grounds that *thak* is not simply a morphological variant of the inflectional perfect marker in Bangla (Mitra, 2024). Specifically, *thak* does not occupy the aspect phrase AspP, but rather occurs lower in the tree, inside the verb phrase vP. A reasonable hypothesis at this point is that the constraint operates on the clause under *jodi*, but is agnostic to composition below the vP. To test this, we can examine clauses that are further embedded. We find that whatever constraint rules out the aforementioned tense-aspect markings in the antecedent does not apply to clauses that are below the highest vP under IF-fut. This is uniformly the case in both the English and Bangla devices:

(19) a. It so happens/it turns out/he hears that [she left at 5], and he is going to be upset
       Compare: ?? She left at 5, and he is going to be upset

    b. In the event that she turns out [to be working right now], we will wait outside
       Compare: ?? In the event that she is working right now, we will wait outside

    c. jodi ami shun-Φ-i /emon-Ta hOye je [mini phOl kha-ϕ-e
       if I hear-PRS-1 /like.this-CLF happen that [mini fruit eat-PRS-3
       /kha-ch-ϕ-e /kh-ech-ϕ-e], tahole ami khuSi hObo
       /eat-PROG-PRS-3 /eat-PRF-PRS-3], then I happy be.FUT.1
       If I hear/ it so happens that Mini eats (in general)/ is eating/ has eaten fruit, then I will be happy

These examples show that as long as the immediately embedded vP (here, headed by *hear/happen/turn-out*) complies with the restrictions (here, it is a simple present clause with future reference), all the 'disallowed' markings and interpretations are acceptable in a clause that is embedded deeper. This suggests that IF-fut imposes some restriction on the clause

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[7]Additionally, it is possible to express in-progress readings under *jodi* using simple present morphology, although this is limited to a subset of predicates. I do not discuss this construction further here (see Mitra (2024) for details), but constitutes further evidence against positing a global interpretative constraint against certain readings.

that is directly embedded under it. The constraint is local.

Let us now turn to question (iii): what property does the constraint target? I have proposed that when considering progressive/perfect-marked antecedents under *jodi*, the unavailability of present-progressive/perfect interpretations should be treated as a separate fact from the unavailability of future-progressive/perfect interpretations (recall that only the former is seen in the English IF-fut devices). I will now justify this separation, which will help to zero in on the constraint imposed by IF-fut. I argue that in the Bangla data above, two separate factors are at play: (i) **F-Asp complementarity:** the future-shifting operator F (which occurs in a wide range of constructions that license future-referring uses of the present tense, including conditional antecedents (Mendes, 2024; Williamson, 2021)) occupies AspP. In Bangla, it therefore cannot co-occur with other material in AspP. This is not attributable to *jodi*, and instead reflects a more general property of the Bangla TAM system, where inflectional aspect markers cannot be stacked. (ii) **Constraint of IF-fut:** *jodi* and other IF-fut devices impose a uniform constraint on their antecedent that rules out past, present progressive, present perfect, present imperfective clauses for reasons explained below. The presence of F in AspP can rescue such clauses by moving the reference time to the future of UT. This option is available in English, leading to future-progressive/perfect antecedents, but unavailable in Bangla (given F-Asp complementarity), leading to an across-the-board unacceptability of progressive and perfect marking under IF-fut.

To justify **F-Asp complementarity** in Bangla, consider a construction without *jodi* that optionally licenses the future-referring present tense: the modal verb *asha kOra* 'hope'. As with English *hope*, a simple present clause under this verb can have future reference:

(20) asha kori [tumi chakri-ta pa-φ-o]
hope do.PRS.1 [you job-CLF get-PRS-2]
I hope [you get the job]

Unlike English, however, a present-tensed clause with inflectional perfect marking can only have a <u>present perfect</u> reading– it fails to get a future-perfect reading in this environment:

(21) asha kori (??totokhhone) [mini chole g-ech-e]
hope do.PRS.1 (??by-then) [mini leave-INF go-PRF-PRS-3]
Available: I hope Mini has left (already)
Unavailable: Salman is arriving tomorrow. I hope Mini has left (by then)

When the inflectional perfect marker is replaced with the auxiliary *thak*, which I have noted does not occupy AspP, both present and future-perfect readings are possible:

(22) asha kori (totokhhone) [mini chole giye thak-e]
hope do.PRS.1 (by-then) [mini leave-INF go-INF *thak*-PRS-3]
I hope Mini has left (already/ by then)

A parallel pattern obtains for present-tensed progressive clauses: while they can have present-progressive readings under *asha kOra*, they fail to get future-progressive readings. It has been independently argued (Williamson, 2021) that future reference under attitude

verbs like *hope* is facilitated by the same mechanism that is responsible for future reference in the conditional antecedent (here, an aspectual operator like F). The facts above suggest that independent properties of Bangla prevent F from co-occurring with other material in AspP.[8] This justifies **F-Asp complementarity**. Moreover, note that progressive and perfect clauses are not *unacceptable* under *asha kOra*— they simply lack future reference. The unacceptability of present-progressive/perfect antecedents under *jodi* must therefore derive from a separate constraint that is not shared by verbs like *asha kOra*. I propose that this constraint is uniform across all IF-fut devices. **F-Asp complementarity** in Bangla demonstrates how a general constraint on IF-fut might interact with specific properties of the TAM system of different languages, and suggests that cross-linguistic differences in the availability of future-progressive/perfect under IF-fut might be derivable from differences in the licensing conditions/co-occurrence restrictions on F.

I turn now to the nature of the constraint on IF-fut. From table 1, we see that all the clauses that are allowed under IF-fut have the future operator F (or at least, have a structure that doesn't preclude the presence of F). At this point, one might hypothesize that IF-fut simply requires the presence of F in the AspP of the immediately embedded clause. Given the meaning contribution of F, the semantic correlate of this constraint would be that the immediately embedded vP must describe an eventuality that is in the future. However, such a purely temporal constraint appears to be insufficient. Specifically, if the constraint imposed by IF-fut was purely temporal,

(i) the predicted status of progressive and imperfective antecedents is unclear; some existing theories predict that they do invoke future times, albeit in intensional worlds (Dowty, 1979; Deo, 2009). Without referring to modal facts, it is difficult to articulate how these form a natural class with the past-tensed and present-perfect antecedents

(ii) future-referring antecedents should be acceptable under IF-fut regardless of their modal status. However, antecedents that describe necessary future events are unacceptable under IF-fut

To account for these, I propose that while future-reference is necessary to be acceptable under IF-fut, it is not sufficient. The necessary and sufficient condition is future-*dependence*. This corresponds to a well-known modal property of historical/metaphysical openness (Condoravdi, 2002). The following section justifies this treatment.

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[8]We can also rule out the possibility that the progressive/perfect markers in Bangla are simply incompatible with future reference– they can have future reference in constructions like the following:

(1) My interview is in an hour. If I smile when I get out, the interview has gone well.

(2) We will reach her place in an hour. If she doesn't answer the door, she is talking to someone on the phone.

Crucially, future-reference in the conditional consequent is usually thought to involve different mechanisms than F (Crouch, 1994). Thus the right generalization is that progressive and perfect-marked clauses fail to get future reference in exactly those environments where future reference is facilitated by F.

2.4.1 Constraint of IF-fut: temporal or modal?

To test the hypothesis that IF-fut simply requires the antecedent vP to describe a future eventuality, consider a future event that is nonetheless certain, such that its truth at UT does not depend on how things develop in the future.

(23) Context 1: a vessel of water is heating on a stove-top. A child is in charge of watching the stove, and fetching her parent when it starts to boil.

   ?? jodi jol-ta   phot-ϕ-e, baccha-Ta baba-ke   Dak-b-e
   ?? if   water-CLF boil-PRS-3, child-CLF father-ACC call-FUT-3

   Intended: if (when) the water boils, the child will call her dad

   Given the natural laws of our world, the antecedent above describes a necessary event (assuming ordinary conditions, it is certain that the water will boil at some point). Though describing a future event, it is still unacceptable under *jodi*. Consider a slight variation of the context:

(24) Context 2: we are testing the efficiency of a new stove by seeing how quickly the water comes to a boil.

   jodi jol-ta   [paanch minute-e] phot-ϕ-e, baccha-ta baba-ke   Dak-b-e
   if   water-CLF [five   minute-LOC] boil-PRS-3, child-CLF father-ACC call-FUT-3

   If the water boils within five minutes, the child will call her dad

When a temporal adverbial modifies the antecedent, making the future event a genuinely open possibility, it is acceptable under *jodi*. This suggests that the set of clauses that are acceptable in the antecedent of *jodi* must have two properties: (i) the vP describes a future eventuality; (ii) the clause admits uncertainty at UT. The joint effect of (i) and (ii) can be captured as a single requirement: the truth of the clause at UT must *depend on* the future (how things develop in the real world).

   At this point, the reader might note (correctly) that a sentence like (23) is also unacceptable with English *if* — the most natural way to express the intended meaning is to use *when*. Indeed, this property of English indicative *if*-conditionals whereby they require uncertainty in the antecedent has been discussed in the literature (Stalnaker, 1976).[9] Thus, one might think of IF-fut conditionals as admitting a subset of the antecedents admitted by English *if*, Hindi *agar*, etc, giving rise to the following typology of conditional connectives based how they constrain the antecedent clause:

   (i) *if, agar*: antecedent truth is not known at UT

   (ii) *jodi, and, falls, in the event*: antecedent truth is not known at UT + antecedent eventuality is in the future

---

[9]Note that it is not obvious a priori that any conditional connective whatsoever must require its antecedent to admit uncertainty by default. In principle, nothing rules out a connective with a meaning akin to *if-or-when*. I don't claim that these cannot be independent constraints. The advantages of such a move are not obvious, however, and it doesn't address the issue highlighted in (i).
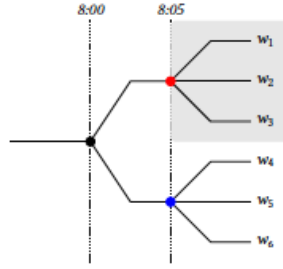
Figure 1: Epistemic and historical modality (from Mendes (2024))

This kind of relation between IF-fut and English *if* is not essential for my account, but is not implausible either. For our purposes, it is a useful way to fix intuitions about the modal correlate of the requirements imposed by *jodi*.

The combination of future reference and uncertainty ties in with a known modal property: *historical/metaphysical* open-ness (Condoravdi, 2002). This has been found to be independently relevant for known contrasts in conditionals and other modal expressions (Condoravdi, 2002; Funk, 1985; Kaufmann, 2005; Khoo, 2015; Bhadra, 2022; Iatridou, 1990; Klecha, 2016). It relates to a sub-type of circumstantial modality called historical modality. I propose that IF-fut does not directly rule out specific tense-aspect markings/interpretations. Rather, past tense, present progressive, present perfect, and imperfective clauses are ruled out because they all converge on the modal property that is disallowed by IF-fut: when evaluated at a time t, they preclude historical open-ness at t.

Just as epistemic modality models the possible ways the world could be given what we know at a given time, historical modality models the possible ways the world could be given what is objectively the case at a given time. It relies on the idea that given the way the world is now, it cannot *now* have been otherwise (Thomason, 1970). The following example (adapted from Mendes (2024)) illustrates some important properties of historical modality viz. it's interaction with time and with epistemic modality:

Figure 1 represents a state-of-affairs where at 8 am, my friend Mini is deciding between between wearing a red or blue sweater to work. At this time, all six worlds $w_1, ... w_6$ are compatible with the way the world could (objectively) be at 8 am. All six worlds are thus in the historical *modal base* MB_{hist}. At 8am, $w_1, ... w_6$ are likewise all compatible with the way the world could be given my knowledge of Mini's outfit, and are therefore in the epistemic modal base MB_{epis}:[10]

At 8:00 am: $\text{MB}_{\text{epis}} = \{w_1, w_2, w_3, w_4, w_5, w_6\}$; $\text{MB}_{\text{hist}} = \{w_1, w_2, w_3, w_4, w_5, w_6\}$

At 8:05, Mini puts on the blue sweater. Now, given that world has evolved into a blue-world, w_1, w_2, w_3 are no longer possible ways that the world could objectively be. MB_{hist} shrinks. However, assuming I am not in the room, my epistemic state is still compatible with all six worlds:

At 8:05 am: $\text{MB}_{\text{epis}} = \{w_1, w_2, w_3, w_4, w_5, w_6\}$; $\text{MB}_{\text{hist}} = \{w_4, w_5, w_6\}$

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[10]I make the standard assumption that modal bases are relativized to an individual (in this example, me), without discussing this explicitly either here or in the formal implementation. For discussions, see e.g. Hacquard (2010).

This simplified example demonstrates some important properties of historical modality. I highlight the two most important ones and their consequences for the current analysis:

(i) All the worlds that are historically accessible from w at t are identical up until t, although they may or may not vary after t

   Consequence: if facts up until t are sufficient to evaluate the truth of p at t, then the truth value of p is identical across all the worlds in the historical modal base at t: either p, or ¬p, is necessary in MB_{hist}

(ii) As traditionally assumed, the historical modal base is a subset of the epistemic modal base: our knowledge at t might be consistent with things that are no longer objective possibilities at t (Klecha, 2016)

   Consequence: if p is necessary in MB_{epis}, it is necessary in MB_{hist}

These correlate with the observations about future-reference and uncertainty earlier in this section: both in cases where a clause does not describe a future eventuality, and in cases where the truth/falsity of the clause is known, the clause fails to be a historically open possibility according to the speaker.[11] I therefore state the constraint of IF-fut in modal terms as follows:

> **Constraint on IF-fut** IF-fut(A)(B) presupposes that A is *open* in the historical modal base at the time of evaluation, where *open* := neither A nor ¬A is necessary in MB_{hist}

We are now in a position to explain the specific restrictions on the antecedents of IF-fut conditionals. I will suggest that the relevant common property of the disallowed past-tensed, present-progressive, present-perfect, and imperfective clauses is that they all preclude historical open-ness (they are historically *settled*) at the evaluation time.

2.5   Tense-aspect and historical open-ness

Under any available analysis of the past tense and perfect aspect, it is uncontroversial to claim that in order to be true at t, a sentence A of the form PAST(p) or PRES(PERF(p)) requires p to hold at some time prior to t. Given that all worlds in MB_{hist} at t agree on the truth of everything up until t, the truth value of p (and therefore of A) will be identical across the historical alternatives. Therefore, A is predicted to be settled in MB_{hist} and correctly ruled out by our constraint.

What about the progressive and imperfective aspect? The right semantics for PROG and IMPF is an open question that has generated a substantial body of research. Crucially for us, these accounts differ on whether or not times after t are involved in computing the truth value of a present-tensed progressive/imperfective clause at t. I will argue that in spite of these differences in the involvement of future *times*, most modern accounts converge in ascribing the modal property of historical settledness (future *independence*) to these aspect categories. The insight follows from the so-called 'imperfective paradox' (and corresponding

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[11]Recall that modal bases are relativized to an individual– what matters is whether the clause is treated as historically open by the relevant individuals, not its status in some absolute/ontological sense.

'progressive paradox'), which has been the departure point for many of the currently available theories.

The crux of the paradox is that although the eventuality denoted by uninflected accomplishment predicates (e.g. *cross-the-road*; Vendler (1957)) appears to include its culmination (#*She crossed the road but did not reach the other side*), the use of progressive/imperfective aspect with accomplishment predicates is felicitous even when future developments preclude the culmination, e.g. *She was crossing the road at 5pm when she got hit by a bus.* The puzzle is that 'she is crossing the road' seems to remain true of 5 pm, regardless of what happens at 5:01. Earlier extensional accounts of the progressive wrongly predicted that 5:01 facts about the evaluation world should matter, making the sentence unacceptable. At the same time, it is clear that to count as an ongoing 'road-crossing', the eventuality being described must bear *some* relation to the expected state of culmination, failing which the truth conditions for *She is crossing the road* would be unintuitively weak. Most current accounts have emerged from an attempt to reconcile these facts. One approach has been to propose intensional semantics for PROG and IMPF, requiring culmination at a future time on only those intensional alternatives that are related to the UT in a predictable way (e.g. inertial/normal futures) (Dowty, 1979; Deo, 2009; Asher, 1992; Landman, 1992; Bonomi, 1997; Zucchi, 1999). These differ on the nature of this set of alternatives, but share the intuition that facts about the evaluation time should be enough to determine it.

Another type of approach has been to retain an extensional semantics for PROG/IMPF, but make different assumptions about what is required for an accomplishment predicate to be true at t, so that these do not involve future facts. E.g. Nadathur & Siegal (2022) propose a causal structure in the semantics of the accomplishment predicates themselves, so that as long as certain facts hold at the evaluation time and bear the right causal relation to the completed action, the corresponding progressive sentence will be true. Parsons (1990) takes the approach of allowing for incomplete events (paralleled by Szabó (2008) who introduces incomplete objects), so that as long as there is a 'partial road-crossing' event at 5pm, the corresponding progressive sentence is true, and therefore facts about 5:01 do not matter.

Abstracting away from how this is implemented, under all of these accounts, the truth of PROG(p) at a time t should only depend on t, regardless of whether or not future times are involved– in other words, the truth of PROG(p) (and IMPF(p)) is predicted to be settled in the historical modal base generated at t. Thus, taking historical settledness as the relevant constraint of IF-fut allows for a natural grouping of PROG and IMPF with PAST and PERF. Given that these categories pattern together across all the constructions involving IF-fut in unrelated languages, I take it as an advantage of the modal generalization that it correctly predicts these to be a natural class while remaining compatible with most current analyses of the progressive and imperfective.

3 Formal Analysis

3.1 System (semantic setup)

I use a typed propositional language with variables ranging over indices and sentences, constants denoting the relations in the model, and the usual logical connectives. The basic

types are *s* for indices, and *t* for truth values. The smallest units of analysis are sentence radicals (correspond to vPs, assuming vP-internal subjects), represented as the set of atomic sentences (At). These have the type $\langle s,t \rangle$.

W is a non-empty set of worlds, and T is a non-empty set of time intervals related by containment $\subseteq$ and precedence $\leq$, such that t$\leq$t' iff no part of t extends beyond t'. Let I = W$\times$T be the set of indices in the model. Truth is evaluated at indices (world-time pairs) and relativized to a context, which provides a unique index $\langle w_c, t_c \rangle$. t_c corresponds to the utterance time UT. Unembedded sentences are evaluated at $\langle w_c, t_c \rangle$ by default. The valuation V is a relation on At such that for any p $\in$ At, V(p,$\langle$w,t$\rangle$) $\in$ {1,0,#}.[12] For any p of arbitrary complexity:

(25) if p $\in$ At, p(w,t) = 1 iff V(p,$\langle$w,t$\rangle$) = 1

(26) $[\![$p (w,t)$]\!]^c$ = 1 iff p(w_c, t_c) = 1

Accessibility relations and modal bases $\langle$**s,st**$\rangle$ An accessibility relation R on I$\times$ I is *modal* if $\langle$w,t$\rangle$R$\langle$w',t'$\rangle$ implies that t = t', and *temporal* if $\langle$w,t$\rangle$R$\langle$w',t'$\rangle$ implies that w = w'. We will be concerned with the historical accessibility relation $\approx$, which has the following properties (adapted from Kaufmann (2005)):

(27) Properties of the historical accessibility relation $\approx$
    a. It is modal: $\langle$w,t$\rangle\approx\langle$w',t'$\rangle$ implies that t = t'
    b. It is an equivalence relation
    c. **Backward-connectedness:** if $\langle$w,t$\rangle\approx\langle$w',t$\rangle$ and t'<t, then $\langle$w,t'$\rangle\approx\langle$w',t'$\rangle$
       If two worlds are historical alternatives of each other at a given time, they are historical alternatives of each other at all prior times
    d. **Historicity:** if $\langle$w,t$\rangle\approx\langle$w',t$\rangle$, then for all p $\in$ At, V(p,$\langle$w,t$\rangle$) = V(p,$\langle$w',t$\rangle$)
       Historical alternatives agree on the truth values of all atomic sentences

27c and 27d together capture the intuition that historical alternatives at t are completely identical up until t, and may diverge after t. Sentences are thought to be uttered against sets of background information/assumptions called *modal bases* Kratzer (1981). A modal base is a modal accessibility relation such that the following holds:

(28) **Consistency of modal bases**: if iRj and i$\approx$k, then kRj

That is, a modal base generated in w at any given time t remains consistent across historical alternatives at t.

Necessity: For any accessibility relation R, ($\Box_R$ p) (w,t) = 1 iff for all $\langle$w',t'$\rangle$ s.t. $\langle$w,t$\rangle$R$\langle$w',t'$\rangle$, p(w',t').

Aspect operators $\langle$**st,st**$\rangle$ are modifiers of sentence radicals. Assuming standard semantics with minimal theoretical commitments:

(29) PERF(p) (w,t) = 1 iff $\exists$t' [t$\subseteq_{fin}$t' & p(w,t') = 1]; $\subseteq_{fin}$ gives a final subinterval of t'

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[12]I will omit the angled brackets around indices when there is no potential for confusion.

(30) F(p) (w,t) = 1 iff ∃t': t < t' & p(w,t') = 1

(31) PROG(p) (w,t) = 1 iff ∀⟨w',t⟩ ∈ R$_{mod}$(w,t), ∀⟨w',t'⟩ ∈ R$_{temp}$(w',t), p(w',t') = 1

(32) IMPF(p) (w,t) = 1 iff ∀⟨w',t⟩ ∈ R$_{mod}$(w,t), ∀⟨w',t'⟩ ∈ R$_{temp'}$(w',t), p(w',t') = 1

R$_{mod}$ and R$_{temp}$ are accessibility relations representing standardly-assumed modal and temporal contributions respectively of IMPF and PROG. R$_{mod}$ gives the relevant set of intensional worlds (e.g. inertial worlds; Dowty (1977)); capturing expected continuity/non-accidental generalization. R$_{temp}$ gives the relevant subintervals (e.g. members of a regular partition; Deo (2009)) at which the embedded vP is instantiated, capturing iteration over some contextually-salient time interval. Following Deo (2009), the progressive and imperfective have near-identical semantics, varying only in the nature of the temporal accessibility relation. As discussed in section 2.5, the important feature for our purposes is that they require the embedded p to be instantiated at the appropriate time interval in each world *in the modal base generated at t.* Recall that this set is consistent across the historical alternatives at t. Thus, the truth of a progressive or imperfective sentence at t does not depend on facts after t, which is the intuition we want to capture.

Tenses ⟨**st,st**⟩ modify sentence radicals (optionally modified by aspect). Present tense is vacuous, past tense is existential.[13]

(33) PRES(p) (w,t) = 1 iff p(w,t) = 1

(34) PAST(p) (w,t) = 1 iff ∃t' s.t. t'<t and p(w,t') = 1

Conditionals Since empirical facts here don't concern the relation between the antecedent and consequent, the exact semantics for the conditional is irrelevant as long as the antecedent is a tensed clause. I treat IF-fut as a two-place predicate of propositions and assume a strict conditional analysis: the conditional is true at an index if the corresponding material conditional is true at all indices accessed by the appropriate accessibility relation R. The selectional restriction of IF-fut is treated as a presupposition about the modal status of the antecedent argument in the historical modal base:

(35) IF-fut(A)(B) (w,t) = undefined, if ($\Box_{\approx}$A ∨ $\Box_{\approx}$¬A)(w,t) = 1. If defined,
        IF-fut(A)(B) (w,t) = 1 iff $\Box_R$(A→B) (w,t) = 1, where R is a modal base

Conditional devices such as English *if* simply lack this presupposition (or require the antecedent to be open in the epistemic modal base, depending on our desired theory for *if*).

3.2   Derivations

Assuming an antecedent (A) of the form 'Mini works/is working/has worked/...'; the vP is translated as *mw*.

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[13]Since I am only concerned with conditionals in unembedded contexts and assuming that the context supplies the utterance time UT as the evaluation time for the antecedent, this semantics for PRES makes the same predictions as one where PRES is deictic on UT. Considering conditionals in embedded contexts might require revising this.

3.2.1 Simple present antecedent

Simple present antecedents are expected to be acceptable under IF-fut with a future reading.

(36) Antecedent LF: [$_{TP}$ PRES [$_{AspP}$ F [$_{vP}$ mw]]]

    a. $[\![PRES(F(mw))]\!]^c = 1$

    b. iff PRES(F(mw)) $(w_c, t_c) = 1$

    c. iff (F(mw)) $(w_c, t_c) = 1$

    d. iff $\exists t'$ [$t_c < t'$ & mw$(w_c, t') = 1$]

    e. Checking the modal status of the antecedent at $\langle w_c, t_c \rangle$. Suppose the antecedent is true in c:

    f. $\Longrightarrow \exists t'$ [$t_c < t'$ & mw$(w_c, t') = 1$]. Let t' = t1.

    g. Consider an arbitrary w' s.t. $\langle w_c, t_c \rangle \approx \langle w', t_c \rangle$

    h. since t_c ¡ t1, nothing guarantees that mw(w',t1) = 1

    i. nothing guarantees that $\exists t'' \neq$ t1 s.t. $t_c < t''$ and mw(w',t'') = 1 (consider a model where there is no future time at w' that verifies mw)

    j. therefore, nothing guarantees that PRES(F(mw)) (w',t_c) = 1

    k. ¬ $\forall \langle w', t' \rangle$ s.t. $\langle w_c, t_c \rangle \approx \langle w', t' \rangle$, PRES(F(mw)) (w',t') = 1

    l. $\Box_\approx$ PRES(F(mw)) $(w_c, t_c) = 0$ (1)

    m. Similarly, if PRES(PERF(mw))$(w_c, t_c) = 0$, then ¬ $\forall \langle w', t' \rangle$ s.t. $\langle w_c, t_c \rangle \approx \langle w', t' \rangle$, PRES(PERF(mw)) (w',t') = 0

    n. $\Longrightarrow (\Box_\approx$ ¬ PRES(PERF(mw)) (w_c, t_c)) = 0   (2)

    o. from (1) and (2), $(\Box_\approx A \vee \Box_\approx \neg A)(w_c, t_c) = 0$

    p. therefore, IF-fut(A)(B) $\neq$ undefined; A is acceptable in the antecedent

3.2.2 Present perfect (*-ech*)

(37) Antecedent LF: [$_{TP}$ PRES [$_{AspP}$ PERF [$_{vP}$ mw]]]

    a. $[\![PRES(PERF(mw))]\!]^c = 1$

    b. iff PRES(PERF(mw)) $(w_c, t_c) = 1$

    c. iff (PERF(mw)) $(w_c, t_c) = 1$

    d. iff $\exists t'$ [$t_c \subseteq_{fin} t'$ & mw$(w_c, t') = 1$]

    e. Checking the modal status of the antecedent at $\langle w_c, t_c \rangle$. Suppose the antecedent is true in c:

    f. $\Longrightarrow \exists t'$ [$t_c \subseteq_{fin} t'$ & mw$(w_c, t') = 1$]

    g. since t_c is a *final* subinterval of t', there is no part of t' that extends beyond t_c. Therefore, $t' \leq t_c$.

    h. Consider an arbitrary w' s.t. $\langle w_c, t_c \rangle \approx \langle w', t_c \rangle$

    i. by **backward-connectedness**: $\langle w_c, t_c \rangle \approx \langle w', t_c \rangle$ and $t' \leq t_c \Longrightarrow \langle w_c, t' \rangle \approx \langle w', t' \rangle$

    j. by **historicity**: $\langle w_c, t' \rangle \approx \langle w', t' \rangle$ and mw$(w_c, t') \Longrightarrow$ mw(w',t')

    k. Since we know that $t_c \subseteq_{fin} t'$, $\Longrightarrow \exists t'$ [$t_c \subseteq_{fin} t'$ & mw(w',t') = 1]

l. $\Longrightarrow$ PERF(mw) (w',t_c) = 1

m. $\Longrightarrow$ PRES(PERF(mw)) (w',t_c) = 1

n. Since $\langle$w',$t_c\rangle$ was arbitrary,

o. $\Longrightarrow$ $\forall\langle$w',t'$\rangle$ s.t. $\langle w_c,t_c\rangle\approx\langle$w',t'$\rangle$, PRES(PERF(mw)) (w',t') = 1

p. $\Longrightarrow$ $\square_\approx$ PRES(PERF(mw)) (w_c,t_c) $\qquad\qquad$ (1)

q. Similarly, if PRES(PERF(mw))(w_c,t_c) = 0, then $\forall\langle$w',t'$\rangle$ s.t.$\langle w_c,\ t_c\rangle\approx\langle$w',t'$\rangle$, PRES(PERF(mw)) (w',t') = 0

r. $\Longrightarrow$ $\square_\approx$ ¬PRES(PERF(mw)) (w_c,t_c) = 1 $\qquad\qquad$ (2)

s. from (1) and (2), ($\square_\approx$A $\vee$ $\square_\approx$¬A)(w_c,t_c) = 1

t. $\Longrightarrow$ IF-fut(A)(B) = undefined; A is unacceptable in the antecedent

3.2.3 Present progressive

(38) LF: [$_{TP}$ PRES [$_{AspP}$ PROG [$_{vP}$ mw]]]

a. $[\![$PRES(PROG(mw))$]\!]^c$ = 1 iff

b. = PRES(PROG(mw)) (w_c,t_c) = 1

c. iff PROG(mw) (w_c,t_c) = 1

d. iff $\forall\langle$w',$t_c\rangle$ $\in$ R_{mod}(w_c,t_c), $\forall\langle$w',t'$\rangle$ $\in$ R_{temp}(w',t_c), mw(w',t') = 1

e. Checking the modal status of the antecedent at $\langle w_c,t_c\rangle$. Suppose the antecedent is true in c:

f. $\Longrightarrow$ $\forall\langle$w',$t_c\rangle$ $\in$ R_{mod}(w_c,t_c), $\forall\langle$w',t'$\rangle$ $\in$ R_{temp}(w',t_c), mw(w',t') = 1 $\qquad$ (1)

g. Consider an arbitrary $\langle$w'',$t_c\rangle$ s.t. $\langle w_c,t_c\rangle$ $\approx$ $\langle$w'',$t_c\rangle$

h. By **consistency of modal bases**, R_{mod}(w_c,t_c) = R_{mod}(w'',t_c)

i. $\Longrightarrow$ from (1): $\forall\langle$w'',t'$\rangle$ $\in$ R_{temp}(w'',t_c), mw(w'',t') = 1

j. $\Longrightarrow$ PROG(mw) (w'',t_c) = 1

k. $\Longrightarrow$ PRES(PROG(mw)) (w'',t_c) = 1 $\qquad\qquad$ (2)

l. since $\langle$w'',$t_c\rangle$ was arbitrary, $\Longrightarrow$ $\forall\langle$w',t'$\rangle$ s.t. $\langle w_c,t_c\rangle\approx\langle$w',t'$\rangle$, PRES(PROG(mw)) (w',t') = 1

m. $\Longrightarrow$ $\square_\approx$ PRES(PROG(mw)) (w_c,t_c) $\qquad\qquad$ (3)

n. Similarly, if PRES(PROG(mw))(w_c,t_c) = 0, then $\forall\langle$w',t'$\rangle$ s.t. $\langle w_c,t_c\rangle\approx\langle$w',t'$\rangle$, PRES(PROG(mw)) (w',t') = 0

o. $\Longrightarrow$ $\square_\approx$ ¬ PRES(PROG(mw)) (w_c,t_c) = 1 $\qquad\qquad$ (4)

p. from (3) and (4), ($\square_\approx$A $\vee$ $\square_\approx$¬A)(w_c,t_c) = 1

q. $\Longrightarrow$ IF-fut(A)(B) = undefined; A is unacceptable in the antecedent

Since the lexical entry for IMPF differs from PROG only in the nature of its temporal accessibility relation R_{temp}, an antecedent of the form PRES(IMPF(p)) is similarly settled in the historical modal base at $\langle w_c,t_c\rangle$, and predicted to be unacceptable.

3.2.4 Past tensed antecedent

(39) Antecedent LF: [$_{TP}$ PAST [$_{AspP}$ F [$_{vP}$ mw]]]. Since nothing occupies AspP in a simple past clause, I assume that past tense can co-occur with F.

    a. $[\![\text{PAST}(\text{F}(\text{mw}))]\!]^c = 1$

    b. iff PAST(F(mw)) $(w_c, t_c) = 1$

    c. iff $\exists t'$ s.t. $t' < t_c$ and F(mw) $(w_c, t') = 1$

    d. iff $\exists t'$ s.t. $t' < t_c$ and $\exists t''$ s.t. $t' < t''$, and mw(w_c, t'')   (1)

    e. Assume that the antecedent is true in c. Let t' in (1) be instantiated by a time t_{ref}, and t'' by a time t_{ev}. Checking the modal status of PAST(F(mw)) at $\langle w_c, t_c \rangle$

    f. from (1): $t_{ref} < t_c$ and $t_{ref} < t_{ev}$, and mw(w_c, t_{ev}) = 1.

    g. Two possibilities:

        i. $t_{ref} < \mathbf{t_{ev}} < \mathbf{t_c}$

        ii. $t_{ref} < \mathbf{t_c} < \mathbf{t_{ev}}$

The complete derivation can be found in the Appendix (A.1). To summarize: when $t_{ev} < t_c$, the derivation parallels that of the present perfect LF above, and correctly predicts that past tense is disallowed under IF-fut when the event time if before UT (i.e. with a past reading). When $t_c < t_{ev}$, the derivation parallels that of simple present antecedents, and predicts that past tense should be acceptable under IF-fut in configurations where the event time is after the time of evaluation (i.e., future-referring readings). As noted in section 2.3, this is indeed possible in Bangla. Given its limited availability, however, we would likely require additional constraints on the interaction of PAST and F to explain why this is not the default reading in Bangla, and further empirical work to test the cross-linguistic robust-ness of this pattern.

3.2.5 Further embedded clauses

I noted in section 2 that when the vP under IF-fut embeds another clause, the restrictions on tense-aspect do not apply to the deeper embedded clause—it can be marked for past tense, progressive, perfect, imperfective. Under the current analysis, an antecedent of the form 'it turns out that Mini is eating fruit' has the following LF:

[$_{TP}$ PRES [$_{AspP}$ F [$_{vP}$ turn-out [$_{CP}$ that [$_{TP}$ PRES [$_{AspP}$ PROG [$_{vP}$ mini-eat-fruit]]]]]]]]

Crucially, since the AspP of the clause directly under IF-fut is occupied by F, this is structurally similar to the simple present antecedents above. Considering the semantics, the eventuality that is relevant for determining the status of the antecedent in MB_{hist} in this case differs from that in the non-embedded progressive-marked clause. E.g. in the antecedent above, the relevant eventuality is akin to a future 'turning-out of M', where M is the proposition expressed by 'Mini is eating fruit'. I take this *turning-out* eventuality to be (roughly) a certain knowledge-gaining event by the speaker. Importantly, while M (given the semantics of PROG) is guaranteed to be settled in $MB_{hist}(w_c, t_c)$, the proposition expressed by 'it turns out that M' (T-M) is *not*: T-M and ¬T-M are both live possibilities at t as

long as the truth/falsity of M is not known to the speaker at t (M is open in MB_{epis}). Such clauses are correctly predicted to be acceptable under IF-fut.[14]

4 Discussion and conclusion

This paper examined a set of indicative conditional devices that place similar restrictions on the tense-aspect marking and interpretation of their antecedent clause. While existing works on the individual constructions have noted some of these restrictions (Bagchi (2005) on Bangla *jodi*, Klinedinst & Rothschild (2012) on conditional *and* in English), they have not been viewed as a unified phenomenon, and neither the full scope of the restrictions nor their appropriate characterization has been examined in detail. However, this might be obscuring a relevant dimension of contrast within conditional meaning. This matters in particular because identifying the semantic components along which conditionals can differ, and the linguistic correlates of these differences, has been a fruitful point of departure in understanding how conditional meaning is built in language. This has been a concern in much of the existing formal research on conditionals (Comrie, 1986; von Fintel & Iatridou, 2023) and modal expressions more generally.

I suggested that the conditional devices examined in this paper evidence a possible division within the category of indicative conditionals based on the modal properties of the antecedent. Specifically, they share a common semantic core IF-fut, which specifies a presuppositional requirement for the antecedent clause be open in the historical modal base generated at the evaluation time. Intuitively, this means that the truth of the antecedent clause must depend on facts after the evaluation time. This parallels other known divisions within conditionals, such as indicative vs counterfactual, factual vs hypothetical, etc, that contrast primarily in the modal properties of the antecedent. For each of these, there are certain devices across languages that are lexically specialized for one part of the contrast (e.g. *stom* in Bulgarian for factual conditionals; Bhatt & Pancheva (2006)), instances where the same lexical item is used but the contrast is marked elsewhere in the construction (e.g. factual vs hypothetical conditionals with *agar* in Farsi; Mirrazi (2022)) and yet others that have distinct interpretations without any overt marking of the contrast (e.g. factual vs hypothetical conditionals with *if* in English; Bhatt & Pancheva (2006)). In relation to the contrast discussed in this paper, devices like *jodi* in Bangla, *in the event* in English, *falls* in German, etc behave like Bulgarian *stom*: they are specialized to express IF-fut. Since historical modality interacts with time in a predictable way (Thomason, 1970; Condoravdi, 2002; Kaufmann, 2005), clauses with tense-aspect configurations that preclude historical open-ness fail to satisfy the presupposition of IF-fut, and are therefore unacceptable as the antecedent of these expressions. The shared modal property explains why this specific set of tense-aspect categories is disallowed under different conditional devices across unrelated languages. Focusing on data from Bangla and English, I suggested that the proposed constraint

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[14]This predicts that T-M is guaranteed to be settled in MB_{hist} in exactly those cases where the speaker already knows the truth/falsity of M at t. In such cases, these clauses should be unacceptable. This indeed seems to be the case: when the embedded clause expresses something that the speaker could not fail to know at t (e.g. an ongoing eventuality in which the speaker is a participant), the resulting *turn-out* clause is unacceptable under IF-fut. The details of the data are not presented here.

interacts with language-specific properties of the TAM system in predictable ways, such that cross-linguistic differences in the availability of progressive and perfect aspect under IF-fut might be derivable from these differences.

This account correctly predicts that present progressive, present perfect, present imperfective (habitual/generic), and past-tensed antecedents are unacceptable under IF-fut. Further, independent constraints on the Bangla TAM system preclude future-shifting of present-tensed PROG and PERF in the antecedent, which is possible in English. While this accounts for the main generalizations, the current implementation makes some puzzling predictions:

(i) IMPF under IF-fut in English: nothing in the current system prevents IMPF from co-occurring with F in English. This should allow for future-shifted present imperfective antecedents that are acceptable under IF-fut (parallel to future-shifted PROG and PERF clauses), and predicted to have 'future habitual-generic' readings wherein the generalizations hold relative to a salient future time. However, it is unclear whether such readings are actually available:

(40) (We are discussing Mary's plans for next year)
In the event that Mary plays golf, she will own a golf kit.

Under the predicted reading, the antecedent should be able to invoke a future time t such that the generalization *Mary plays golf (habitually)* holds of t. However, this interpretation is hard to get. The salient reading simply involves a specific future event of Mary's playing. Simple present antecedents under IF-fut seem unable to express a future generalization, suggesting that IMPF does not appear under IF-fut, contra our predictions. Note, however, that such future-shifted habitual-generic readings also seem unavailable under English *if*:

(41) If [Mary plays golf], she will own a golf kit.

Under *if*, the antecedent can either describe a generalization that holds *at UT*, or a future golf-playing event (or perhaps a future time at which she *starts* to play). Crucially, it can't seem to describe a generalization about Mary's habits relative to a future time. This might reflect a more general property of the imperfective aspect that is not captured by the treatment here.

(ii) F under PAST: as noted in section 3.2.4, nothing in the current account prevents F from occurring in past-tensed clauses. While past-referring uses of the past tense are still correctly predicted to be unacceptable under IF-fut, the account predicts that it should be possible to get past tense under IF-fut with *future*-referring readings. There is some evidence for this under Bangla *jodi*, but it is not clear why this is not the default reading for Bangla, nor why past-tense is generally unacceptable under IF-fut. The interaction of F with PAST likely needs to be constrained in order to refine these predictions. More generally, while I have adopted from Williamson (2021) and Mendes (2024) the idea that future-reference in the conditional antecedent is facilitated by a future-shifting operator that is separate from both the tense and the conditional connective, I have made the simplifying assumption that F is in-principle available in the conditional antecedent unless prevented by another another aspect operator competing for the same slot (in Bangla). However, the details of Williamson's (2021) account suggest that this is unlikely to be empirically adequate. A careful consideration of the licensing conditions for F and the semantics of past tense in Bangla and English

is likely to provide a more satisfactory account of PAST under IF-fut.

The close parallels in tense-aspect restrictions across multiple conditional devices and languages suggests that the modal status of the antecedent in a historical modal base might be a relevant parameter along which conditional expressions can vary. Future research should test both the breadth of these generalizations and how they interact with independently known facts about the verbal system of different languages. If the cross-linguistic generalizations are shown to hold, this will suggest that conditional reasoning from objectively open possibilities is distinguished by the linguistic system, parallel to the way that reasoning from false possibilities seems to be (Iatridou, 1990; Khoo, 2015). This will in turn enrich our understanding of the relevant units that compose conditional meaning in language.

Abbreviations

1	first person
2	second person
3	third person
ACC	accusative
CLF	classifier
COP	copula
FUT	future
GEN	genitive
INF	infinitive
LOC	locative
NEG	negative
PRF	perfect
PROG	progressive
PRS	present
PST	past

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Appendix

A.1: Derivation for past-tensed antecedents under IF-fut

(42) Antecedent LF: [$_{TP}$ PAST [$_{AspP}$ F [$_{vP}$ mw]]]. Since nothing occupies AspP in a simple past clause, I assume that past tense can co-occur with F.

   a. $[\![PAST(F(mw))]\!]^c = 1$

   b. iff $PAST(F(mw))\ (w_c,t_c) = 1$

   c. iff $\exists t'$ s.t. $t'<t_c$ and $F(mw)\ (w_c,t') = 1$

   d. iff $\exists t'$ s.t. $t'<t_c$ and $\exists t''$ s.t. $t'<t''$, and $mw(w_c,t'')$ (1)

   e. Assume that the antecedent is true in c. Let t' in (1) be instantiated by a time t_{ref}, and t'' by a time t_{ev}. Checking the modal status of $PAST(F(mw))$ at $\langle w_c,t_c\rangle$.

   f. from (1): $t_{ref} < t_c$ and $t_{ref} < t_{ev}$, and $mw(w_c,t_{ev}) = 1$.

   g. Two possibilities:

     i. $t_{ref} < \mathbf{t_{ev}} < \mathbf{t_c}$

     ii. $t_{ref} < \mathbf{t_c} < \mathbf{t_{ev}}$

(43) **Case i: $\mathbf{t_{ev}} < \mathbf{t_c}$:**

   a. Consider an arbitrary w' s.t. $\langle w_c,t_c\rangle \approx \langle w',t_c\rangle$

   b. by **backward-connectedness**: $\langle w_c,t_c\rangle \approx \langle w',t_c\rangle$ and $t_{ev} \leq t_c \Longrightarrow \langle w_c,t_{ev}\rangle \approx \langle w',t_{ev}\rangle$

   c. by **historicity**: $\langle w_c,t_{ev}\rangle \approx \langle w',t_{ev}\rangle$ and $mw(w_c,t_{ev}) \Longrightarrow mw(w',t_{ev})$

   d. Since $t_{ref} < t_{ev}, \Longrightarrow \exists t''$ s.t. $t_{ref}<t''$ and $mw\ (w',t'') = 1, \Longrightarrow F(mw)\ (w',t_{ref}) = 1$

   e. Since $t_{ref} < t_c, \Longrightarrow \exists t'$ s.t. $t'<t_c$ and $F(mw)\ (w',t') = 1, \Longrightarrow PAST(F(mw))\ (w',t_c) = 1$ (2)

   f. Since $\langle w',t_c\rangle$ was arbitrary, from (2): $\Box_{\approx} PAST(F(mw))\ (w_c,t_c)$ (3)

   g. Similarly, if $PAST(F(mw))(w_c,t_c) = 0$, then $\Box_{\approx} \neg PAST(F(mw))\ (w_c,t_c) = 1$ (4)

   h. from (3) and (4), $(\Box_{\approx}A \vee \Box_{\approx}\neg A)(w_c,t_c) = 1$

   i. $\Longrightarrow$ IF-fut(A)(B) = undefined; clause is unacceptable in the antecedent

This correctly predicts that past tense in the antecedent should be unacceptable when the event is in the past of t_c.

(44) **Case ii: $\mathbf{t_c} < \mathbf{t_{ev}}$:**

   a. From (1): $mw\ (w_c,t_{ev}) = 1$

   b. Consider an arbitrary w' s.t. $\langle w_c,t_c\rangle \approx \langle w',t_c\rangle$. Since $t_c < t_{ev}$,

   c. nothing guarantees that $mw\ (w',t_{ev}) = 1$

   d. nothing guarantees that $\exists t'' \neq t_{ev}$ s.t. $t_{ref} < t''$ and $mw\ (w',t'') = 1$

   e. $\Longrightarrow$ nothing guarantees that $f(mw)\ (w',t_c)$

   f. $\Longrightarrow$ nothing guarantees that $PAST(F(mw))\ (w',t_c) = 1$

   g. $\Longrightarrow \neg \forall \langle w',t'\rangle$ s.t. $\langle w_c,t_c\rangle \approx \langle w',t'\rangle$, $PRES(F(mw))\ (w',t') = 1$

h. $\implies \neg \ \Box_{\approx} \ \text{PAST}(\text{F(mw)}) \ (\text{w}_\text{c},\text{t}_\text{c}) = 1$ (5)

i. Similarly, if $\text{PAST}(\text{F(mw)})(\text{w}_\text{c},\text{t}_\text{c}) = 0$, then $\neg \forall \langle \text{w'},\text{t'} \rangle$ s.t. $\langle \text{w}_\text{c},\text{t}_\text{c} \rangle \approx \langle \text{w'},\text{t'} \rangle$, $\text{PAST}(\text{F(mw)})$ $(\text{w'},\text{t'}) = 0$, and $\neg \ \Box_{\approx} \ \neg \text{PAST}(\text{F(mw)}) \ (\text{w}_\text{c},\text{t}_\text{c}) = 1$ (6)

j. from (5) and (6), $(\Box_{\approx}\text{A} \lor \Box_{\approx}\neg\text{A})(\text{w}_\text{c},\text{t}_\text{c}) = 0$

k. $\implies \text{IF-fut}(\text{A})(\text{B}) \neq$ undefined; clause is acceptable in the antecedent

This predicts that past tense should be acceptable in the antecedent in a configuration where the event time is after the time of evaluation, t_c (future-referring reading).