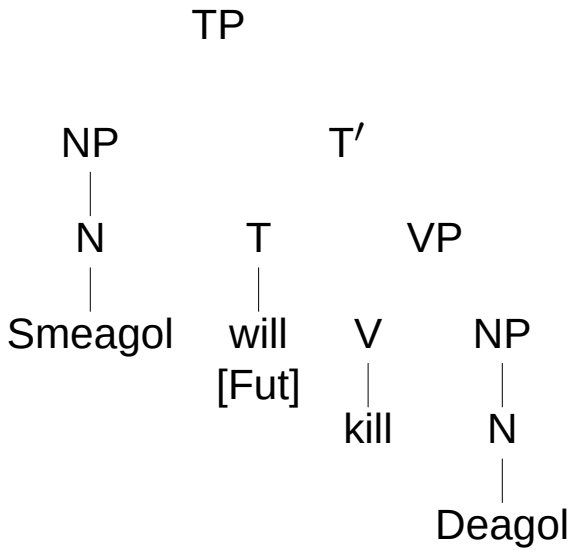
Tense

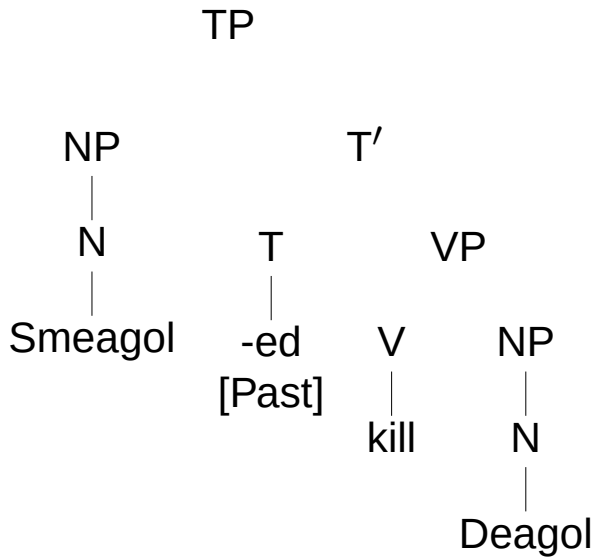
Ling 406/802; Spring 2005

Readings: *Meaning and Grammar*, Ch. 5.3.1

Syntax of Tense

- Clause structure of simple tensed sentences



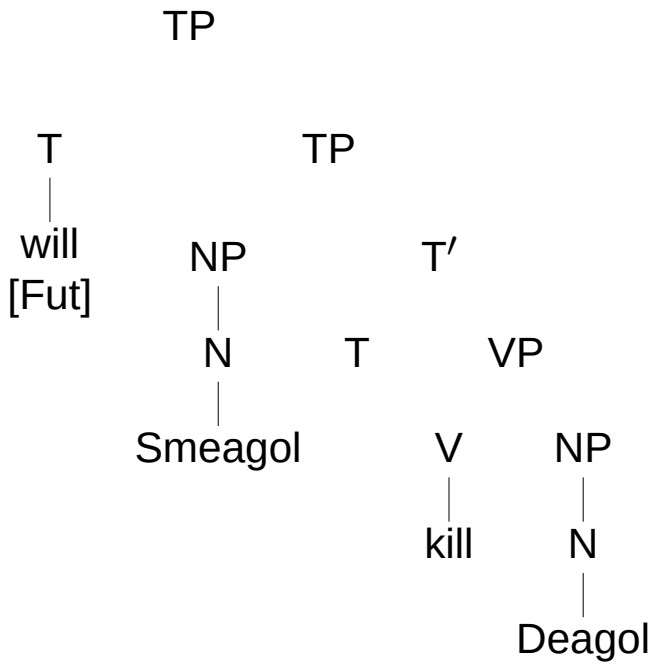


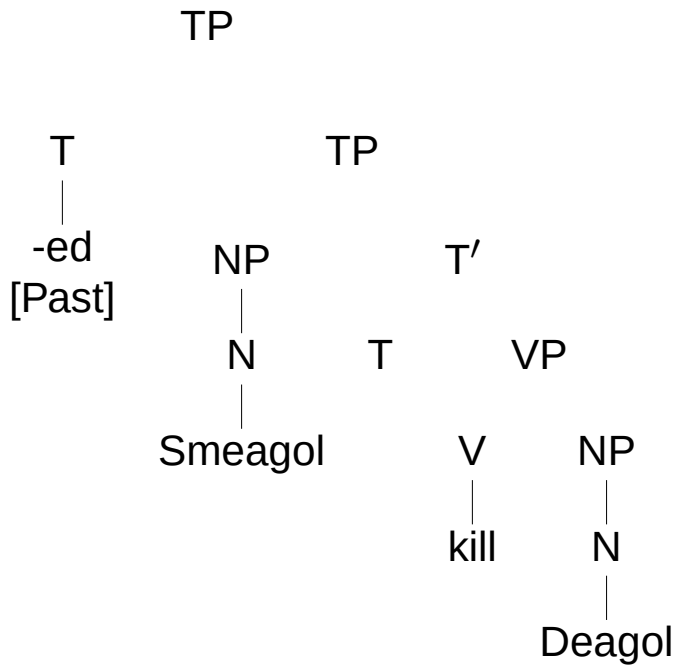
- We want to apply semantics of tense in IPC to English.

  But tense in IPC is a sentential operator: it operates on formulas/clauses, whereas in clause structure of English, tense takes a VP.

Syntax of Tense (cont.)

- Apply an operation at LF (Logical Form) to yield an interpretable structure: tense raising (TR).





- So, you need the following syntactic rules.

(1) a. TP $\rightarrow$ NP T′

b. T′ $\rightarrow$ T VP

c. tense raising (TR): [$_{TP}$ NP T VP] $\Rightarrow$ [T [$_{TP}$ NP VP]]

Semantics of Tense

- Future tense

$[\![$ TP $]\!]^{M,w,i,g}$ = 1 iff for some i' such that $i < i'$, [[Smeagol kill Deagol]]$^{M,w,i',g}$ = 1.

T

will
[Fut]

TP

Smeagol kill Deagol

- Past tense

$[\![$ TP $]\!]^{M,w,i,g}$ = 1 iff for some i' such that $i > i'$, [[Smeagol kill Deagol]]$^{M,w,i',g}$ = 1.

T

-ed
[Past]

TP

Smeagol kill Deagol

Syntax of a Fragment of English (F3)

1. (a) TP $\rightarrow$ NP T′
   (b) T′ $\rightarrow$ T VP
   (c) TP $\rightarrow$ TP conj TP
   (d) TP $\rightarrow$ neg TP
   (e) T $\rightarrow$ Past, Pres, Fut
   (f) VP $\rightarrow$ V_t NP
   (g) VP $\rightarrow$ V_i
   (h) VP $\rightarrow$ V_{dt} NP PP[to]
   (i) NP $\rightarrow$ Det N_c
   (j) NP $\rightarrow$ N_p
   (k) PP[to] $\rightarrow$ to NP
   (l) Det $\rightarrow$ the, a, every
   (m) N_p $\rightarrow$ Frodo, Smeagol, Deagol, Sam, Aragorn, ... he_1, ..., he_n, ...
   (n) N_c $\rightarrow$ book, fish, man, hobbit, ...
   (o) V_i $\rightarrow$ is intelligent, is hungry, is tall, ...
   (p) V_t $\rightarrow$ destroy, kill, read, ...
   (q) V_{dt} $\rightarrow$ give, introduce, ...
   (r) conj $\rightarrow$ and, or
   (s) neg $\rightarrow$ it is not the case that

2. Rule for Quantifier Raising (QR)
   $[_{TP}$ X NP Y] $\Rightarrow$ $[_{TP}$ NP_i $[_{TP}$ X e_i Y]]

3. Rule for Tense Raising (TR)
   $[_{TP}$ NP T VP] $\Rightarrow$ $[_{TP}$ T $[_{TP}$ NP VP]]

A Model for F3

An F3 model for English is a 5-tuple $< W, I, <, U, V >$, where:

1. W is a set of worlds.
2. I is a set of instants ordered by the relation $<$.
3. U is the domain of individuals.
4. V is a function that assigns an intension to the constants of F3.
   (a) If β is a proper name, then $V(\beta)$ is a constant function from $W \times I$ to U denoting the bearer of the proper name.
   (b) V(fish)$(< w, i >)$ = $\{x$: x is a fish in w at time $i\}$.
   (c) V(is tall)$(< w, i >)$ = $\{x$: x is tall in w at time $i\}$.
   (d) V(kill)$(< w, i >)$ = $\{< x, y >$: x kill y in w at time $i\}$.
   (e) V(give)$(< w, i >)$ = $\{< x, y, z >$: x give y to z in w at time $i\}$.
   (f) V(it is not the case that) = $\begin{bmatrix} 1 \rightarrow 0 \\ 0 \rightarrow 1 \end{bmatrix}$

(g) V(and) = $\begin{bmatrix} < 1,1 > \rightarrow 1 \\ < 1,0 > \rightarrow 0 \\ < 0,1 > \rightarrow 0 \\ < 0,0 > \rightarrow 0 \end{bmatrix}$

(h) V(or) = $\begin{bmatrix} < 1,1 > \rightarrow 1 \\ < 1,0 > \rightarrow 1 \\ < 0,1 > \rightarrow 1 \\ < 0,0 > \rightarrow 0 \end{bmatrix}$

Semantics of F3

1. If A is a category and β is a trace or a pronoun, $[\![[_A\ \beta]]\!]^{M,w,i,g} = g(\beta)$; otherwise, $[\![[_A\ \beta]]\!]^{M,w,i,g} = V(\beta)$

2. If A and B are any categories, $[\![[_A$ B$]]\!]^{M,w,i,g} = [\![$B$]\!]^{M,w,i,g}$

3. $[\![[_{PP}$ to NP$]]\!]^{M,w,i,g} = [\![$NP$]\!]^{M,w,i,g}$

4. $[\![[_{TP}$ NP T'$]]\!]^{M,g} = 1$ iff $[\![$NP$]\!]^{M,w,i,g} \in [\![$T'$]\!]^{M,w,i,g}$

5. $[\![[_{TP}$ TP1 conj TP2$]]\!]^{M,w,i,g} = [\![$conj$]\!]^{M,w,i,g}(<[\![$TP1$]\!]^{M,w,i,g}, [\![$TP2$]\!]^{M,w,i,g}>)$

6. $[\![[_{TP}$ neg TP$]]\!]^{M,w,i,g} = [\![$neg$]\!]^{M,w,i,g}([\![$TP$]\!]^{M,w,i,g})$

7. $[\![[_{VP}$ V_t NP$]]\!]^{M,w,i,g} = \{$x: $<$x, $[\![$NP$]\!]^{M,w,i,g}> \in [\![V_t]\!]^{M,w,i,g}\}$

8. $[\![[_{VP}$ V_{dt} NP PP$]]\!]^{M,w,i,g} = \{$x: $<$x, $[\![$NP$]\!]^{M,w,i,g}$, $[\![$PP$]\!]^{M,w,i,g} > \in$ $[\![V_t]\!]^{M,w,i,g}\}$

9. $[\![$[every $\beta]_i$ TP$]\!]^{M,w,i,g}$ = 1 iff for all $d \in U$, if $d \in [\![\beta]\!]^{M,w,i,g}$, then $[\![$TP$]\!]^{M,w,i,g[d/e_i]}$ = 1, where $e_i = t_i$ or $e_i =$ he$_i$

10. $[\![$[a $\beta]_i$ TP$]\!]^{M,w,i,g}$ = 1 iff for some $d \in U$, $d \in [\![b]\!]^{M,w,i,g}$, and $[\![$TP$]\!]^{M,w,i,g[d/e_i]}$ = 1, where $e_i = t_i$ or $e_i =$ he$_i$

11. $[\![$[the $\beta]_i$ TP$]\!]^{M,w,i,g}$ = 1 iff for some $d \in U$, $[\![\beta]\!]^{M,w,i,g} = \{d\}$, and $[\![$TP$]\!]^{M,w,i,g[d/e_i]}$ = 1, where $e_i = t_i$ or $e_i =$ he$_i$

12. $[\![$Pres TP$]\!]^{M,w,i,g} = [\![$TP$]\!]^{M,w,i,g}$

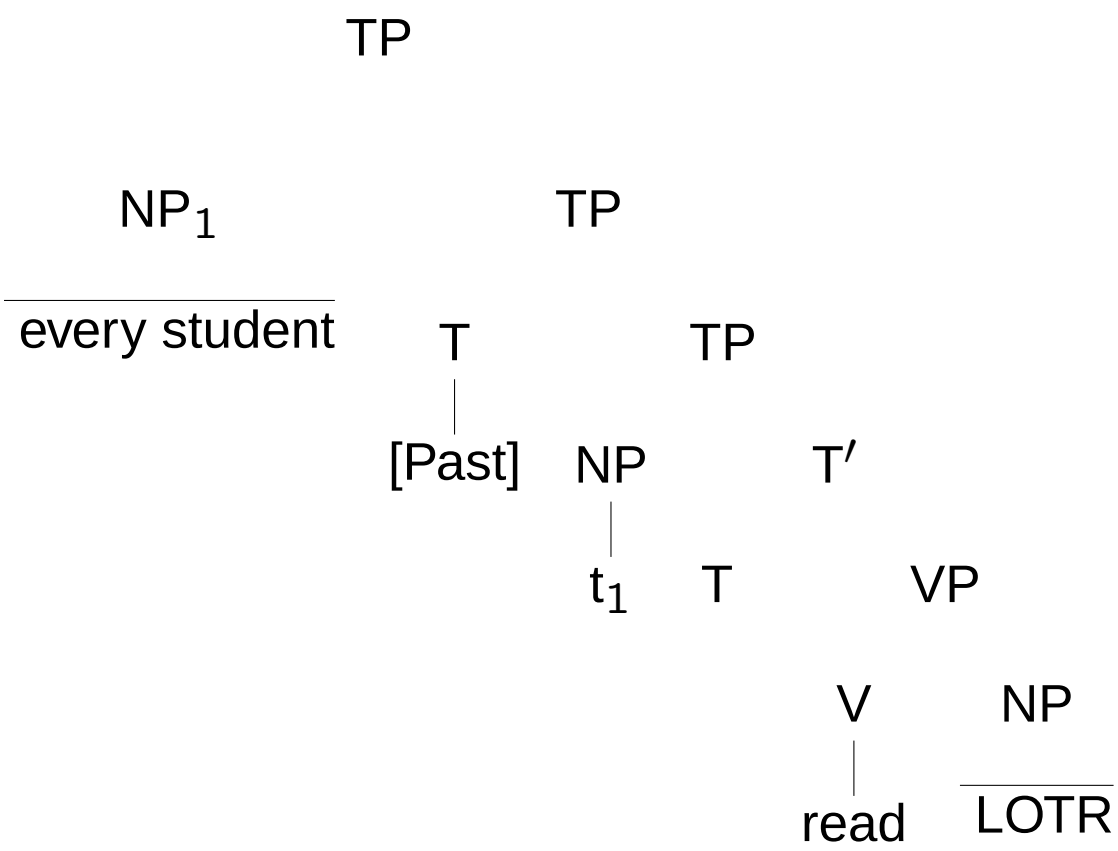
13. $[\![$Past TP$]\!]^{M,w,i,g}$ = 1 iff for some $i' \in I$ such that $i' < i$, $[\![$TP$]\!]^{M,w,i',g}$ = 1

14. $[\![$Fut TP$]\!]^{M,w,i,g}$ = 1 iff for some $i' \in I$ such that $i' > i$, $[\![$TP$]\!]^{M,w,i',g}$ = 1

Compositional Semantics

(2) Every student read *Lord of the Rings*.

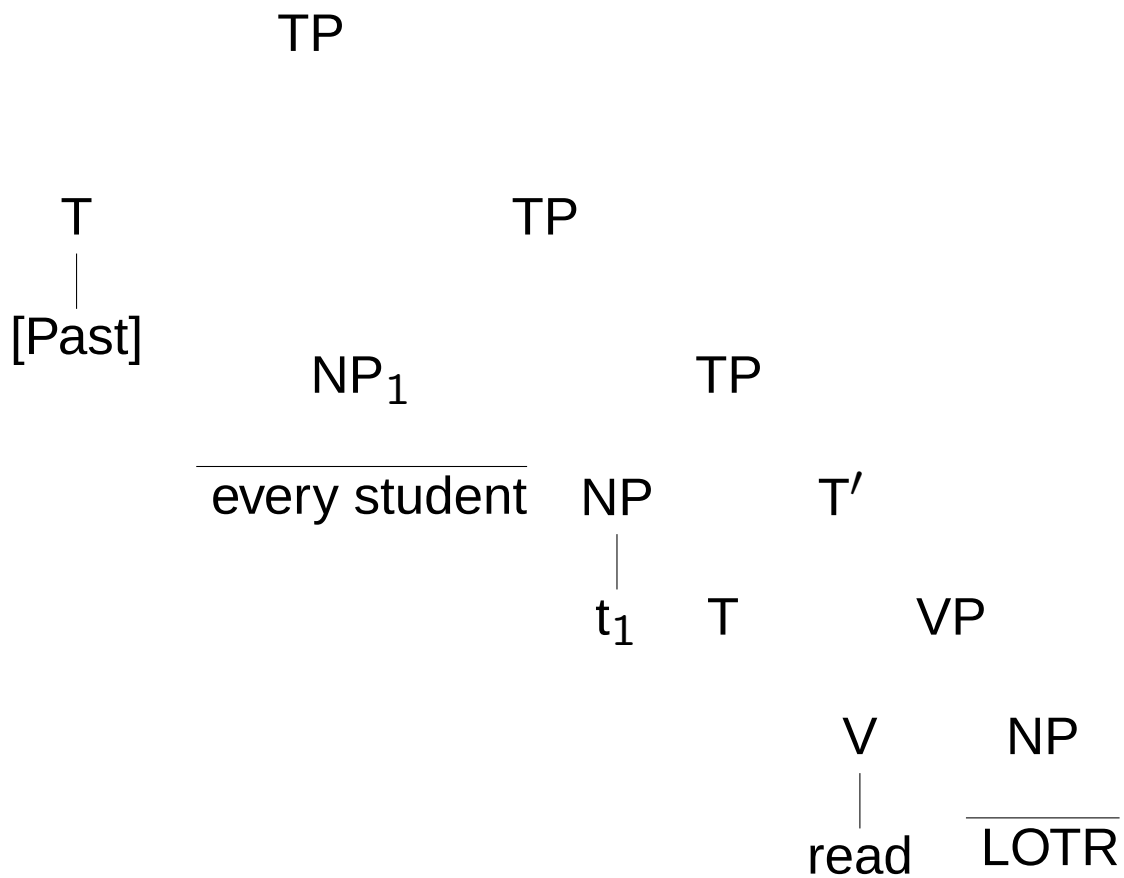
LF1: every>Past



Compositional Semantics

(3) Every student read *Lord of the Rings*.

LF2: Past>every



Problems: Scope of Tense and Quantified Nominal Phrase

- The possible readings are too restricted.

  (4) Every student read *Lord of the Rings*.

  '$\forall >$Past' reading: "Every current student read *Lord of the Rings* at some past time (possibley at different past times)."

  'Past$>\forall$' reading: "There is a particular past time in which every past student read *Lord of the Rings* at that time."

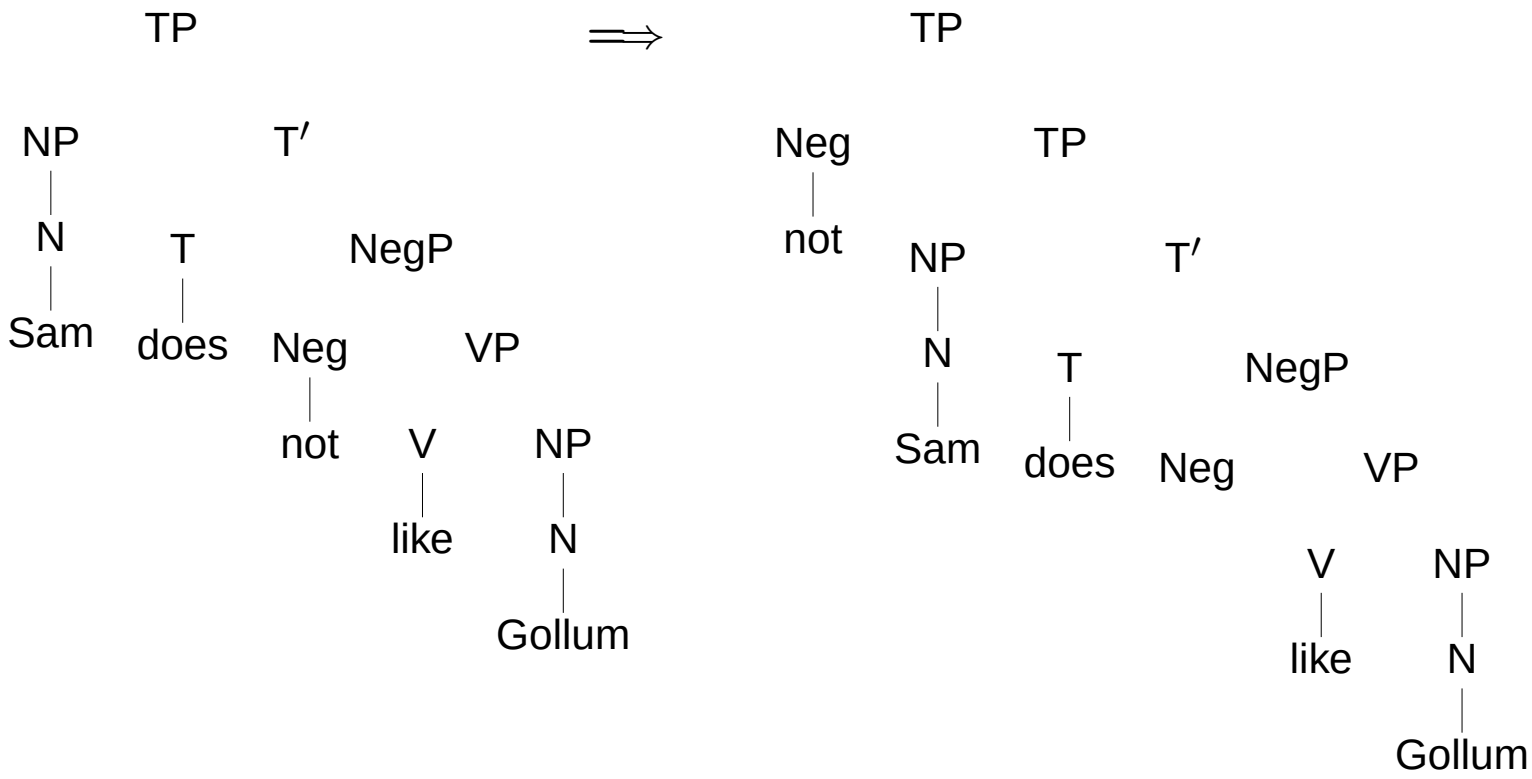
  Not available: "There is a particular past time in which every current student read *Lord of the Rings* at that time."

  Not available: "Every past student and every current student read *Lord of the Rings* at some past time (possibly at different past times)."

Problems: Scope of Negation and Tense

- Negation

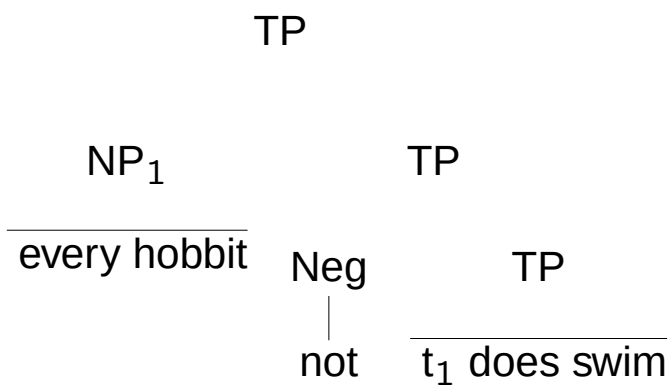
(5) Sam does not like Gollum.

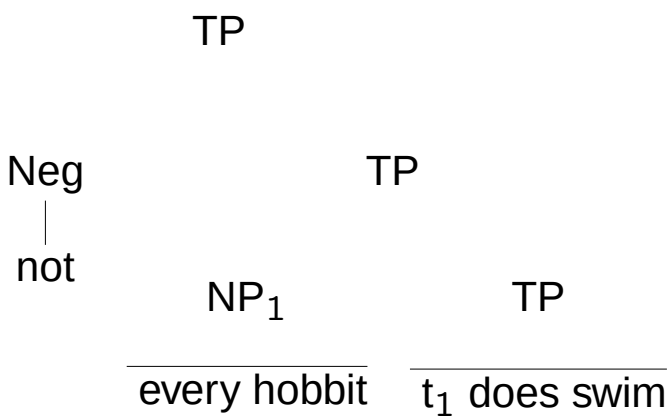


Problems: Scope of Negation and Tense (cont.)

- Scope of negation and quantified NP

  (6) Every hobbit does not swim.





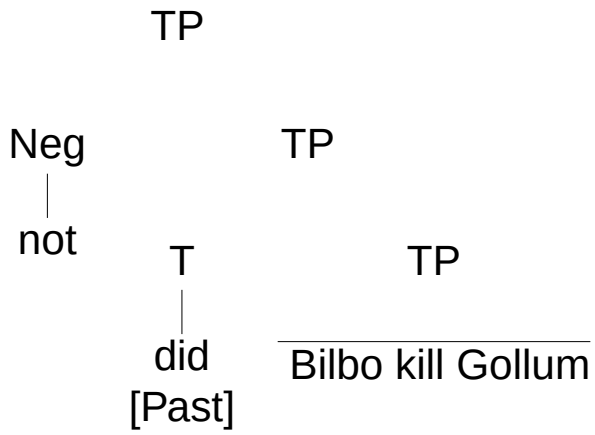
$\forall x[\text{hobbit}(x) \rightarrow \neg\text{swim}(x)]$

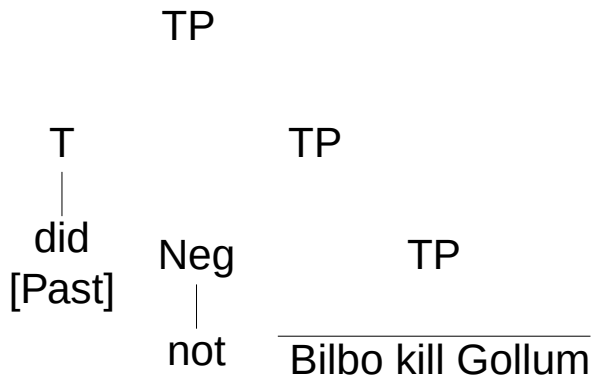
$\neg\forall x[\text{hobbit}(x) \rightarrow \text{swim}(x)]$

Problems: Scope of Negation and Tense (cont.)

- Scope of negation and tense

(7) Bilbo did not kill Gollum.





$\neg \mathbf{P}\text{kill}(\text{bilbo}, \text{gollum})$

"There is no time that precedes the evaluation time at which Bilbo kills Gollum."

$\mathbf{P} \neg \text{kill}(\text{bilbo}, \text{gollum})$

"There is a time that precedes the evaluation time at which Bilbo does not kill Gollum." (trivially true, non-sensical reading)

Problems: Scope of Negation and Tense (cont.)

- Interpretation obtained from ‘neg$>$tense’ scope is not always adequate.

  (8) John didn’t turn off the stove. (Partee 1973)

  ‘neg$>$tense’ reading: “There is no time that precedes the evaluation time at which John turns off the stove.” = “ John has never turned off the stove.”

  The reading we want to obtain: “There is a specific time that the speaker has in mind, R, such that R precedes the time of evaluation, and John doesn’t turn off the stove at R.”