

Openness requirements and conditional ‘iffiness’: evidence from Bangla
jodi-conditionals

Auromita Mitra (Disha); NYU

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A question of iffiness

- ▶ Hypothetical conditionals: in all the relevant cases where the antecedent is true, the consequent is true
- ▶ In philosophical literature: translated as a two-place connective that relates sentences
- ▶ *if*-clauses as restrictors : “The history of the conditional is the story of a syntactic mistake. There is no two-place *if* . . . *then* connective in the logical forms of natural languages. *If*-clauses are devices for restricting the domains of various operators.” (Kratzer, 1986)

However...

- ▶ **iffiness** (Von Stechow and Iatridou, 2002): *if* adds some meaning beyond marking restriction, unlike syntactically similar restrictors

(1) (??if)/when Peter wakes up, he usually makes coffee

- ▶ At each point in the domain, there is a question of whether the antecedent holds
- ▶ But is this just a general/pragmatic constraint on modal assertion? Diversity: Condoravdi (2002)
- ▶ Evidence from a larger set of conditional connectives

- ▶ Subordinating connective used in conditional statements: indicative, counterfactual
- ▶ Distribution: more restricted than *if*
- ▶ This work:
 - ▶ **Empirical question:** how to characterize the restriction?
 - ▶ **Formal question:** where/how is the restriction specified?
- ▶ **Main claim:** *jodi* presupposes a particular attitude towards the antecedent that is independent of the modality of the consequent, adding to growing evidence that conditional connectives make lexically-specific semantic contributions beyond marking a quantifier-restriction: conditionals are semantically ‘iffy’

Roadmap

Empirical question

Sketching an analysis

Formal question

Implications and conclusion

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Scope of data

- ▶ Indicative conditionals
- ▶ Eventive antecedents
- ▶ Single-case conditionals (excludes 'whenever' readings: *if she woke up early, she went to the gym*)
- ▶ Restrictions on what can appear in the antecedent. Consequent is not constrained.

Restrictions: tense-aspect marking

- ▶ (2) 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
- ▶ (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
b. ?? jodi o paper-ta journal-e submit kor-l-o, amra publish korbo na
?? if he paper-CLF journal-GEN submit do-PST-3, we publish do.FUT.3 NEG
Intended: If he submitted the paper to a journal, we will not publish it
- ▶ Other clauses that behave like (b): present/past progressive, present/past perfect

Restrictions: interpretation of ambiguous aspect marking

- ▶ (4) a. If she drinks coffee (tomorrow), she will be jumpy during the meeting [future reading of antecedent]
- b. If she drinks coffee (in general), she will love this place [habitual-generic reading of antecedent]

- ▶ (5) a. jodi porer bochor 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. ?? jodi ekhane khub brishti pORe, tahole (nishchoi) sobar onek-gulo kore
?? if here much rain fall-PRS-3, then (likely) everyone-GEN many-CLF
chhata ache
umbrella COP
Intended: If it rains a lot here, then (I bet) everyone owns multiple umbrellas

- ▶ Simple present clauses are only acceptable on the future interpretation; not on the habitual-generic interpretation

Restrictions: type of future-event

Future-reference is necessary, but not sufficient: only genuinely open future possibilities are acceptable:

- ▶ (6) 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

- ▶ (7) Context 2: we are testing the efficiency of a new stove by seeing how quickly the water boils.

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

- ▶ Shared by *if*; recalls Von Stechow and Iatridou (2002)-style iffiness— uncertainty requirement

Generalization

- ▶ Observation: all the allowed antecedent clauses are future *dependent* at UT (truth at UT depends on future facts about the evaluation world); all the disallowed clauses are future-independent at UT
- ▶ Dependence on future times in the evaluation world: corresponds to a known modal property: **historical/ontic/metaphysical openness** (Condoravdi, 2002)
- ▶ Historical modality: models (*our perception of*) the possible ways that the world could be given what is objectively the case now. Intuitively: corresponds to an attitude of ‘in-principle knowability’ (Kaufmann, 2005)
- ▶ Interacts with epistemic modality: historical possibilities are a subset of epistemic possibilities (Klecha, 2016)
- ▶ **Empirical question:** *jodi(A)(B)* is acceptable iff A is *open* in the historical modal base at the evaluation time; *open* := neither A nor $\neg A$ is necessary
- ▶ Argue for a lexical, presuppositional account: *jodi* directly specifies this. Restrictions on tense-aspect derive from known interactions of historical modality with time.

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Tense-aspect and future reference in conditional antecedent

- ▶ Choices:
 - ▶ antecedent and consequent clause both have tense and aspect
 - ▶ evaluation time of the antecedent = evaluation time of the conditional = UT for unembedded conditionals
 - ▶ uniform semantics for tense-aspect
 - ▶ future reference in the antecedent is facilitated by a future-shifting operator F (prospective aspect; Matthewson (2012); Matthewson et al. (2022); Williamson (2021); Mendes (2024)), which occupies AspP
 - ▶ Bangla disallows aspect-stacking (AspP cannot host more than one operator)
- ▶ LF of a simple present antecedent with future reference:

(8) TP PRES [_{AspP} F [_{VP} ...]

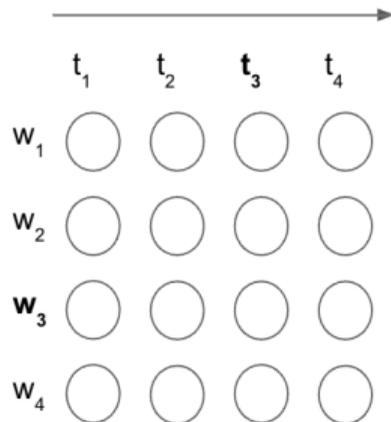
- ▶ Truth conditions for conditional: strict conditional: *if A, then B* is true iff in all relevant worlds, the material conditional $A \rightarrow B$ is true

Formal system: setup

- ▶ Propositional language; atomic sentences (At) correspond to sentence radicals
- ▶ W : non-empty set of worlds, T : non-empty set of time intervals related by containment \subseteq and precedence \leq . $I = W \times T$: set of indices (Thomason, 1970; Kaufmann, 2005)
- ▶ Truth evaluated at indices (world-time pairs) and relativized to a context c , which provides a unique index $\langle w_c, t_c \rangle$. $t_c = UT$, the utterance time
- ▶ For any p of arbitrary complexity:

$$(9) \quad \text{if } p \in At, p(w,t) = 1 \text{ iff } V(p, \langle w,t \rangle) = 1$$

$$(10) \quad \llbracket p(w, t) \rrbracket^c = 1 \text{ iff } p(w_c, t_c) = 1$$

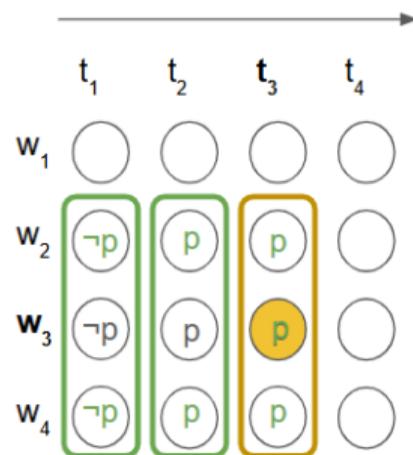


Formal system: historical modality and modeling future-dependence

An accessibility relation R on $I \times I$ is *modal* if $\langle w, t \rangle R \langle w', t' \rangle$ implies that $t = t'$.

The historical accessibility relation \approx :

- (11) a. Is modal
b. Is an equivalence relation
c. **Backward-connectedness**
if $\langle w, t \rangle \approx \langle w', t \rangle$ and $t' \leq t$, then $\langle w, t' \rangle \approx \langle w', t' \rangle$
if two worlds are historical alternatives of each other at t , they are historical alternatives 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



Formal system: historical modality and modeling future-dependence

- ▶ **Modal base:** a modal accessibility relation that is consistent across historical alternatives: if iRj and $i \approx k$, then kRj .
- ▶ **historicity** and **backward connectedness** guarantee: all the worlds accessible from w at t are identical up until t
- ▶ **Consequence:** if facts up until t are sufficient to evaluate the truth of p at t , the truth value of p is identical across all the worlds in the historical modal base at t : either p , or $\neg p$, is necessary in MB_{\approx} . p is settled in MB_{\approx}
- ▶ Semantics for *jodi*:

$$(12) \quad jodi(A)(B)(w,t) = \text{undefined, if } (\Box_{\approx} A \vee \Box_{\approx} \neg A)(w,t) = 1. \text{ If defined,} \\ jodi(A)(B)(w,t) = 1 \text{ iff } \Box_R(A \rightarrow B)(w,t) = 1, \text{ where } R \text{ is a modal base}$$

Formal system: tense and aspect

Tenses

$$(13) \text{ PRES}(p) (w,t) = 1 \text{ iff } p(w,t) = 1$$

$$(14) \text{ PAST}(p) (w,t) = 1 \text{ iff } \exists t' \text{ s.t. } t' < t \text{ and } p(w,t') = 1$$

Aspect

$$(15) \text{ PERF}(p) (w,t) = 1 \text{ iff } \exists t' [t \subseteq_{fin} t' \ \& \ p(w,t') = 1]; \subseteq_{fin} \text{ gives a final subinterval of } t'$$

$$(16) \text{ F}(p) (w,t) = 1 \text{ iff } \exists t': t < t' \ \& \ p(w,t') = 1$$

$$(17) \text{ PROG}(p) (w,t) = 1 \text{ iff } \forall \langle w',t \rangle \in R_{\text{mod}}(w,t), \forall \langle w',t' \rangle \in R_{\text{temp}}(w',t), p(w',t') = 1$$

$$(18) \text{ IMPF}(p) (w,t) = 1 \text{ iff } \forall \langle w',t \rangle \in R_{\text{mod}}(w,t), \forall \langle w',t' \rangle \in R_{\text{temp}}(w',t), p(w',t') = 1$$

Formal system: tense and aspect

Tenses

(19) $\text{PRES}(p)(w,t) = 1$ iff $p(w,t) = 1$

(20) $\text{PAST}(p)(w,t) = 1$ iff $\exists t'$ s.t. $t' < t$ and $p(w,t') = 1$

Aspect

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

(22) $\text{F}(p)(w,t) = 1$ iff $\exists t': t < t' \ \& \ p(w,t') = 1$

(23) $\text{PROG}(p)(w,t) = 1$ iff $\forall \langle w',t \rangle \in R_{\text{mod}}(w,t), \forall \langle w',t' \rangle \in R_{\text{temp}}(w',t), p(w',t') = 1$

(24) $\text{IMPF}(p)(w,t) = 1$ iff $\forall \langle w',t \rangle \in R_{\text{mod}}(w,t), \forall \langle w',t' \rangle \in R_{\text{temp}}(w',t), p(w',t') = 1$

Derivation: present perfect antecedent

jodi Mini has worked, she will leave soon.

- (25) Antecedent LF: $[_{TP} PRES [_{AspP} PERF [_{vP} mw]]]$
- $\llbracket PRES(PERF(mw)) \rrbracket^c = 1$
 - iff $PRES(PERF(mw)) (w_c, t_c) = 1$
 - iff $\exists t' [t_c \subseteq_{fin} t' \ \& \ mw(w_c, t') = 1]$
 - Checking the modal status of the antecedent at $\langle w_c, t_c \rangle$. Suppose the antecedent is true in c:
 - $\implies \exists t' [t_c \subseteq_{fin} t' \ \& \ mw(w_c, t') = 1]$
 - since t_c is a *final* subinterval of t' , there is no part of t' that extends beyond t_c . Therefore, $t' \leq t_c$.
 - Consider an arbitrary w' s.t. $\langle w_c, t_c \rangle \approx \langle w', t_c \rangle$
 - by **backward-connectedness**: $\langle w_c, t_c \rangle \approx \langle w', t_c \rangle$ and $t' \leq t_c \implies \langle w_c, t' \rangle \approx \langle w', t' \rangle$
 - by **historicity**: $\langle w_c, t' \rangle \approx \langle w', t' \rangle$ and $mw(w_c, t') \implies mw(w', t')$
 - Since we know that $t_c \subseteq_{fin} t'$, $\implies \exists t' [t_c \subseteq_{fin} t' \ \& \ mw(w', t') = 1]$
 - $\implies PRES(PERF(mw)) (w', t_c) = 1$

Sample derivation: present perfect antecedent (contd.)

- (26) a. Since $\langle w', t_c \rangle$ was arbitrary,
b. $\implies \forall \langle w', t' \rangle$ s.t. $\langle w_c, t_c \rangle \approx \langle w', t' \rangle$, $\text{PRES}(\text{PERF}(mw)) (w', t') = 1$
c. $\implies \Box_{\approx} \text{PRES}(\text{PERF}(mw)) (w_c, t_c)$ (1)
d. Similarly, if the antecedent is false in c, then $\forall \langle w', t' \rangle$ s.t. $\langle w_c, t_c \rangle \approx \langle w', t' \rangle$, $\text{PRES}(\text{PERF}(mw)) (w', t') = 0$
e. $\implies \Box_{\approx} \neg \text{PRES}(\text{PERF}(mw)) (w_c, t_c)$ (2)
f. from (1) and (2), $(\Box_{\approx} A \vee \Box_{\approx} \neg A)(w_c, t_c) = 1$
g. $\implies \text{jodi}(A)(B) = \text{undefined}$; clause is unacceptable in the antecedent

Sample derivation: simple present antecedent with future reference

jodi Mini works (tomorrow), she will be in the office.

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

a. $\llbracket \text{PRES}(\text{F}(\text{mw})) \rrbracket^c = 1$

b. **iff** $\exists t' [t_c < t' \ \& \ \text{mw}(w_c, t') = 1]$

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

d. $\implies \exists t' [t_c < t' \ \& \ \text{mw}(w_c, t') = 1]$.

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

f. since $t_c < t'$, there is a counter-model where $\text{mw}(w', t') = 0$

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

h. Similarly, if $\text{PRES}(\text{PERF}(\text{mw}))(w_c, t_c) = 0$, then $\neg \forall \langle w', t' \rangle$ s.t. $\langle w_c, t_c \rangle \approx \langle w', t' \rangle$, $\text{PRES}(\text{PERF}(\text{mw}))(w', t') = 0$ (2)

i. **from (1) and (2), it does not follow that** $(\Box_{\approx} A \vee \Box_{\approx} \neg A)(w_c, t_c) = 1$

j. therefore, $\text{jodi}(A)(B) \neq \text{undefined}$; A is acceptable in the antecedent

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'Two types' of conditional reasoning, and diversity

- ▶ Q: What might lead to a ban against historically/ontically settled antecedents?
- ▶ If we assume (i) conditionals simply restrict the domain of a modal; (ii) a general pragmatic principle of diversity (ban against vacuous restriction), we might say: the embedded modal under *jodi* is always ontic
- ▶ Since epistemic possibilities are a superset of ontic possibilities, openness in the former does not guarantee openness in the latter. This would force ontic openness
- ▶ Relates to: a tradition of classifying conditionals as enabling two distinct types of reasoning: **ontic**: *if x happen(s/ed), y will/would happen*; **epistemic**: *if I learn that x, I will/would conclude y* (e.g. Schulz (2007))
- ▶ **Alternative hypothesis**: *jodi* is specialized for 'ontic' reasoning, and the restrictions simply follow from diversity. (This doesn't say anything about the role of the antecedent)

Epistemic reasoning with *jodi*

- ▶ Q: Is *jodi* just unable to restrict epistemic modals?
- ▶ A: Unlikely:
 - ▶ Formally: the consequent can be in the past of UT: *jodi*[he wins], he has trained hard If the consequent modal base was ontic, this would be trivially true
 - ▶ Interpretationally: the consequent above means: ‘I will conclude/believe that he has trained hard’
 - ▶ Linguistically: these consequents most naturally include *taar maane* ‘that means’; or *nishchoi* ‘surely’
- ▶ Conclusion: not a restriction against reasoning over epistemic possibilities, but rather on what kinds of facts can be used in the reasoning. The speaker must have an attitude of un-knowability towards these facts.
- ▶ Formally: the restriction is specifically on the status of the antecedent clause in an ontic modal base; cannot be derived as a consequence of a pragmatic diversity condition
- ▶ **Formal question** *jodi*(A)(B) presupposes that A is open in the historical modal base MB_{hist} at the time of evaluation

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Back to iffiness

- ▶ I made two claims that are not predicted by a ‘restrictor-only’ account of conditionals:
 1. The antecedent can invoke modality that is independent of the consequent
 2. Conditional connective can select for properties of this modality (or its associated attitudinal state)
- ▶ Both of these have been independently proposed:
 1. Based on English *if* (Van Fraassen, 1981): *If my wife deceives me, I won't believe it* — If the antecedent modality was epistemic, the conditional would be contradictory
 2. Based on German *falls* (Kaufmann et al., 2024): *falls(A)(B)* presupposes that some agent actively entertains the question of whether A

Summary

- ▶ Systematic restrictions on the *antecedent* – unexpected under analyses where the antecedent simply restricts the domain of evaluation of the consequent. This account: part of lexical meaning of conditional devices
- ▶ What is this meaning component? : modal openness requirement – evidence for *iffiness*
- ▶ Iffiness(es) across conditional devices: there are different *kinds* of openness requirements (invoking different, specific, domains) (Kaufmann et al., 2024)
- ▶ Broadly similar restrictions with *in the event*; conditional-*and*
- ▶ Future work: interaction with stativity; constraints on counterfactual uses of *jodi*

Thank you!

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Restrictions: further embedded clauses

- ▶ ‘Disallowed’ markers and interpretations are acceptable in a further embedded clause, as long as the clause directly under *jodi* complies with the restrictions
- ▶ (28) *jodi* ami shun- ϕ -i je [mini phOI kha- ϕ -e /kha-ch- ϕ -e /kh-ech- ϕ -e], tahole ami
if I hear-PRS-1 that [mini fruit eat-PRS-3 /eat-PROG-PRS-3 /eat-PRF-PRS-3], then I
khuSi hObo
happy be.FUT.1
If I hear that [Mini eats (in general)/ is eating/ has eaten fruit], then I will be happy

Open questions and future directions

- ▶ F under PAST

(29) jodi kaaj-ta mini-i korlo, tumi acho ki korte?
if work-CLF mini- do-PST-3, you COP-3 what do.INF?
If it is Mini who does the work, what are you here for?

- ▶ Future-shifted habitual-generics

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

The $<$ and \leq relations

- ▶ $t \leq t'$ iff no part of t extends beyond t'
- ▶ $t < t'$ iff $t \leq t'$ and t and t' have no part in common
- ▶ **Backward-connectedness:** if $\langle w, t \rangle \approx \langle w', t \rangle$ and $t' \leq t$, then $\langle w, t' \rangle \approx \langle w', t' \rangle$
- ▶ $F(p)(w, t) = 1$ iff $\exists t': t < t' \ \& \ p(w, t') = 1$

F invokes an interval that is strictly after t , so that $F(p)$ cannot be true at t by virtue of p being true at t (it must depend on future times).

Allen Statements		Pictorial Example	Chronological Sequence	$x \leq y$	$x < y$	$y \leq x$	$y < x$
Relations	Inverse Relations						
X before Y	Y after X		$X_{start} < X_{end} < Y_{start} < Y_{end}$	✓	✓		
X equals Y	Y equals X		$X_{start} = Y_{start} < X_{end} = Y_{end}$	✓		✓	
X meets Y	Y met by X		$X_{start} < X_{end} = Y_{start} < Y_{end}$	✓			
X overlaps Y	Y overlapped by X		$X_{start} < Y_{start} < X_{end} < Y_{end}$	✓			
X contains Y	Y during X		$X_{start} < Y_{start} < Y_{end} < X_{end}$			✓	
X starts Y	Y started by X		$X_{start} = Y_{start} < X_{end} < Y_{end}$	✓			
X finishes Y	Y finished by X		$Y_{start} < X_{start} < X_{end} = Y_{end}$	✓		✓	

Figure: \leq and $<$ in terms of Allen relations

Arguments for aspectual source of future-reference (F)

- ▶ Williamson (2021): A wider set of constructions show the same *pattern* of future-reference: future-shift in dependent clause, NO independent shift in the main clause, temporal donkey anaphora
- ▶ Mendes (2024): happens in non-modal constructions too; always co-occurs with subjunctive mood marking in languages with richer mood morphology
- ▶ Bangla facts: separation between scheduled, futurate uses and plain future reference of simple present
- ▶ Matthewson (2012): Gitksan has an overt marker that appears in exactly this set of constructions and is obligatory for future reference

Why epistemic openness is not a ‘default’ for conditional connectives:

- (8) a. $\{\overset{?}{?}\text{Falls/Wenn}\}$ Peter aufwacht, trinkt er immer einen Kaffee.
falls/wenn Peter wakes up drinks he always a coffee
- b. $\{\overset{?}{?}\text{Falls/Wenn}\}$ Peter zeitig aufwacht, trinkt er immer einen Kaffee.
falls/wenn Peter early wakes up drinks he always a coffee
- (9) a. $\{\overset{?}{?}\text{If/When}\}$ Peter wakes up, he always drinks a coffee.’
- b. $\{\overset{\checkmark}{\checkmark}\text{If/When}\}$ Peter wakes up early, he always drinks a coffee.’

Even on its conditional uses, *wenn* does not have the same requirement. Moreover, *falls*, which is another conditional connective, is not acceptable even with epistemic openness. This shows: epistemic openness is only ONE kind of *iffiness*.