

Modal Constraints on Temporal Reference

General Session

This paper highlights two novel phenomena which illuminate constraints on temporal reference under the scope of intensional predicates, and proposes an analysis in which modals quantify not over (whole) worlds, but over (potentially partial) histories; temporal reference embedded by the modal is then constrained to just the times contained in these partial histories.

Constraint #1: Temporal Incommensurability. Temporal comparatives like *later*, *earlier*, etc., cannot span across speech time; i.e., they cannot compare two times if one is before speech time and one is after.

- (1) a. Mary got_i pregnant 12 months ago. She gave_j birth 9 months later_j. $i < j < n$
 b. Mary will_i get pregnant 12 months from now. She'll_j give birth 9 months later_j. $n < i < j$
 c. Mary got_i pregnant 3 months ago. #She's gonna_j give birth 9 months later_j. $\#i < n < j$
- (2) a. Mary gave_j birth 3 months ago. She got_i pregnant 9 months earlier_j. $i < j < n$
 b. Mary will_j give birth 12 months from now. She'll_i get pregnant 9 months earlier_j. $n < i < j$
 c. Mary will_j give birth 6 months from now. #She got_i pregnant 9 months earlier_j. $\#i < n < j$

On the assumption that temporal comparatives relate reference time to an anaphoric time from a previous utterance, prior theories of tense do not account for this constraint. Tenses are predicted to constrain the temporal range of reference time itself, but not the anaphoric time introduced by these comparatives.

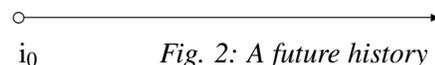
Constraint #2: (Non-)Ban on Forward Shifting. Abusch (1993) (see also Schlenker 2004) formulates the Upper Limit Constraint (ULC), which says the the time of the embedding predicate is the upper bound on the reference time of the lower clause, as a way to explain that in (2a), the time of pregnancy cannot be any later than the time of believing. The novel observation here, however, is that this actually depends on the embedding verb, and that a verb like *hope* is in fact compatible with forward shifting.

- (3) a. Martina thought_i Carissa got_j pregnant. $j \not> i$
 b. Martina hoped_i Carissa got_j pregnant. $j > i$ (or $j < i$)

Clearly here the ULC is too strong in ruling out a relative-future reading in (3b). Proposals like Kratzer (1998) and Anand & Hacquard (2008) miss as well since they derive the ULC by arguing that embedded past tenses are ambiguous between 'real' relative past (giving $j < i$) and a null tense (giving $j = i$).

This paper argues that modals and attitude verbs quantify over partial histories, thereby imposing temporal constraints on their prejacent, depending upon the modal base. Since *think* and *hope* quantify over different kinds of histories, they impose different temporal constraints.

Partial Histories. I adopt a branching times (BT) model which allows for partial worlds, or histories, which do not extend across all times. I call these partial histories. Two particular kinds of partial histories are relevant; *actual histories* are histories which (if i_0 below is evaluation time) have a present and a past but no future (they come to an end); *future histories* are the inverse, they have a lower bound but no upper bound.



This picture allows for modal bases to be sets of partial histories. The upshot of this is that modals may establish temporal constraints on their prejacent. Consider the modal verb *have to*; on its epistemic reading, it is restricted just to present or past times; on its deontic reading it cannot be associated with past times. The same goes for *must*, *got to*, etc.

- (4) a. He has to fill out this form_i at 3. #epistemic, ^{OK}deontic, $n < i$
 b. He has to have filled out the form_i at 3. ^{OK}epistemic, #deontic, $i < n$

Note that whatever temporal restrictions exist on the prejacent can't be written into the denotation of a modal like *have to* itself, since the temporal constraints depend on what contextual modal base is used. Thus they must actually fall out from the modal base choice itself. If we take the epistemic modal base to be a set of actual histories (motivated by the notion that we cannot know the future), then the ban on an epistemic

reading for (4a) is expected. Likewise, we cannot have rules (in the present) governing past behaviors, so the deontic modal base is a set of future histories, deriving the impossibility of a deontic reading in (4b).

Explaining Temporal Incommensurability. Taking *will* to be a modal (Condoravdi 2003, Kaufmann 2005, Klecha 2012), I argue that it quantifies over future histories, since it requires reference time of the prejacent to be in the future (on its predictive, not epistemic, reading). Since *will* scopes over the comparative *9 months later*, this expression is evaluated not at the actual world but in the histories that *will* quantifies over; since these histories only extend as far back as the present, times before the present are not defined.

$$(5) \quad \llbracket \text{she PRES}_i \text{ will}_j \text{ give birth 9 months later}_k \rrbracket = \lambda h . \forall h' \in \text{FUT}(h, i) . \text{birth}(h', j) \ \& \ j >_{h'}^{9\text{mos.}} k$$

If (5) = (1c), the ordering $>_{h'}$ does not include k , leading to infelicity. If *will* quantified over whole worlds/histories, this would not be ruled out. Likewise, (2c) is bad because the actual world (the evaluation world for matrix contexts) is taken to be an actual history (in the BT sense); i.e., it is only defined up to evaluation time. This picture of the evaluation world aligns with theories of *will* as a modal, which argue that simple future tenses cannot exist because of the unknowability or unsettledness of the future. Modeling the evaluation world this way is a formal way to capture this idea.

Note that in the $W \times T$ framework times are totally independent from worlds, and there would be no reason to think that the ordering of two times would be dependent on a world variable. This is support for the BT model, in which the time and world (history) indices are not independent.

Explaining the ULC. The ban on forward shifting can be explained straightforwardly by appealing to this notion of partial histories as well. If *think* quantifies over actual histories (histories which extend up to event time of the attitude predicate), the embedded event time (3a) cannot be after the event time of *think*.

$$(6) \quad \llbracket \text{martina PAST}_i \text{ think carissa } \emptyset_j \text{ get pregnant} \rrbracket = \lambda h . \forall h' \in \text{DOX}_m(h, i) . \text{c-get-preg}(h', j)$$

As with other theories of sequence of tense, I assume that an embedded past tense can stand for a true past or for a null tense which morphologically agrees with a higher past; however, unlike, e.g., Anand & Hacquard, I take this null tense to place *no* constraints on the temporal anaphor it introduces, rather than constraining it to be cotemporal with the matrix event time. The constraint against forward shifting in (6) is due to h' being an actual history (not extending beyond local evaluation time), rather than any constraint placed on j . This then explains why (3b) is felicitous with a forward shifting interpretation; *hope* can quantify over future histories (as well as past histories). The lower past actually does not place any constraint on the temporal interpretation of the embedded clause whatsoever. As further support, consider that when these attitude verbs are in the present, the same constraints apply.

$$(7) \quad \begin{array}{ll} \text{a. Martina thinks}_i \text{ Carissa } \{\text{got}_j, \#\text{gets}_k\} \text{ pregnant.} & j < i, \#i < k \\ \text{b. Martina hopes}_i \text{ Carissa } \{\text{got}_j, \text{gets}_k\} \text{ pregnant.} & j < i, i < k \end{array}$$

(A small digression on (7b): I argue that the Present is better analyzed a Non-Past, explaining the possibility for future reference in (7b). The inability of the Non-Past to have future reference in matrix contexts is due to the notion, explained above, that evaluation world is an actual history; i.e., it introduces the same temporal constraints doxastic attitude verbs and epistemic modals do.)

Summary. This paper first raises two novel phenomena, which cannot be explained by current proposals, then proposes a BT model in which modals quantify over partial histories and thereby impart temporal constraints on embedded predicates. (The matrix evaluation world can also be modeled as a partial history.) This explains why temporal comparatives cannot cross over the evaluation time of a modal (speech time for present tense modals), and why different embedding attitude verbs give rise to different temporal constraints on their predicates, in both present and past SOT contexts.

SELECTED REFERENCES Abusch, D. 1991. The present under past as de re interpretation. WCCFL 10. • Anand, P. & V. Hacquard. 2008. When the Present is all in the Past. In *Recent Advances in the Syntax and Semantics of Tense, Mood and Aspect*. • Klecha, P. 2012. Optional and obligatory modal subordination. S&B 15. • Schlenker, P. 2004. Sequence phenomena and double access readings generalized. In *The Syntax of Time*.