An Introduction to the Semantics of Tense [1]

1. Introducing Evaluation Times

(1) **Obvious, Fundamental Fact about Sentences of English**
The truth of some sentences (of English) depends upon the time they are uttered.

"George is president"
- True on 1/19/2009
- False on 1/21/2009

(2) **Classic Intuition**
The fact in (1) seems similar to the fact that the truth of a sentence can depend upon the *possible world* that it's uttered in.

"Unicorns exist."
- False in w_0
- True in those worlds where the events of *The Last Unicorn* take place.

(3) **Classic Idea**
It seems, then, that the extension of an expression (e.g., sentence) should be calculated relative to (i) a possible world, (ii) a variable assignment, and **(iii) a time**

(4) **What is Time?**
We can be agnostic about the 'ultimate nature' of time (thank God!). But, we should lay out some axiomatic assumptions concerning its structure.

a. Moments: Time is made up of infinitesimally small 'moments' (or 'instants')
M = the set of moments (instants)

b. Ordering: The set M is structured into a dense, strict total ordering (<)

- Asymmetric: If $a < b$ then it's not the case that $b < a$
- Transitive: If $a < b$ and $b < c$, then $a < c$
- Total: For all $a, b \in M$, either $a < b$, $b < a$, or $a = b$
- Dense: For all $a, b \in M$, if $a < b$, there is a $c \in M$ such that $a < c$ and $c < b$

c. Intervals: Time can be divided up into 'temporal intervals'

Interval I of M = $I \subseteq M$ and for all $a,b \in I$, if $a < c$ and $c < b$, then $c \in I$

[1] The material in this handout is based upon the following course readings: Ogihara 2011: Sections 1-2, 4-5; Kusumoto 2005: Sections 1-3; von Stechow 2009: Sections 1-11.2.

(5) **Important Relations Between Intervals**

a. Overlap: $I \circ I'$ *iff* $I \cap I' \neq \varnothing$

b. Subinterval: $I \subseteq I'$ *iff* (definition the same as for sets)

c. Precedence: $I < I'$ *iff* For all $i \in I$ and i' in I', $i < i'$
(every moment in I precedes every moment in I')

(6) **Implementing the 'Classic Idea' in (3)**

$[\![\text{XP}]\!]^{w,t,g}$ = 'the extension of XP relative to world w, variable assignment g, and **time t'**

- Just as *w* is called 'the evaluation world', we refer to *t* as 'the evaluation time'
- Right now, we can be a little agnostic as to whether the evaluation time is a moment or an interval of moments

(7) **Desired Result of a Compositional Semantics**

$[\![\text{George is president}]\!]^{w,t,g} = T$ *iff* George is president in world w at time t

Thus:
- $[\![\text{George is president}]\!]^{w0,\ 1/19/2009,\ g}$ = T
- $[\![\text{George is president}]\!]^{w0,\ 1/21/2009,\ g}$ = F

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2. Modeling Tenses as Operators Shifting the Evaluation Time

(8) **Another Classic Observation**

Contrasts like the following suggest that past tense may function semantically to shift the evaluation time of the sentence.

a. $[\![\text{George **is** president}]\!]^{w0,\ 1/21/2009,\ g}$ = F
b. $[\![\text{George **was** president}]\!]^{w0,\ 1/21/2009,\ g}$ = T

- Intuitively, (8b) is true in w_0 at time 1/21/2009 because there is a *past time* t' such that George is president in w_0 at t' (*i.e.*, t' = 1/19/2009)

c. $[\![\text{George **is** president}]\!]^{w0,\ 1/19/2001,\ g}$ = F
d. $[\![\text{George **will be** president}]\!]^{w0,\ 1/19/2001,\ g}$ = T

- Intuitively, (8d) is true in w_0 at time 1/19/2001 because there is a *future time* t' such that George is president in w_0 at t' (*i.e.*, t' = 1/21/2009)

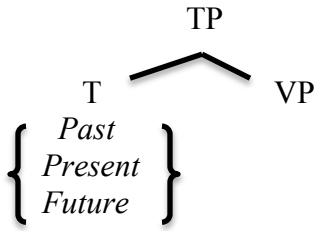
(9) **Desired Results of a Compositional Semantics**

a. [[George **is** president]]^{w,t,g} = T *iff* George is president in world w at time t

b. [[George **was** president]]^{w,t,g} = T *iff*
∃t' . t' < t & George is president in world w at time t'

c. [[George **will be** president]]^{w,t,g} = T *iff*
∃t' . t < t' & George is president in world w at time t'

(10) **Obtaining the Desired Results, Part 1: The Functional Architecture of the Clause**
Every sentence (of English) contains a T(ense) Phrase, whose complement is the VP



(11) **Obtaining the Desired Results, Part 2: The VP-Internal Subject Hypothesis**
The subject of a sentence is initially Merged as SpecVP; it then undergoes (A-)movement to SpecTP.

$[_{TP}$ Past $[_{VP}$ George [be president]]] ➔ $[_{TP}$ George $[_{TP}$ 1 $[_{TP}$ Past $[_{VP}$ t_1 [be president]]]]]

(12) **Obtaining the Desired Results, Part 3: Verb Raising and Tense Lowering**

- English auxiliary verbs raise (via head-movement) to T
- English main verbs do not raise, but T undergoes lowering (at PF) to the main verb
- **In either case, the raising/lowering has no semantic effect**
  - **The raising/lowering is basically 'undone' by LF**

a. Sentence: George is president.

b. PF: $[_{TP}$ George $[_{TP}$ 1 $[_{TP}$ [Pres be$_2$] $[_{VP}$ t_1 [t_2 president]]]]]
'*is*'

c. LF: $[_{TP}$ George $[_{TP}$ 1 $[_{TP}$ Pres $[_{VP}$ t_1 [be president]]]]]

(13) **Obtaining the Desired Results, Part 4: Lexical Semantics of Predicates**
We encode in their lexical semantics the fact that the extension of a predicate depends upon the evaluation time.

a. $[\![\text{president}]\!]^{w,t,g} = [\ \lambda x_e :\ x \text{ is president in w at t}\ ]$

b. $[\![\text{be}]\!]^{w,t,g} = [\ \lambda P_{<e,t>} :\ P\ ]$

(14) **Obtaining the Desired Semantics, Key Ingredient: Tense as a Sentential Operator**

a. Special, Syncategorematic Rule for Present Tense
$[\![\text{Pres XP}]\!]^{w,t,g} = [\![XP]\!]^{w,t,g}$

[Pres XP] is true at world w and time t iff XP is true at world w and time t

b. Special, Syncategorematic Rule for Past Tense
$[\![\text{Past XP}]\!]^{w,t,g} = T \text{ iff } \exists t' . t' < t \ \&\ [\![XP]\!]^{w,t',g} = T$

[Past XP] is true at world w and time t iff there is a time t' preceding t such that XP is true at world w and time t'

c. Special, Syncategorematic Rule for Future Tense
$[\![\text{Fut XP}]\!]^{w,t,g} = T \text{ iff } \exists t' . t < t' \ \&\ [\![XP]\!]^{w,t',g} = T$

[Fut XP] is true at world w and time t iff there is a time t' following t such that XP is true at world w and time t'

(15) **Predictions of This System (Calculations Left as Exercise to the Reader)**

a. (i) *Sentence:* "George **is** president"
(ii) *LF:* $[_{TP}$ George $[_{TP}$ 1 $[_{TP}$ **Pres** $[_{VP}\ t_1$ [be president]]]]]
(iii) *Truth-Conditions:*
$[\![(15aii)]\!]^{w,t,g} = T$ *iff* George is president in w at t

b. (i) *Sentence:* "George **was** president"
(ii) *LF:* $[_{TP}$ George $[_{TP}$ 1 $[_{TP}$ **Past** $[_{VP}\ t_1$ [be president]]]]]
(iii) *Truth-Conditions:*
$[\![(15bii)]\!]^{w,t,g} = T$ *iff* $\exists t' . t' < t$ & George is president in w at t'

c. (i) *Sentence:* "George **will be** president"
(ii) *LF:* $[_{TP}$ George $[_{TP}$ 1 $[_{TP}$ **Fut** $[_{VP}\ t_1$ [be president]]]]]
(iii) *Truth-Conditions:*
$[\![(15cii)]\!]^{w,t,g} = T$ *iff* $\exists t' . t < t'$ & George is president in w at t'

3. The Problem of Tensed Complement Clauses: A First Encounter

(16) **Long-Observed Fact About English (and Other Languages)**
- The sentence below seems to be ambiguous
- It can be true in the scenarios (a) and (b); however, it isn't true in scenario (c)

Dave thought that George was president.

a. *Simultaneous Reading:* Dave thought "George is president"
b. *Back-Shifted Reading:* Dave thought "George was president"
c. *Forward-Shifted Reading:* * Dave thought "George will be president"

Side Note: Just because (16) is true in both (16a,b) doesn't mean it's ambiguous…

Question for Reader: How would you show that (16a,b) is truly ambiguous?

(19) **Towards an Analysis, First Ingredient**
To begin, given that we now have evaluation *times* as well as evaluation worlds, we might naturally want to revise our conception of what an 'intension' is…

- The intension of an expression maps a possible world **and time** onto the extension of that expression at that world and time

b. $[\ \lambda w' : [\ \lambda t' : [[XP]]^{w', t', g}\ ]\ ]$ = 'the intension of XP'

- If the extension of XP is type τ, then its intension is type $\langle s,\langle i,\tau\rangle\rangle$
- Thus, a **proposition** is now a function of type $\langle s,\langle i,t\rangle\rangle$

(20) **Towards an Analysis, Second Ingredient**
Given our revised conception of 'intensions', we need to slightly revise our tools for compositionally deriving intensions…

a. (Revised) Intensional Function Application [Option 1]
If X is a structure consisting of two daughters – Y and Z – and if $[[Y]]^{w,t,g}$ is a function whose domain contains $[\ \lambda w' : [\ \lambda t' : [[Z]]^{w', t', g}\ ]\ ]$, then:

$$[[X]]^{w,t,g} = [[Y]]^{w,t,g}\ (\ [\ \lambda w' : [\ \lambda t' : [[Z]]^{w', t', g}\ ]\ ]\ )$$

b. Object-Language Time Abstraction [Option 2]

$[[\ [\ \lambda t\ XP\ ]\ ]]^{w,t,g}$ = $[\ \lambda t' : [[XP]]^{w,t',g}\ ]$

(21) **Towards an Analysis, Third Ingredient**

- In our original semantics for *thinks*, the 'doxastic alternatives' of an entity (at a world) basically form a proposition
  - It's the proposition summing up all the individual beliefs of x (at w)

- Given our revised conception of a 'proposition', it would be natural to slightly revise our definition of 'Dox-Alt':

Dox-Alt(x,w,t) is a set of **world-time pairs** <w',t'>, such that:
- <w',t'> is consistent with the beliefs of x (in w at t)
- All of x's beliefs (in w at t) hold at <w',t'>
- According to their beliefs (in w at t), x might be in w' at time t'

(22) **Towards an Analysis, Fourth Ingredient**
Given all the revisions above, we should accordingly revise our semantics for *thinks*

$[\![\text{ believes / thinks }]\!]^{w,t,g} =$
$[\lambda p_{<s,<i,t>>} : [\lambda x_e : \forall <w',t'> \in \text{Dox-Alt}(x,w,t) . p(w')(t') = T]]$

(23) **Key Result of These Revisions: Back-Shifted Readings**

a. Sentence: Dave thought that George was president.

b. LF:
[Dave [1 [**Past** [t_1 [think [λw [**λt** [George [2 [**Past** [t_2 [be president] …]

c. Predicted Truth-Conditions: (Calculation left as exercise to reader)

$\exists t' . t' < t \ \& \ \forall <w', t''> \in \text{Dox-Alt}(\text{Dave},w, t') .$
$\exists t''' . t''' < t'' . \ \&$ George is president in w' at t'''

There is a time t' before t (now) such that
in all of Dave's doxastic alternatives <w',t''> in w at t',
there is a time t''' before t'' such that
George is president in w' at t'''

Dave thought that he occupied a world/time where George was president in the past.

(24) **Some Discussion**

- Unfortunately, our new system only predicts the existence of the 'back-shifted' reading in (16b)…
  - We don't yet predict that (23a) is also true in scenario (16a)

(25) **Towards the 'Simultaneous Reading'**

Notice that if there *were* no embedded tense in the subordinate clause, then we would generate truth-conditions that hold in (16a)!

a. LF: [Dave [1 [**Past** [t_1 [think [λw [**λt** [George [2 [t_2 [be president] …]

b. Predicted Truth-Conditions: (Calculation left as exercise to reader)

∃t' . t' < t & ∀<w', t''> ∈ Dox-Alt(Dave,w, t') . George is president in w' at t''

Dave thought that he occupied a world/time where George is president

(26) **Some Preliminary Tools to Derive the 'Simultaneous Reading'**

Special Rule of Tense Deletion
If CP is complement to VP, which is complement to [Past], and TP' is complement to CP, then if TP' is headed by [Past], then the head of TP' can *optionally* delete before LF

$[_{TP}$ Past $[_{VP}$ V $[_{CP}$ C $[_{TP'}$ Past VP']…] → $[_{TP}$ Past $[_{VP}$ V $[_{CP}$ C $[_{TP'}$ VP']…]

(27) **Evidence Supporting 'Tense Deletion': Kamp-Abusch Sentences**

a. Sentence:
Dave **said** yesterday [that one week later he **would** think [he **felt** better]]]

b. Verifying Scenario:
Dave has been sick lately. However, when you talked to him yesterday, he was sure that he would start improving soon. In fact, he said "One week from now, I will think that I feel better."

c. Key Observation:
- In scenario (b), the event of the 'feeling better' does not precede *any* time mentioned in the sentence
  - It's six days after the utterance time
  - It's seven days after Dave's (past) saying event
  - It's at the same time as the (future) thinking event
- However, the embedded clause headed by 'feel' bears *past* tense!
- This suggests that the most deeply embedded past tense in (27a) really isn't interpreted…
  - And our rule in (26) would allow us to delete that tense from the LF!

4. Some Problems for the Simple Operator Semantics for Tense

4.1 The Anaphoric Behavior of Tense

The way that our semantics in (14b,c) quantifies over *all* times ends up leading to problems, especially when negation enters the picture…

(28) **The Classic Example (Partee 1973)**

a. Context: You've just baked some cookies, and are driving them over to a friend's house. While you're on the road, you suddenly realize that you left the stove on.

b. Sentence: (Oh no!) I didn't turn off the stove!

Our semantics for past tense in (14b) cannot predict the truth/felicity of (28b) in scenario (28a), no matter what scope is assigned to negation and tense…

(29) **Predictions of Our Operator Semantics**

a. Tense Scoping Over Negation: [I [1 [**Past** [**No**t [t_1 turn off stove] …]

Predicted Truth Conditions
∃t' . t' < t & it is not the case that I turned off the stove in w at t'

b. Negation Scoping Over Tense [I [1 [**Not** [**Past** [t_1 turn off stove] …]

Predicted Truth Conditions
It is not the case that ∃t'. t' < t & I turned off the stove in w at t'

- The reading in (29a) is too weak; it's made true simply by the fact that I've been driving my car for the last five minutes.

- The reading in (29b) is too strong; it says that it's never (ever) been the case that I've turned off the stove.

(30) **Some Informal Reflections on the Intuitive 'Meaning' of (28b)**

- We intuitively understand (28b) to be 'talking about' *only* a salient, limited past time

  - Roughly, it says that *at the time since you took the cookies out*, it isn't the case that you turned off the stove

- Thus, tensed sentences don't seem to be *general* statements about the past…
  … rather, they are statements about *specific* past times, ones salient in the context

- In this way, tenses seem to behave a little bit like *pronouns* (Partee 1973)

4.2 'Later-Than-Matrix' Readings of Embedded Tenses in Relative Clauses

A more acute problem for our semantics in (14) concerns the way in which tenses are claimed to shift the evaluation time for the rest of the sentence…

(31) **Past Tense in Relative Clause Can be Construed as 'Later' than Matrix Past Tense**

a. Sentence: Hillary married a man who became president.

b. Scenario: Hillary married Bill in 1975. Bill became president in 1993.

(32) **The Problem, Part 1: No 'Later-than-Matrix' Reading if DP Scopes Below Tense**

a. LF: $[_{TP}$ Hillary $[_{TP}$ 1 $[_{TP}$ **Past** $[_{VP}$
$[_{DP}$ a man $[_{CP}$ who $[_{TP'}$ 2 $[_{TP'}$ **Past** $[_{VP'}$ t_2 became president] …]
$[_{VP}$ 3 [t_1 married t_3] …]

b. Predicted Truth-Conditions $\exists t' . t' < t$ & $\exists x . x$ is a man in w at t'
& $\exists t'' . t'' < t'$ & x becomes president in w at t''
& Hillary marries x in w at t'

*Hillary married a man who **had become** president (prior to the marriage).*

Why is the fact in (32) a problem? After all, if we simply assume the DP scopes above the matrix tense, then we easily allow the 'later-than-matrix' reading!

(33) **'Later-than-Matrix' (LTM) Possible if DP Scopes Above Tense**

a. LF: $[_{TP}$ $[_{DP}$ a man $[_{CP}$ who $[_{TP'}$ 2 $[_{TP'}$ **Past** $[_{VP'}$ t_2 became president] …]
$[_{TP}$ 3 $[_{TP}$ Hillary $[_{TP}$ 1 $[_{TP}$ **Past** $[_{VP}$ t_1 married t_3] …]

b. Predicted Truth-Conditions $\exists x . x$ is a man in w at t
& $\exists t' . t' < t$ & x becomes president in w at t'
& $\exists t'' . t'' < t$ & Hillary marries x in w at t''

Hillary married a man x such that x (eventually) became president (prior to now)

(34) **The Problem, Part 2: LTM in English *is* Possible when DP Scopes Below Tense**

a. Sentence (Kusumoto 2005): I tried not to hire **anyone who performed badly**.

b. Scenario:
At our company, I made efforts not to hire persons A, B, C, D, E. Exactly those people indeed went on later to perform very badly.

(35) **The Key Observation**

- In scenario (34b), the time of the 'performance' follows the time of the 'trying'
- *However, the DP is an NPI, and so it must take scope below negation at LF.*
- **However, this means that LF, the DP must take scope within the subordinate infinitival clause…**
  … and so it must also be taking scope below the matrix past tense…

Since our 'operator semantics' in (14) only predicts 'LTM' readings if the DP scopes above the matrix tense, it has a real problem capturing the possibility of such a reading in (34)…

4.3 The Compositional Semantics of Temporal Adverbs

Another major problem for our semantics in (14) is the way that it assumes VPs are of type <e,t>

(36) **The Problem: Temporal Adverbials**

a. Sentence: Dave left yesterday.

b. Plausible Truth-Conditions:
∃t' . t' < t & Dave leaves x in w at t' & **t' is on the day preceding t**

c. The Problem: How can we derive something like (36b) from the LF for (36a)?

- In our current system, the verb *left* is of type <e,t> (13)
- Any higher constituent (VP, TP) ends up being of type t or type <e,t>
- **Thus, in our current system, the only way that something can modify the 'predication time' is by shifting the evaluation time.**

d. An Attempt: $[[\text{yesterday XP}]]^{w,t,g}$ = T *iff*
∃t' . $[[XP]]^{w,t,g}$ = T and t' is on the day preceding t

e. Immediate Problem: This isn't going to interact with past tense in the right way

(i) [Yesterday [Past [Dave leave]]]
∃t' . ∃t'' < t' & Dave leaves in w at t'' & t' is on the day preceding t
Dave leaves at a time preceding a time yesterday.

(ii) [Past [Yesterday [Dave leave]]]
∃t' . t' < t & ∃t'' . Dave leaves in w at t'' & t'' is on the day preceding t'
Dave leaves on the day preceding some past time t'

5. Current Approaches to Tense Semantics: Tense as Pronoun vs. Tense as Quantifier

There are currently two general approaches to tense semantics that solve the problems above.

(37) **Common Ground Between the Two Approaches**

a. Time Arguments: The complement of TP projects an argument over times

- This is the general solution to the problem in Section 4.3

b. No Shifting:
While the semantics of T is sensitive to the evaluation time, tense itself does not actually *shift* the evaluation time.

- This is the general solution to the problem in Section 4.2

b. Anaphoric Behavior:
There is *something* 'pronominal'/'anaphoric' in the meaning of tense

- This is the general solution to the problem in Section 4.1

In as much as there is general consensus on these points, we could say that these are (some of) the things that the field has learned about the nature of tense semantics…

5.1 Tense as a (Restricted) Indefinite

The first family of approaches views T-heads as being something like indefinite determiners…

(38) **Tense as an Indefinite, First Ingredient: Verbs and Temporal Arguments**

- Verbs have an argument place for times
- *e.g.*, an intransitive verb is now of type <e,<i,t>>; transitives are <e,<e,<i,t>>>, *etc.*
- This time argument (type i) can be either an interval or a moment
  - To simplify things, we could assume that 'moments' are just singleton intervals.

$[\![\text{dance}]\!]^{w,t,g} = [\lambda x_e : [\lambda t_i : x \text{ dances in } w \text{ at } t]]$

$[\![\text{marry}]\!]^{w,t,g} = [\lambda y_e : [\lambda x_e : [\lambda t_i : x \text{ marries } y \text{ in } w \text{ at } t]]$

Thus, VPs are now of type <i,t>…
We can therefore model tenses as temporal quantifiers, of type <<i,t>,t>

(39) **Tense as an Indefinite, Second Ingredient: Tenses as (Restricted) Quantifiers**

- In addition to being of type <<i,t>,t>, tenses come packed with an index
- As shown below, this index must be mapped to a set (interval) of times

a. $[\![\text{Past}_i]\!]^{w,t,g}$ = $[\lambda P_{<it>} : \exists t' . t' < t \ \& \ t' \in g(i) \ \& \ P(t') = T]$

'there is a time t' before the evaluation time t *and within the interval g(i)* s.t. P(t') = T'

b. $[\![\text{Pres}_i]\!]^{w,t,g}$ = $[\lambda P_{<it>} : \exists t' . t' = t \ \& \ P(t') = T]$

'there is a time t' *that equals the evaluation time t* and P(t') = T'

For reasons that will be explained later, we temporarily put aside a treatment of 'future tense'…
(though it should be clear how you would write an entry for 'Fut' on the basis of (39a))

(40) **Illustration: Solution to the Problem in Section 4.1**

a. Sentence: I didn't turn off the stove!

b. LF: $[_{TP}$ I $[_{TP}$ 1 $[_{TP}$ Neg $[_{TP}$ Past_2 $[_{VP}$ t_1 turn off the stove] …]

c. Predicted Truth-Conditions:
It is not the case that ∃t' . t' < t & **t' ∈ g(2)** & I turn off the stove in w at t'

*There is no past time **within g(2)** when I turned off the stove.*

- If 'g' maps index 2 to the topical, salient past interval stretching from when I took the cookies out to when I left the house, **then we predict (40a) is true and felicitous in context (28a)!**

(41) **An Analysis of Temporal Adverbs**
We can model temporal adverbs as being type <i,t>, and combining with the VP via PM

a. $[\![\text{yesterday}]\!]^{w,t,g}$ = $[\lambda t' : t' \text{ is on the day preceding } t]$

b. Illustration:

(i) $[\![[_{VP} [_{VP} \text{Dave leaves}] \text{ yesterday}]]\!]^{w,t,g}$ = (by PM)

(ii) $[\lambda t' : [\![\text{Dave leaves}]\!]^{w,t,g}(t') \ \& \ [\![\text{yesterday}]\!]^{w,t,g}(t')]$ = (by Lex., LC)

(iii) [λt' : Dave leaves in w at t' & t' is on the day preceding t]

(42) **Illustration: Solution to the Problem in Section 4.3**

a. Sentence: Dave left yesterday

b. LF: $[_{TP}$ Dave $[_{TP}$ 1 $[_{TP}$ $Past_2$ $[_{VP}$ $[_{VP}$ t_1 leaves] yesterday] …]

c. Predicted Truth-Conditions (Compare to (36b))
∃t' . t' < t & t' ∈ g(2) & Dave leaves in w at t' & t' is on the day preceding t

(43) **Illustration: Solution the Problem in Section 4.2**

Our semantics in (38)-(39) allows us to get 'Later-than-Matrix' readings without scoping the DP above the matrix tense.

- To show this without going into the complex semantics of 'try' (34), let's just assume (for the moment) that there's a type-shifting operator that allows quantificational DPs to be interpreted *in-situ*… [2]

a. Sentence: Hillary married a man who became president.

b. LF: $[_{TP}$ Hillary $[_{TP}$ 1 $[_{TP}$ $Past_2$ $[_{VP}$ t_1 married
$[_{DP}$ a man $[_{CP}$ who $[_{TP'}$ 3 $[_{TP'}$ **$Past_4$** $[_{VP'}$ t_3 became president] …]

c. Predicted Truth-Conditions
∃x . x is a man in w at t
& ∃t' . t' < t & t' ∈ g(4) & x becomes president in w at t'
& ∃t'' . t'' < t & t'' ∈ g(2) & Hillary marries x in w at t''

- These truth-conditions only require that the time of the 'becoming president' precede the matrix evaluation time
- Thus, they allow that the 'becoming president' can *follow* the time of the marriage…

d. How This Works:

- In our 'indefinite semantics' in (39), tenses like 'Past' do not shift the evaluation time of their complements…
- Therefore, the evaluation time of the embedded '$Past_4$' in (43b) is still the matrix evaluation time…

[2] For a concrete illustration of such an operator, see:
http://people.umass.edu/scable/LING610-FA14/Handouts/14.Quantificational-DPs2.pdf

5.2 Tense as a Pronoun

The second family of approaches traces its lineage back to Partee (1973), and is perhaps better attested in the semantic literature on tense than the 'indefinite' approach from Section 5.1…

- It shares with the 'indefinite' approach the assumption in (38) that the complement of TP is of type <i,t>

- However, it views the Tense heads as being of type i (rather than <<i,t>,t>)

(44) **Tense as Pronoun Referring to Times**

- T-heads are pronominal anaphors referring directly to temporal intervals (or moments).

- As anaphors, they bear a pronominal index, and their extension is determined by the variable assignment.

- The tense features introduce presuppositions that restrict the potential referents of these pronouns (just like phi-features on type e pronouns)

a. (i) $[\![\text{Past}_i]\!]^{w,t,g}$ is defined only if $g(i) < t$
(ii) if defined, then $[\![\text{Past}_i]\!]^{w,t,g} = g(i)$

b. (i) $[\![\text{Pres}_i]\!]^{w,t,g}$ is defined only if $g(i) = t$
(ii) if defined, then $[\![\text{Pres}_i]\!]^{w,t,g} = g(i)$

(45) **Illustration: Solution to the Problem in Section 4.1**

a. Type <it,it> Semantics for Negation: $[\lambda P_{<it>} : [\lambda t : P(t) = F]]$

b. Sentence: I didn't turn off the stove!

c. LF (given (45a)): $[_{TP}$ I $[_{TP}$ 1 $[_{TP}$ Past_2 $[_{NegP}$ Neg $[_{VP}$ t_1 turn off the stove] …]

d. Predicted Truth-Conditions:

(i) $[[(45c)]]^{w,t,g}$ is defined only if $g(2) < t$

(ii) If defined, $[[(45c)]]^{w,t,g} = T$ iff
It is not the case that I turn off the stove in w at g(2)

- If 'g' maps index 2 to the topical, salient past interval stretching from when I took the cookies out to when I left the house, **then we predict (45b) is true and felicitous in context (28a)!**

(46) **Illustration: Solution to the Problem in Section 4.3**
Again, since we still assume that VPs are of type <i,t>, the approach to adverbial modification in (41)-(42) can also be adopted by 'pronominal tense' theories.

a. LF: $[_{TP}$ Dave $[_{TP}$ 1 $[_{TP}$ Past$_2$ $[_{VP}$ $[_{VP}$ t_1 leaves] yesterday] …]

b. Predicted Truth-Conditions (Compare to (36b))

(i) $[[(46a)]]^{w,t,g}$ is defined only if g(2) < t

(ii) If defined, then $[[(46a)]]^{w,t,g}$ = T *iff*
Dave leaves in w at g(2) & g(2) is on the day preceding t

(47) **Illustration: Solution to the Problem in Section 4.2**
Again, since we still assume that Tense doesn't shift evaluation time, the approach to LTM readings in (43) can also be adopted by the 'pronominal tense' theories.

a. LF: $[_{TP}$ Hillary $[_{TP}$ 1 $[_{TP}$ Past$_2$ $[_{VP}$ t_1 married
$[_{DP}$ a man $[_{CP}$ who $[_{TP'}$ 3 $[_{TP'}$ **Past$_4$** $[_{VP'}$ t_3 became president] …]

b. Predicted Truth-Conditions

(i) $[[(47a)]]^{w,t,g}$ is defined only if g(2) < t and g(4) < t

(ii) If defined, then $[[(47a)]]^{w,t,g}$ = T *iff*
∃x . x is a man in w at t & x becomes president in w at g(4) &
Hillary marries x in w at g(2)

- Since g(4) is only required to precede t, these truth-conditions will hold even when the 'becoming president' (g(4)) follows the marriage (g(2))

5.3 Comparing the Two Families of Approaches

(48) a. Obvious Question:
What are the reasons for preferring one approach over the other?

b. Disappointing Answer:

- At the moment, it's very hard to empirically decide between the 'quantificational' and 'pronominal' approaches

- In fact, some have proposed that *both* theories are correct, but for different languages (Ogihara & Sharvit 2012)…

A Historical Aside:

- Pronominal approaches to tense were the first alternative offered to the 'operator semantics' (which itself was taken from earlier work on 'Tense Logic')

- Enç (1987) and Abusch (1997) develop complex theories of tense based upon the idea that tenses are pronouns and can behave syntactically as such
  - (i.e., tenses can be bound and can undergo movement)

- However, Ogihara (1996) and von Stechow (2002) show that many of the results of these pronominal theores can be captured within an indefinite semantics for tense

- I have the subjective impression that in recent years, there has been more work assuming an indefinite semantics for tense (though pronominal approaches are still well represented…)

(49) **A Consideration Commonly Raised Against a Pronominal Theory of Tense**

It is possible to utter past-tense sentences 'out of the blue', in such cases, the past tense doesn't seem to be anaphoric to any contextually salient, topical time

a. Illustration:
   (i) Hey man, tell me something interesting about the Ancient Egyptians.
   (ii) Well, they **built** some of the world's largest tombs…

On The Other Hand…

- If contextual restriction is built into the meaning of the indefinite semantics in (39), then 'indefinite' approaches to tense face a parallel problem with (49a)

- Kratzer (1998) argues that the surface past tense in (49aii) in such cases is misleading, and that it might 'underlyingly' be a present perfect…
  (We'll explore this idea later on…)

(50) **A Considerations Against the Indefinite Theory of Tense**

- As shown in (40), the solution to Problem 4.1 requires that negation out-scopes tense in such sentences…

- However, syntacticians have structural reasons for wanting TP to take NegP as complement…

- As shown in (45), a pronominal theory of tense can account for such sentences while allowing T to out-scope Neg.

(51) **Another Consideration Against the Indefinite Theory of Tense**

Kratzer (1998) argues that under a pronominal theory of tense, the 'tense deletion' rule in (26) could fall out as a consequence of more general mechanisms governing the features of bound pronouns…

(Again, we'll explore this idea in more detail later on…)