Incrementality, Dialogue and Syntax

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*Major Leverhulme Fellowship F/00158/BF

The Dynamics of Conversational Dialogue (DynDial)
ESRC-RES-062-23-0962
www.kcl.ac.uk/research/groups/ds

Incrementality, context and compositionality: the relevance of dialogue

Dialogue Modelling: interactive structure-building

What does context-dependence amount to?

Dynamic Syntax: incremental structure/content growth

Ellipsis and Context

Grammar, Context and Compositionality

On representationalism, intentionality, linguistic knowledge

Outline

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Confronting the challenge of context, ellipsis and dialogue

- Promoting a concept of grammar as mechanisms for proposition construction: WHY?
- Abandoning the traditional competence move:
  - 'natural data' degenerate
  - no direct link between data and grammar or knowledge and use
  - 'knowledge of language' is 'knowing that' and independent of context

The challenge of context, ellipsis and dialogue

Towards a concept of grammar as mechanisms for actions that enable propositions to grow:

- Sentence-based grammars fail to explain the extensive non-sentential nature of much dialogue.
  - linguistic knowledge in static sentence-bound terms with linguistic processing relegated to performance

    immediacy, *incrementality*, *crossmodality*

    (Marslen-Wilson & Tyler 1980, Altmann & Steedman 1988)
  - grammar-internal anaphora/ellipsis *vs* discourse-based anaphora/ellipsis

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  - dialogue data so full of ellipsis as to be "degenerate"?
  - grammar-internal ellipsis as syntactic/semantic yields incomplete accounts, multiple ambiguities, unrelated to anaphora
  - pragmatic ellipsis treated as peripheral
  - "fractal heterogeneity" of ellipsis

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  - grammar-internal ellipsis as syntactic/semantic yields incomplete accounts, multiple ambiguities, unrelated to anaphora
  - pragmatic ellipsis treated as peripheral
  - "fractal heterogeneity" of ellipsis
  - no explanation of folk intuition
  - no explanation of how language acquisition could be based on such apparently degenerate data
- Elliptical utterances do not always allow the recovery of some 'underlying' sentence.

The response: to address the context-dependency challenge

- Result of incorporating into syntax aspects of processing:

  incrementality: i.e. underspecification+update

- dynamic, evolving structured content and context

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    bottom-up compositionality definable for resulting LF
- No concept of sentences or sentence meaning as being fundamental to grammar Miller & Weinert 1998

What dialogue data tell us

- The evolving, structural nature of NL context dependence
  - as displayed by elliptical fragments in monologue and dialogue equally
  - invariably straddling syntax/semantics/pragmatics boundaries(see e.g. Cooper and Ginzburg 2004)
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- In conversation, inference based on *mutual knowledge/common ground* is NOT a prerequisite for communication
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- Linguistic knowledge: the update dynamics of communication
  - word by word incrementality within a grammar system
  - NL grammars as mechanisms for communicative interaction relative to context

Outline

Developing utterances (together) in a dialogue context

- Where do utterance boundaries occur?

(1) Alex: We're going to London

Hugh: to see Granny.

(2) Ruth: I'm afraid I burned the kitchen ceiling.

Michael: Did you burn

Ruth: myself? No, well only my hair.

- Speaker/hearer exchange of roles across ALL syntactic dependencies (Purver et al 2009), *split utterances*:

(3) A: Have you read ...

B: any of your chapters? Not yet.

(4) Gardener: I shall need the mattock.

Home-owner: The...

Gardener: mattock. For breaking up clods of earth.[BNC]

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- A language game emerging at earliest stages of language acquisition

(5) Carer: Old McDonald had a farm... On that farm he had a

Child: cow.

Guessing intentions?

- Intentions emerge/develop during dialogue:

(6) Daughter: Oh here dad, a good way to get those corners out
Dad: **is to stick yer finger inside**.
Daughter: well, that's one way (Lerner 1991)

(7) A: Oh. They don't mean us to be friends, you see. So if we want to be ...
B: **which we do**
A: then we must keep it a secret. [natural data]

(8) (A and B arguing:)
A: In fact what this shows is
B: **that you are an idiot**

(9) (A mother, B son)
A: This afternoon first you'll do your homework, then wash the dishes and then
B: **you'll give me £10?**

(10) (teacher to child)
A: And your name is ...
B: **Mary**

(11) Jim: The Holy Spirit is one who⟨pause⟩ gives us?
Unknown: **Strength**.
Jim: Strength. Yes, indeed. ⟨pause⟩ The Holy Spirit is one who gives us? ⟨pause⟩
Unknown: **Comfort**. [BNC HDD: 277-282]

Dialogue mechanisms and the grammar

- If we revise the concept of utterance understanding,

  dropping the necessary recovery of the proposition
  "which the speaker could have intended"
  on the basis of some pre-established
  "mutual knowledge" / "common ground"

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- Case study: split utterances
  - instead of intention-recognition, an account of split utterances requires explanation in terms of low-level linguistic mechanisms (i.e. the grammar) embedded in the sequential environment established by conversational practices

Dialogue and standard syntax/semantics models

- **Denotational semantics** is externalist, unrelated to all cognitive considerations, and, without structure, inadequate for explanation of dialogue ellipsis.
  - (naive) GQ semantics not predicting psycholinguistic results/dialogue phenomena (Bosch 2008, Purver & Ginzburg 2004)
- Non-incremental, context-insensitive **grammars**:
  - inadequacy of head-driven models: fragments can be resolved before emergence of head-projected structure.
  - speaker/listener switching deeply problematic for all sentence-based models.
- Concept of **context** needed for ellipsis neither denotational nor static: context involves incremental structural update.
  - Structure derived from arbitrary sentence parts can be context for subsequent (elliptical) fragment (Purver et al 2009)
  - How can children do it so easily?

Ellipsis and current syntax/semantics models

- Elliptical forms need SYNTACTIC characterisation but involve multiple ambiguity (sloppy/strict):
  (12) John defended himself because his solicitor wouldn't
  stripping, *gapping*, *sluicing*, *antecedent-contained ellipsis*. No basis for parallelism (Fiengo & May 1994, Fox 2002)

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  (13) A. They X-rayed me, and took a urine sample, took a blood sample. Er, the doctor
  B: Chorlton?
  A: Chorlton, mhm, he examined me..... [BNC]
  (14) Hat Kim nicht den Brief geschrieben? Nein Ich/*Mich
  Did Kim not write the letter ? No, I_{NOM}
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- **Pragmatic** accounts are partial and presume an independent grammar (Carston 2002, Stainton 2006)
  (16) Covent Garden? Right at the traffic lights and straight on up.

Dialogue and pragmatic/psycholinguistic models

- Standard assumption: understanding involves recognition of speaker's intentions, grounded in *mutual knowledge/common ground* (Grice, Sperber & Wilson, Clark etc etc) hence split utterances, completed "together" must be due to joint *we*-intentions

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- do children communicate in the same way as adults? (Breheny 2006)
- since children acquire systematic clause-building abilities from conversational dialogue, how do they do it?

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- Are participants building a shared structure with shared processes?

Outline

The Process of Building up interpretation

- Building representations of content as goal-driven monotonic tree-growth from word-sequence

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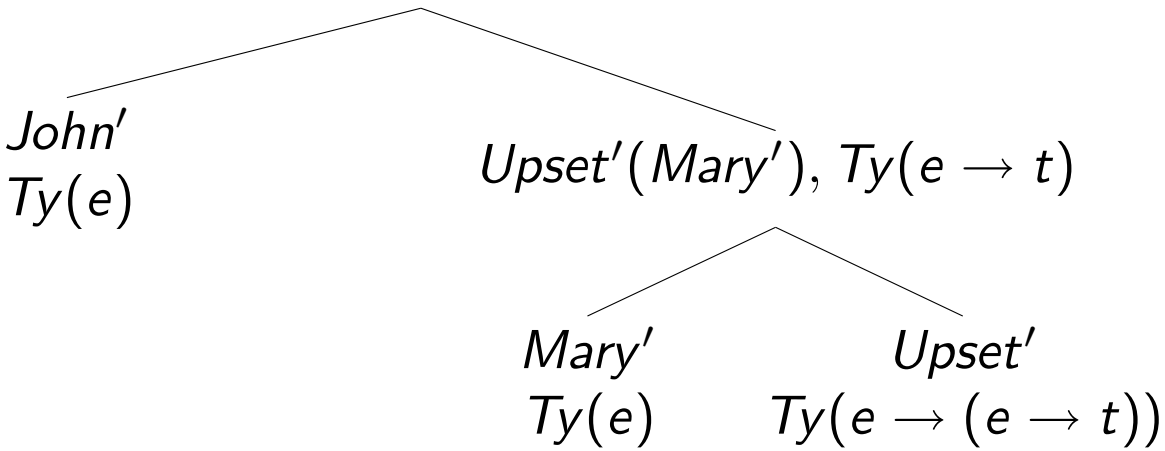
(19) Parsing *Mary, John upset*

$$?Ty(t), \Diamond \quad \longmapsto \quad Upset'(Mary')(John'), Ty(t), \Diamond$$



NPs map onto (epsilon) terms of type e, propositions are of type t.
All terms are concepts, induced from procedures given by words
Scope evaluation defined on resulting tree.

A language to talk about trees: LOFT Blackburn & Meyer-Viol 1994

from the point of view of treenode n, $Tn(n)$:

$\langle\downarrow_0\rangle X$	X holds at argument daughter of Tn(n).
$\langle\downarrow_1\rangle X$	X holds at functor daughter of Tn(n).
$\langle\uparrow\rangle X$	X holds at mother of Tn(n).
$\langle\downarrow_*\rangle X$	Tn(n) dominates X.
$\langle\uparrow_*\rangle X$	Tn(n) is dominated by X.
$\langle L\rangle X$	the LINK relation (between nodes in distinct trees)
$\langle L^{-1}\rangle X$	the inverse LINK relation.

Requirements: $?X$ for any X including modal statements – constraints on future developments

Actions all the way

- 'computational actions' inducing schematic partial tree growth

$$?Ty(t), \Diamond \quad \longmapsto \quad \begin{array}{c} ?Ty(t) \\ \diagup \quad \diagdown \\ ?Ty(e), \Diamond \qquad ?Ty(e \rightarrow t) \end{array}$$

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- words as packages of actions, e.g.
  - verbs induce (partial) propositional templates: *upset*

IF	$\{?Ty(e \rightarrow t)\}$
THEN	make($\langle\downarrow_1\rangle$);go($\langle\downarrow\rangle$);
	put($Fo(Upset')$,
	$Ty(e \rightarrow (e \rightarrow t))$)
	go($\langle\uparrow_1\rangle$); make($\langle\downarrow_0\rangle$);
	go($\langle\downarrow_0\rangle$); put($?Ty(e)$)
ELSE	ABORT

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- Requirements, $?X$ drive all tree growth eg
  - Case specifications as tree-growth requirements: eg. Nominative $?\langle\uparrow_0\rangle Ty(t)$

Underspecification: structural

- Processing non-contiguous dependencies:
  long distance dependency as building "unfixed node" with later resolution

  (19) *Mary, John upset*

$$Tn(0),\ ?Ty(t), \Diamond$$

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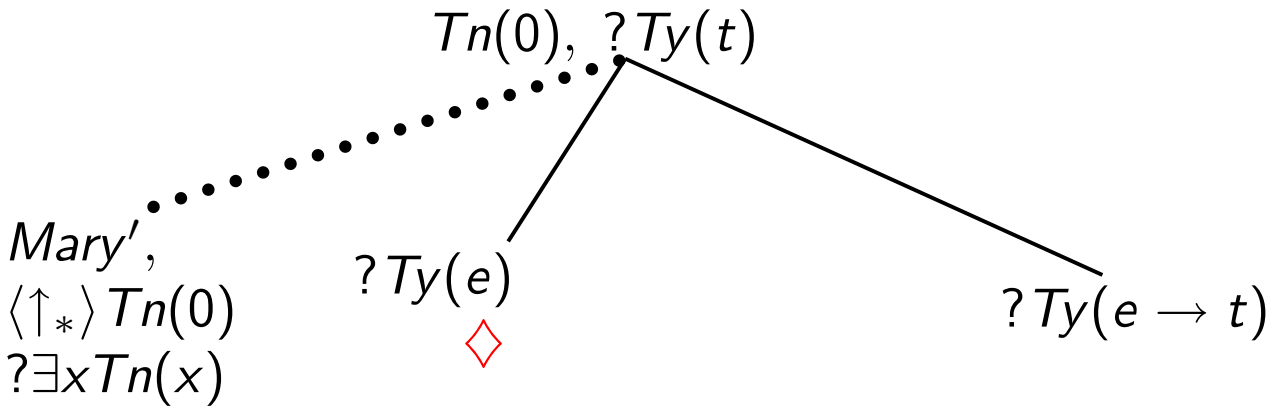

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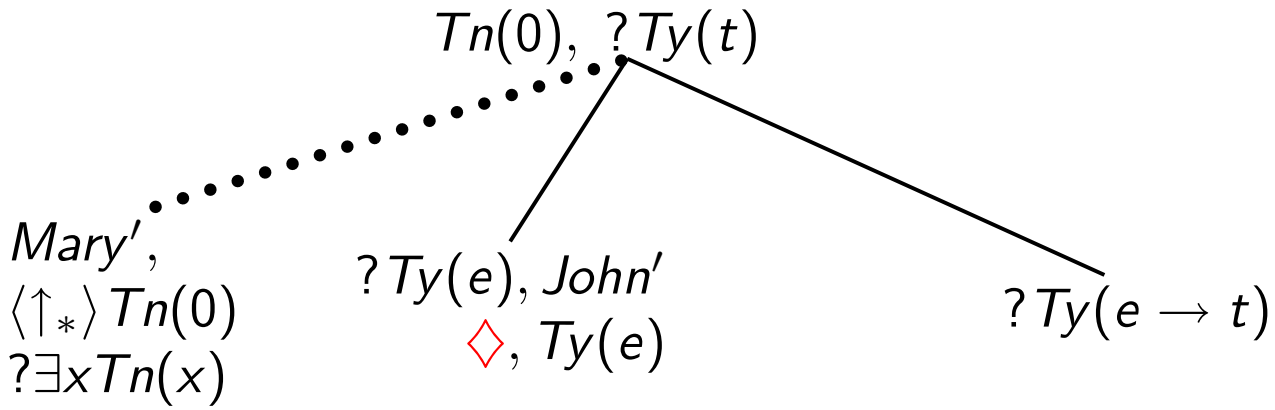

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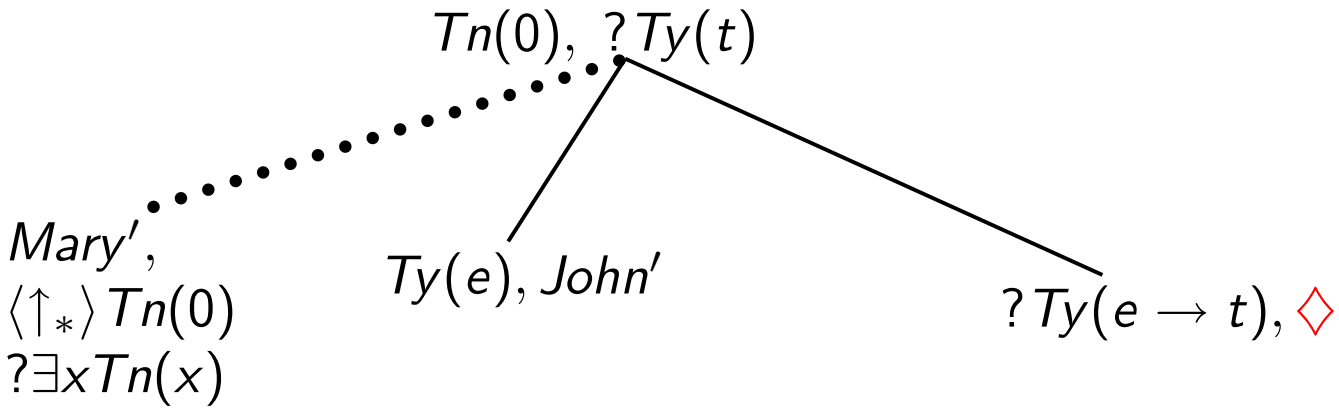

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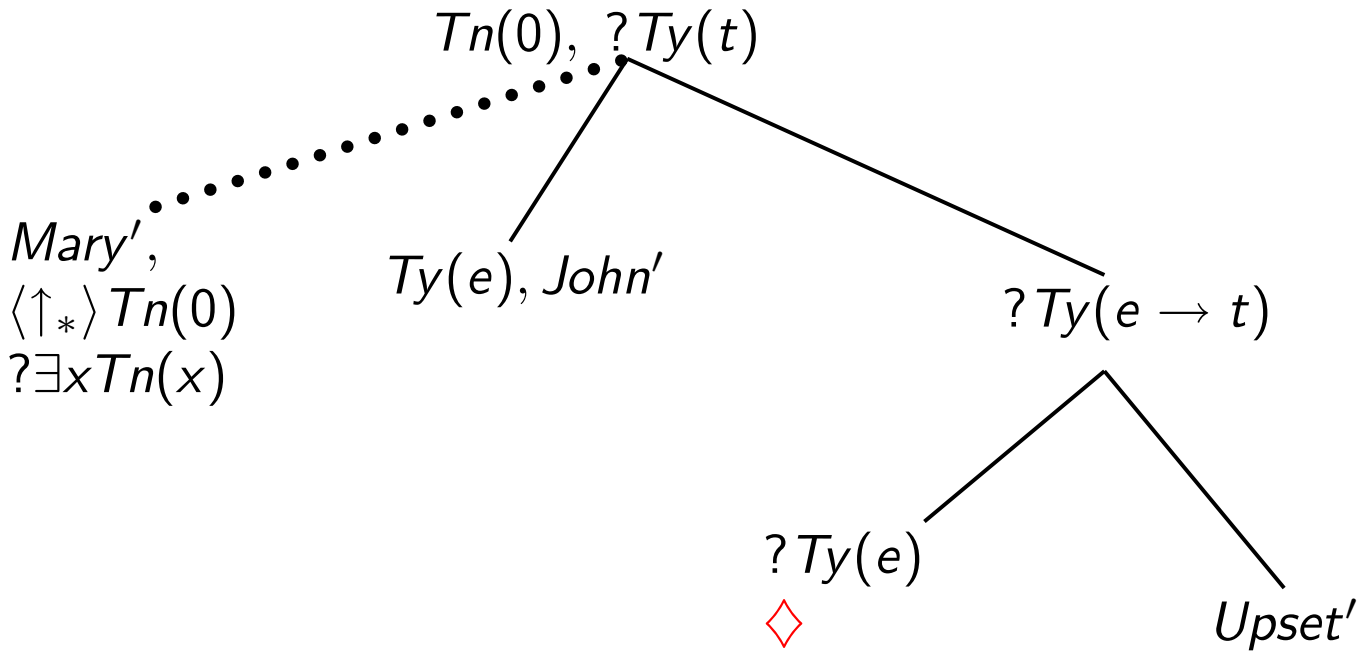

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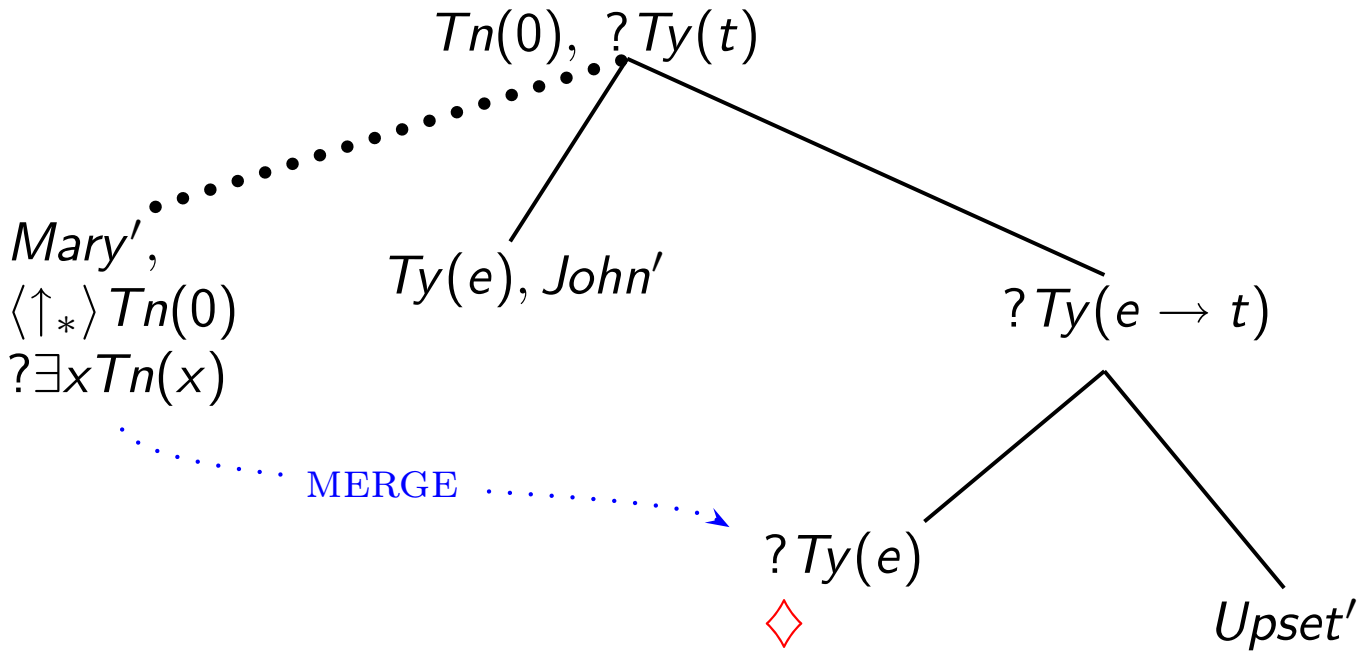

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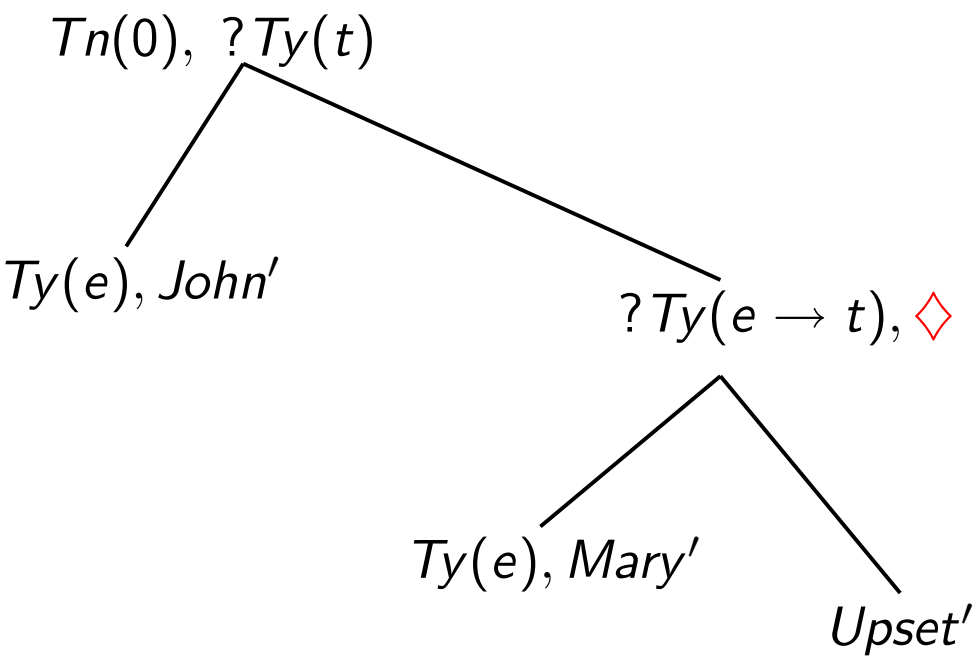

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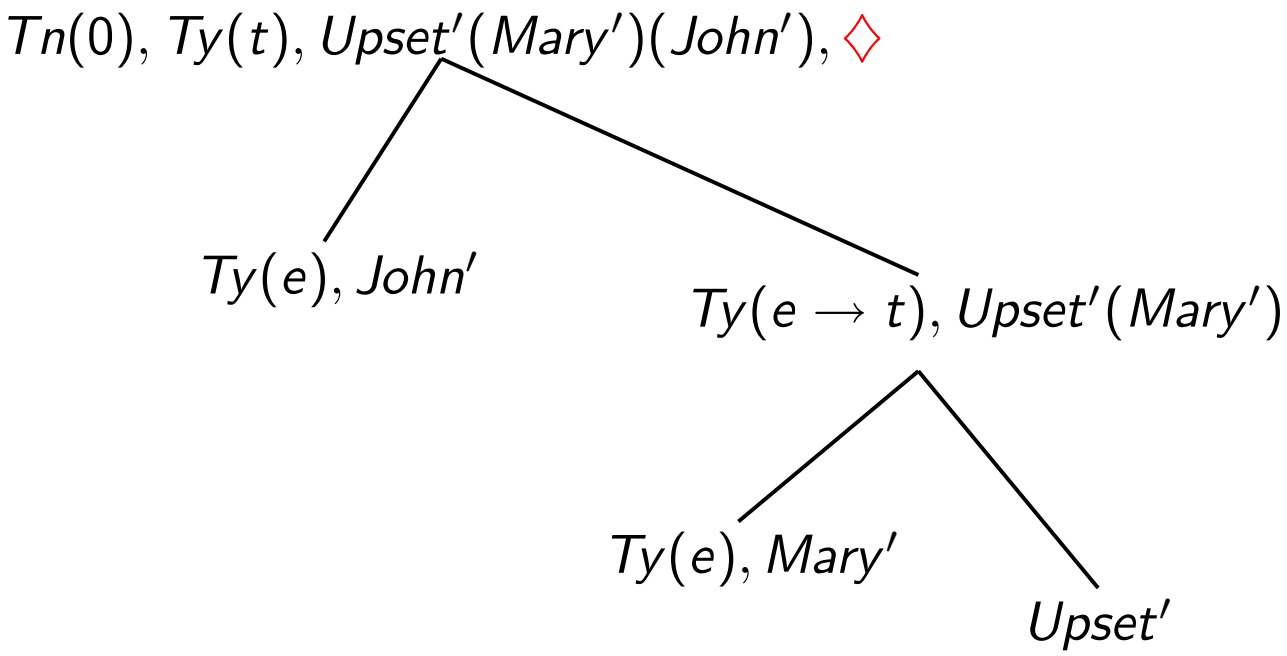

Generation

- Speakers go through the same tree-growth actions, except they also have a somewhat richer goal tree.
- Each word licensed must update partial tree towards the goal tree
  - Generating *Mary John upset*

GOAL TREE

$Upset'(Mary')(John')\,Ty(t), \Diamond$

$John'$
$Ty(e)$

$Upset'(Mary'), Ty(e \rightarrow t)$

$Mary'$
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$Upset'$
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TEST TREE

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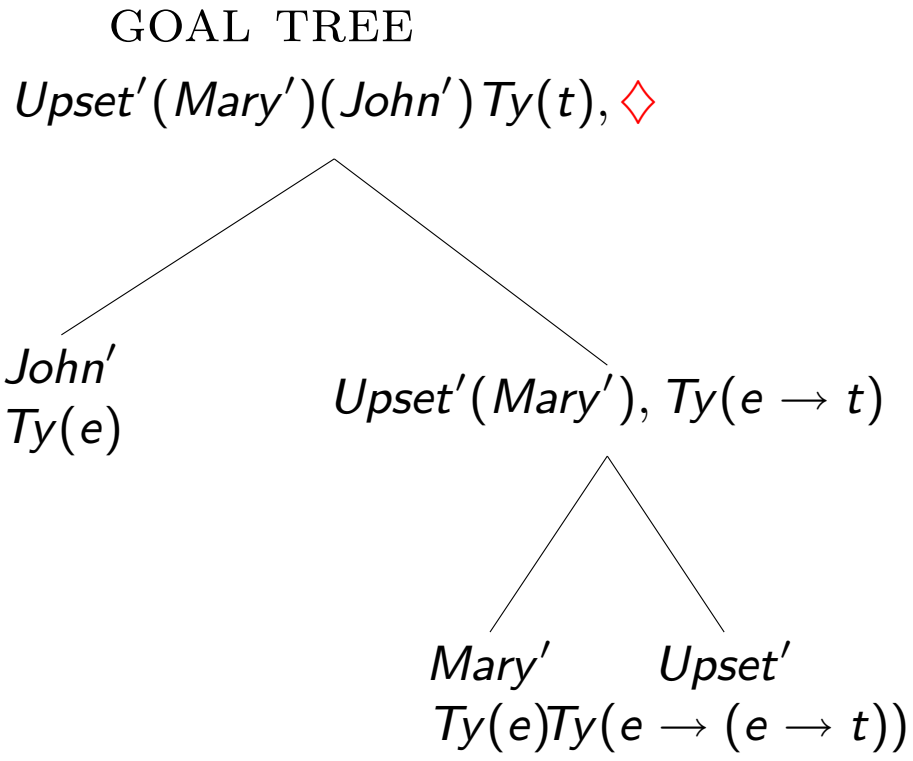

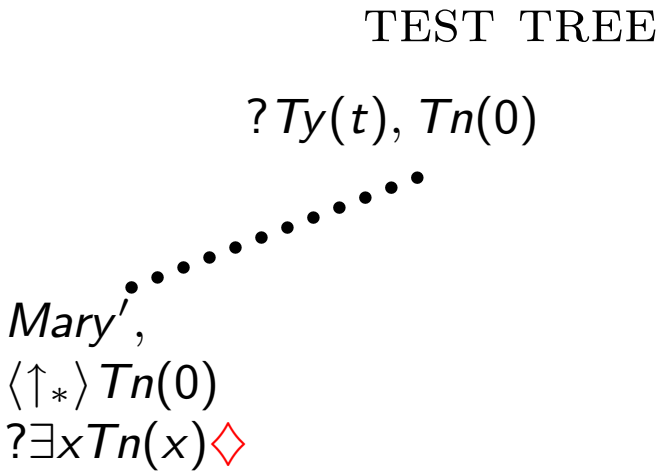

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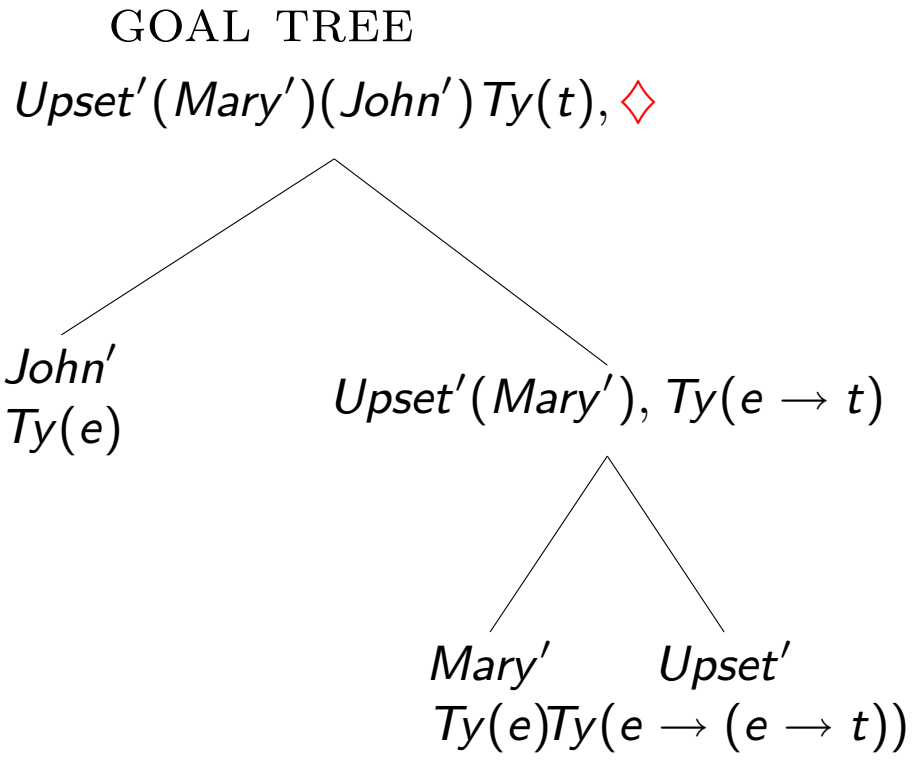

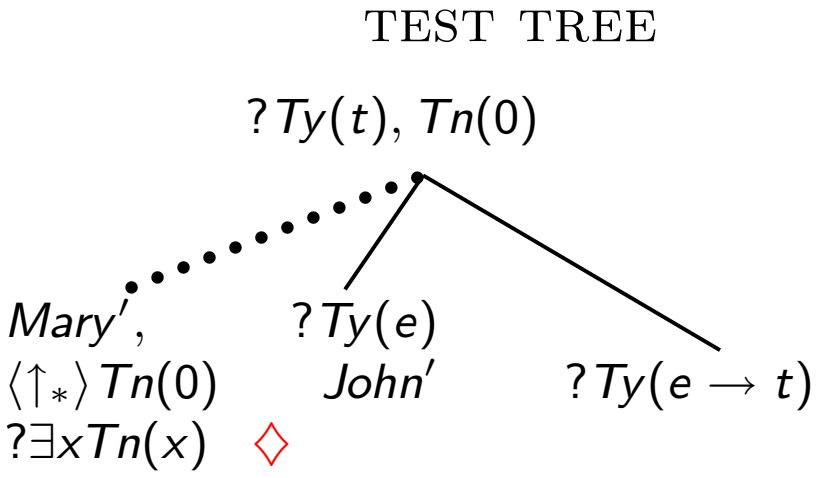

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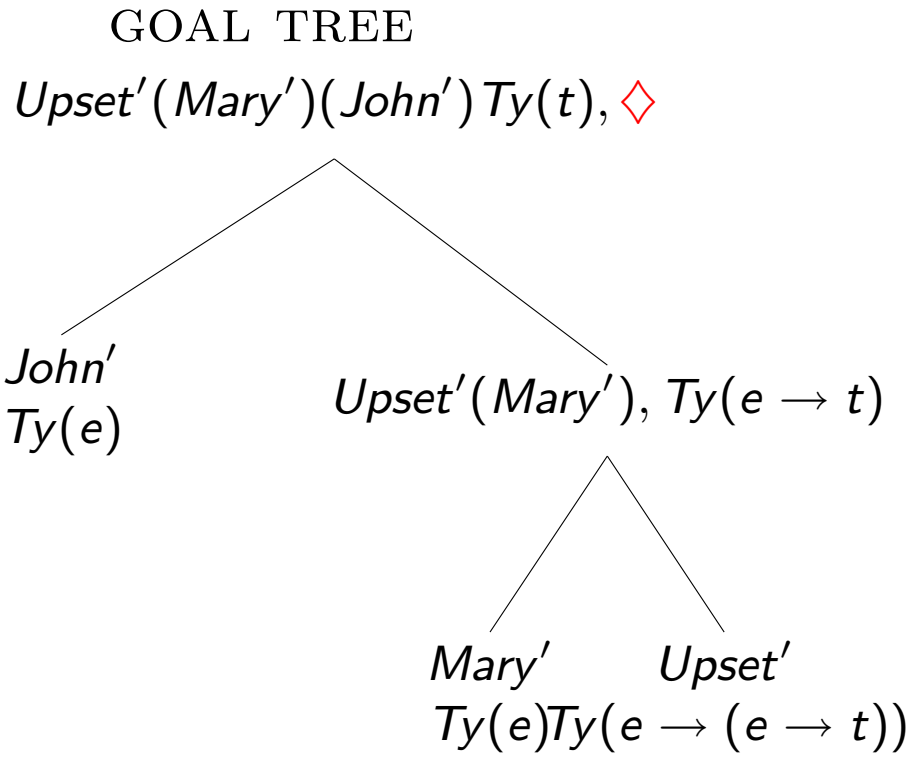
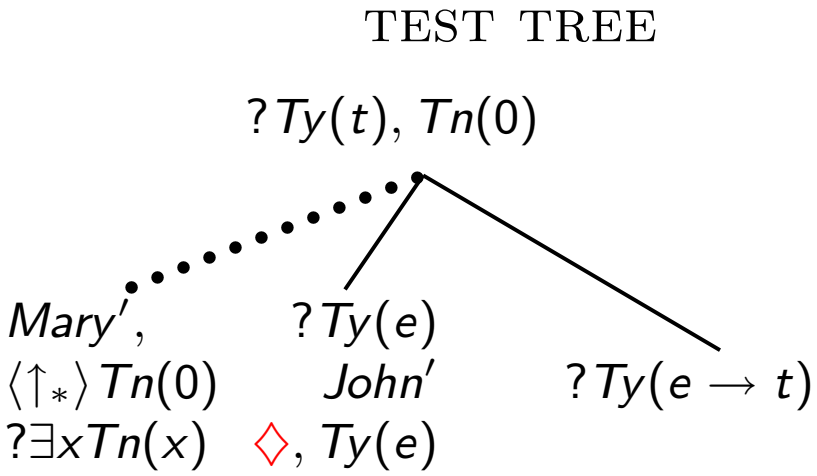
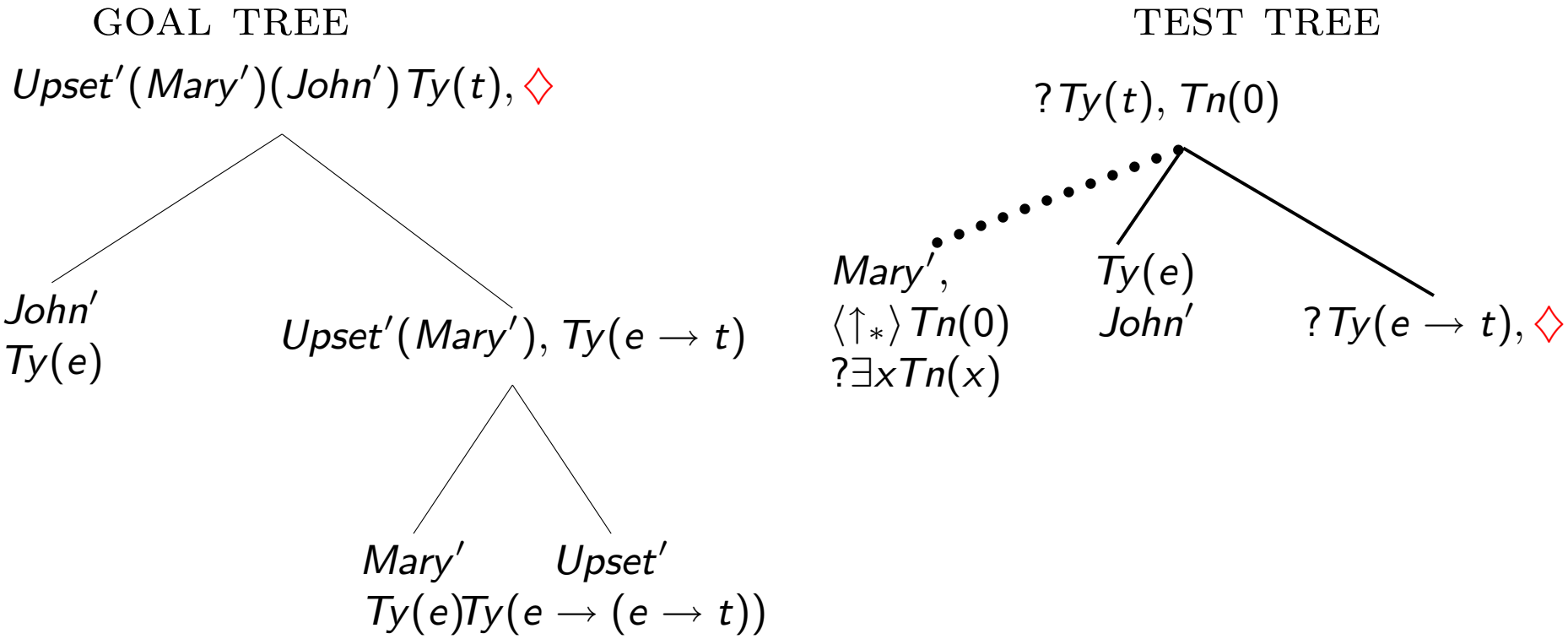




Gen: ‘Mary John

Generation

- Speakers go through the same tree-growth actions, except they also have a somewhat richer goal tree.
- Each word licensed must update partial tree towards the goal tree
  - Generating *Mary John upset*



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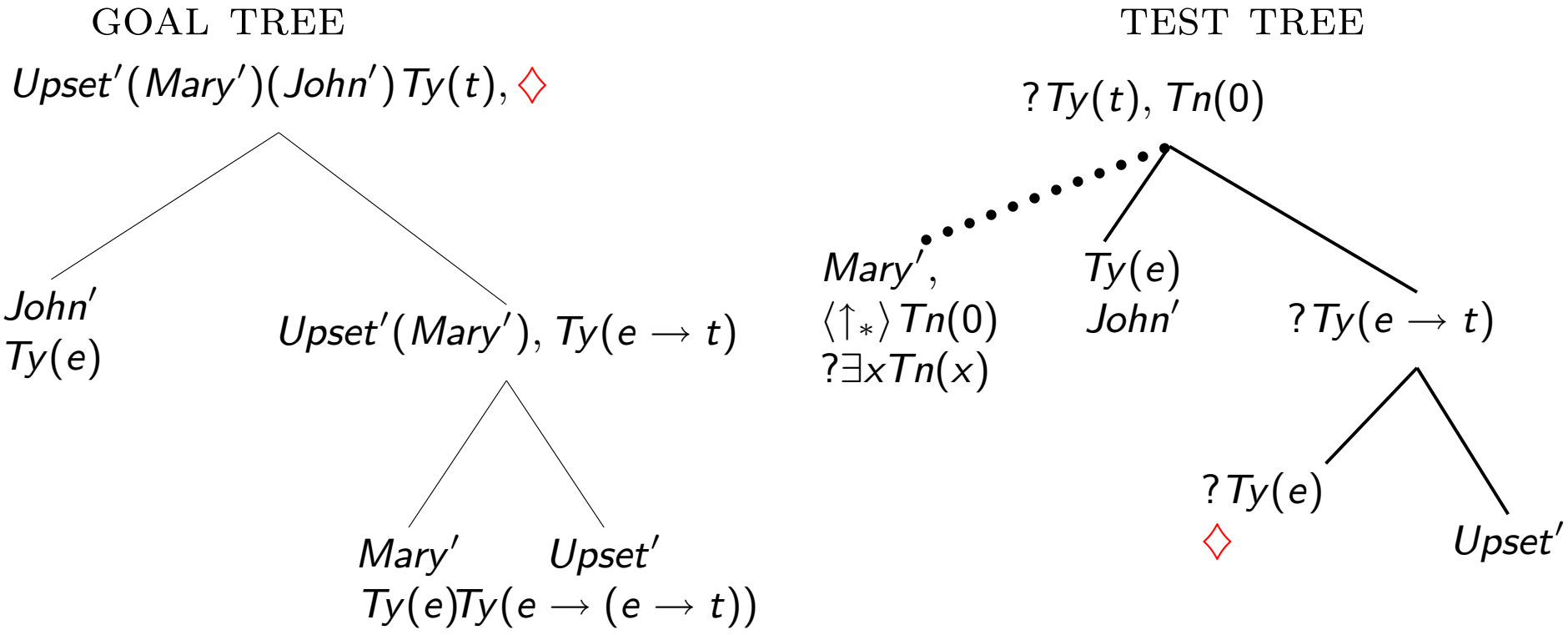

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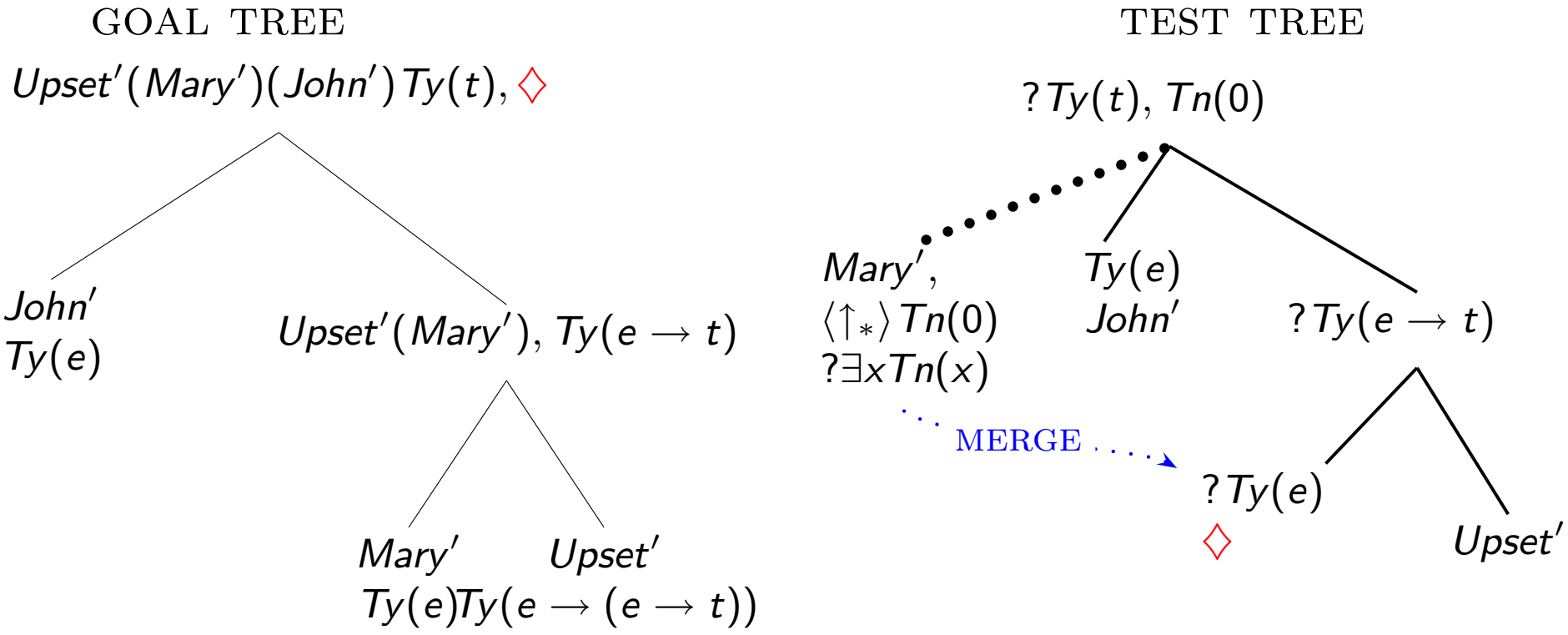

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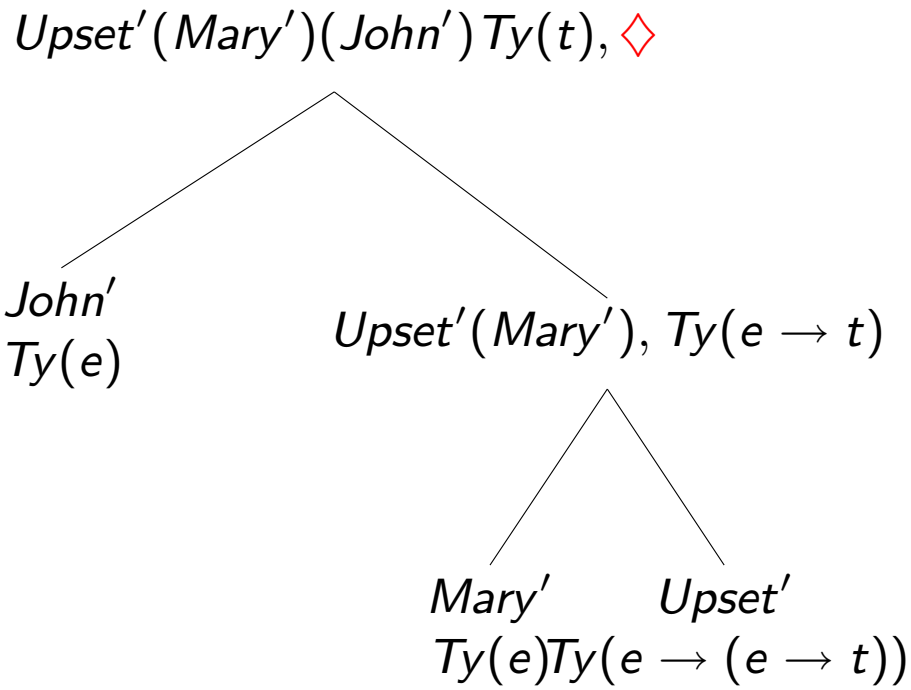
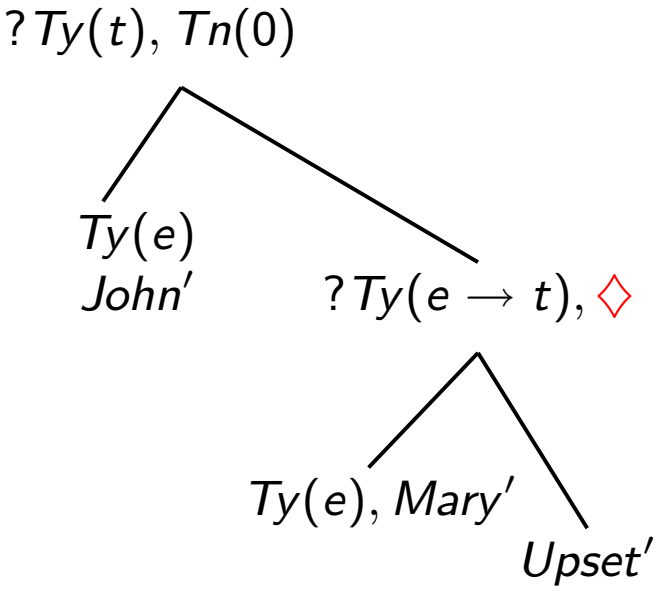


TEST TREE



Gen: 'Mary John upset

Underspecification: content

- Pronouns project META-VARIABLES (**U**)
  Substituted by item from context during construction

(20) Someone was smoking He fainted.

Underspecification: content

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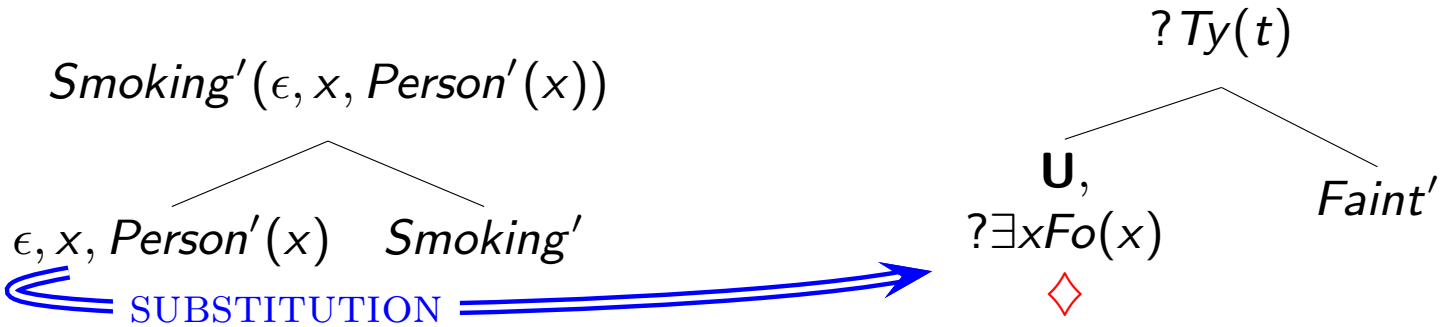
TREE AS CONTEXT: TREE UNDER CONSTRUCTION:



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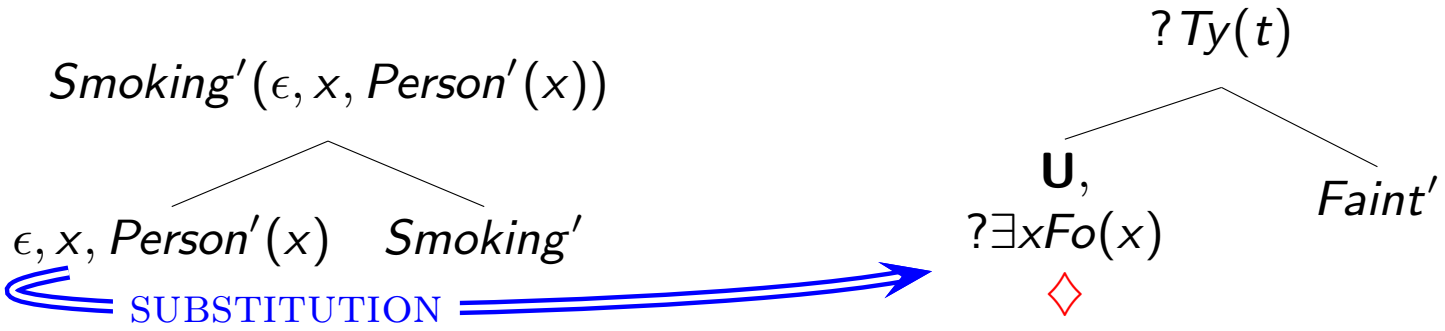


- Also applicable to definite NPs, enabling construction of complex restrictors
- Choice can be locally delayed, as in expletives *It is likely John will get the job.*

Growing "quantified names" to reflect environment

Building up arbitrary-names via terms with scope constraints:

$$\frac{\exists x \phi(x)}{\phi(\epsilon, x, \phi(x))}$$

(21) Parsing *Someone is ill* collecting scope constraints

S event term $\quad S < x, \; Ill'(\epsilon, x, Person'(x)), Ty(t)$

DP $\quad \epsilon, x, Person'(x) \qquad Ill'$

N', D $\quad (x, Person'(x)) \qquad \lambda P.\epsilon, P$

N $\quad x \qquad Person'$

Rule for interpreting logical form yields equivalent of:

$\exists x.Person'(x) \wedge Ill'(x)$

$S : Person'(\mathbf{a}) \wedge Ill'(\mathbf{a})$

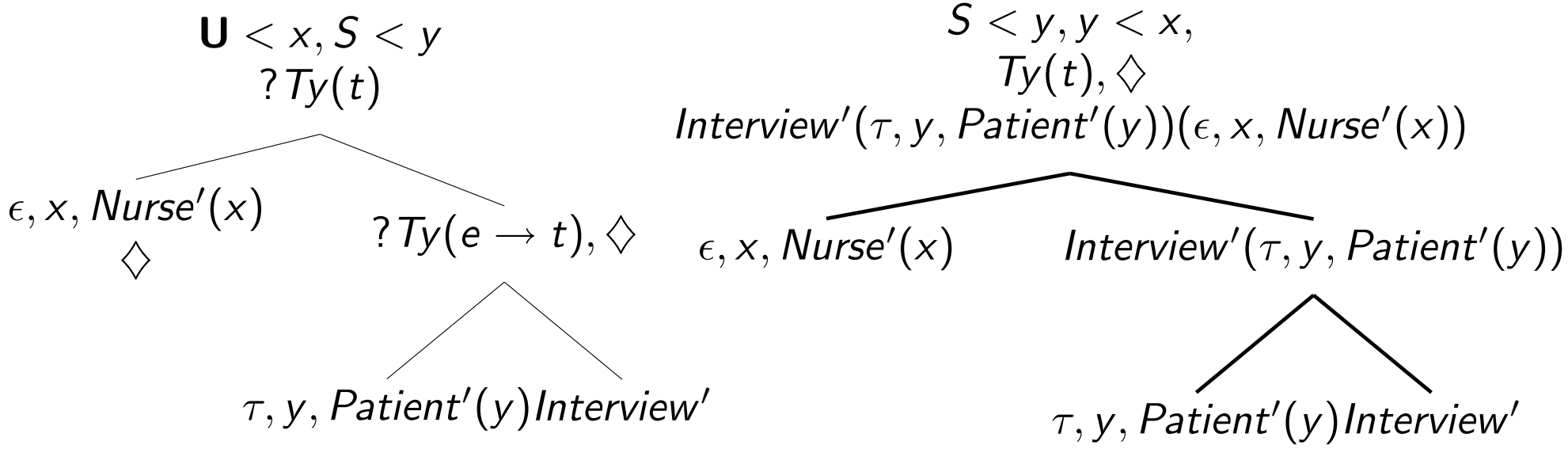
$\mathbf{a} = (\epsilon, x, Person'(x) \wedge Ill'(x))$

Incorporating underspecification+update into name growth

- Indefinites allow delayed scope-dependency choice (like expletives):
  - (22) Every professor ensured that two students submitted a report
  - (23) A nurse interviewed every patient.
  - (24) Few nurses interviewed most patients.

  Processing (23)

  Late fixing of scope construal :

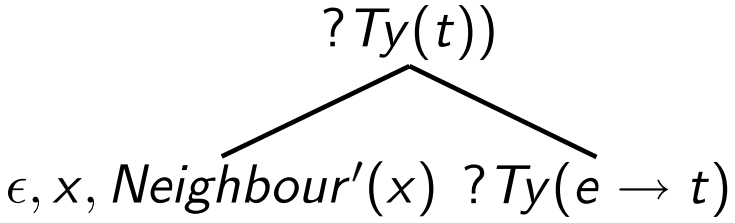


- Context for delayed scope choice is previous tree-transition

Constructing contexts - relative clause construal

- One partial tree as context for another, with LINKed trees sharing a formula; relative pronouns as providing a copy of the head (at an unfixed node)

(25) A neighbour, who I like, smokes.



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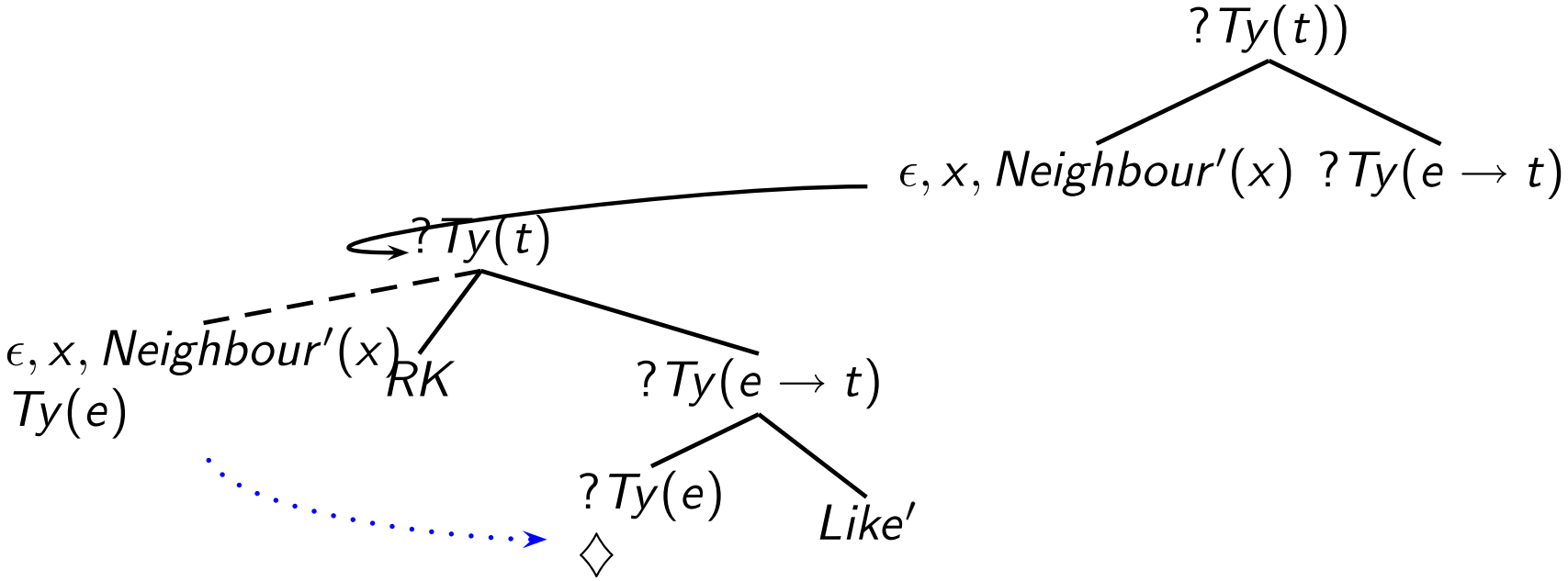

Constructing context - relative clause construal

- The resulting pair of trees evaluable as a conjunction

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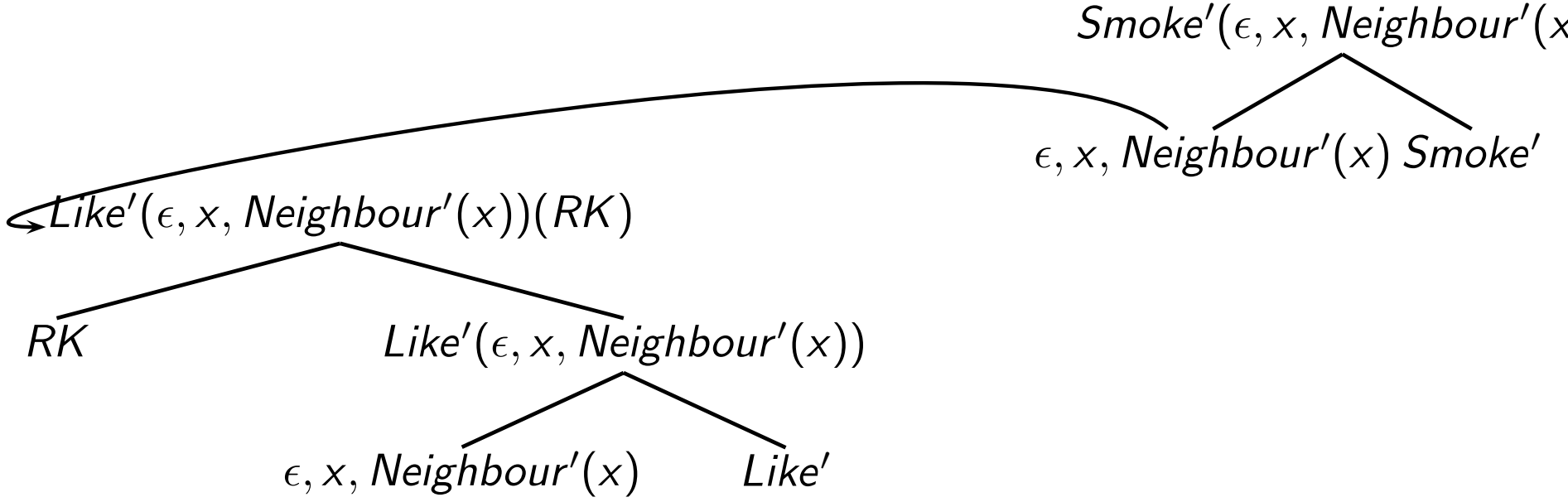


Resulting formula:

$Like'(\epsilon, x, Neighbour'(x))(RK) \wedge Smoke'(\epsilon, x, Neighbour'(x))$

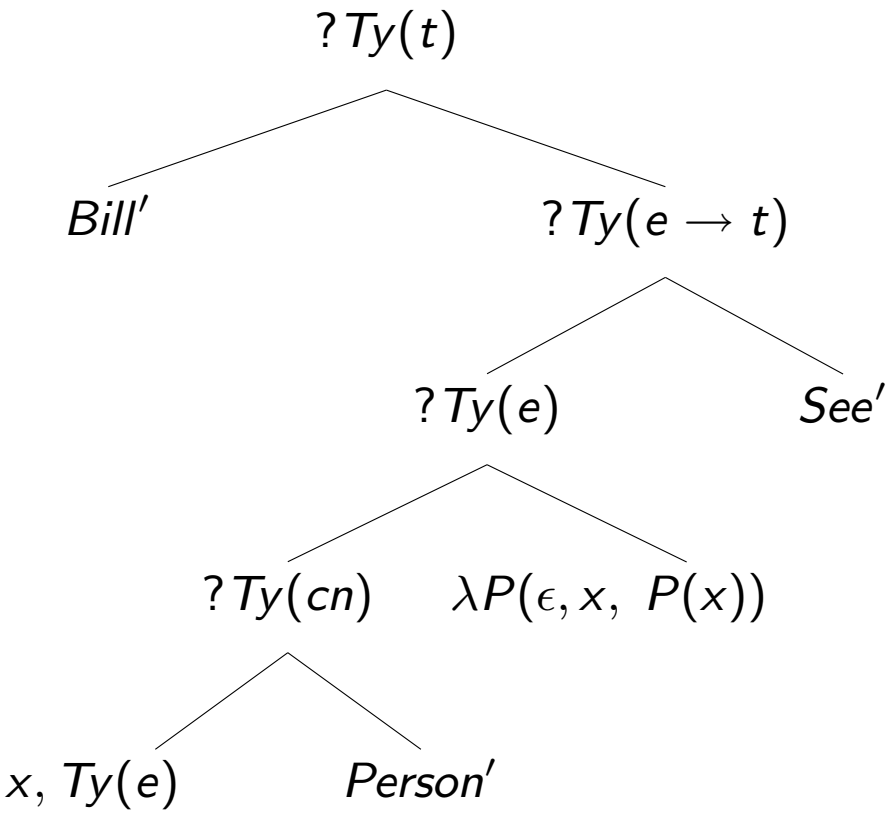
Compiled conjunction feeds into scope evaluation:

$$Like'(\mathbf{a})(RK) \wedge Smoke'(\mathbf{a})$$

$$\mathbf{a} = \epsilon, x, (Like'(x)(RK) \wedge Smoke'(x))$$

Transition from variable: restrictive relatives

(26) Bill saw someone that John likes



Bill saw someone

Transition from variable: restrictive relatives

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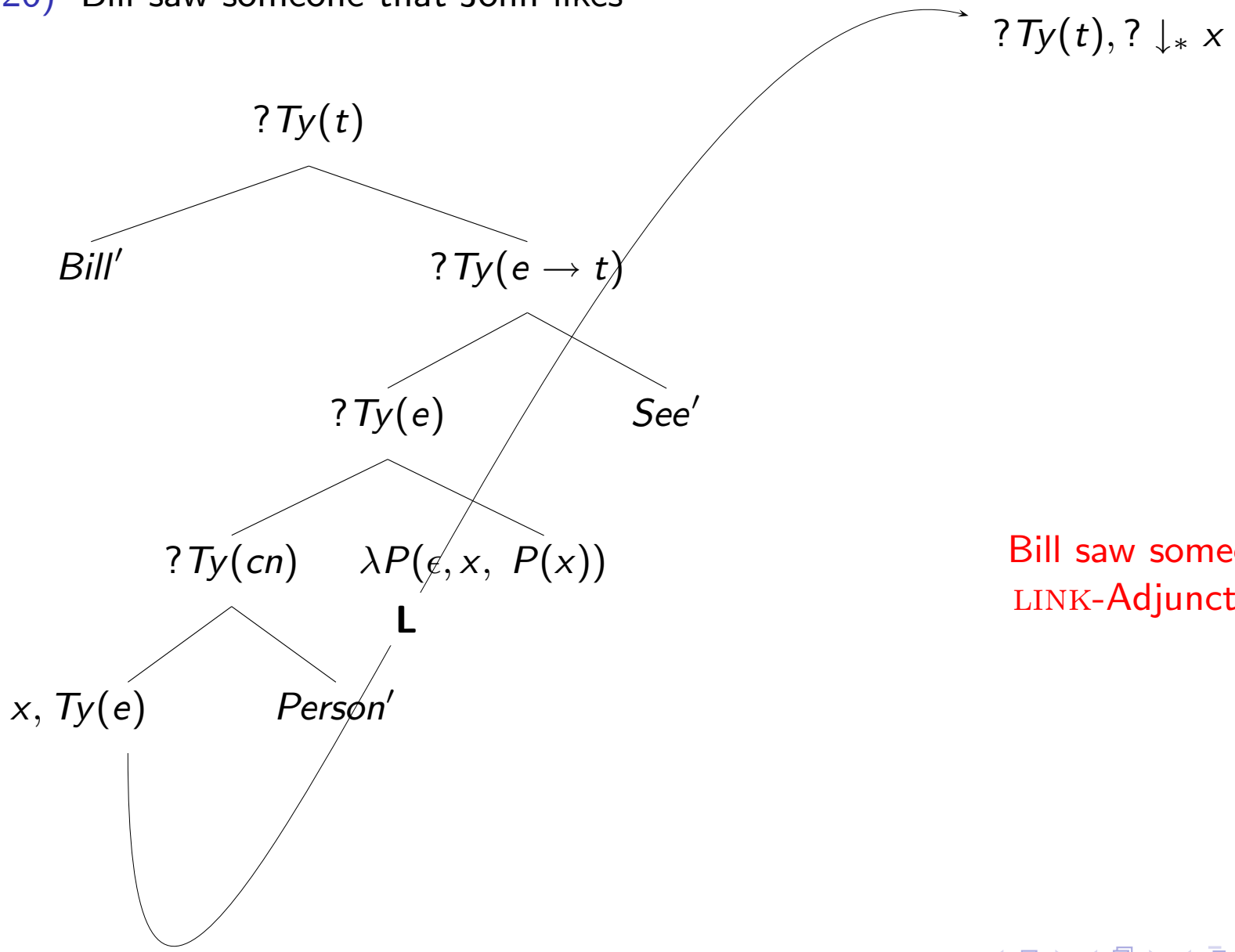

Bill saw someone
LINK-Adjunction

Transition from variable: restrictive relatives

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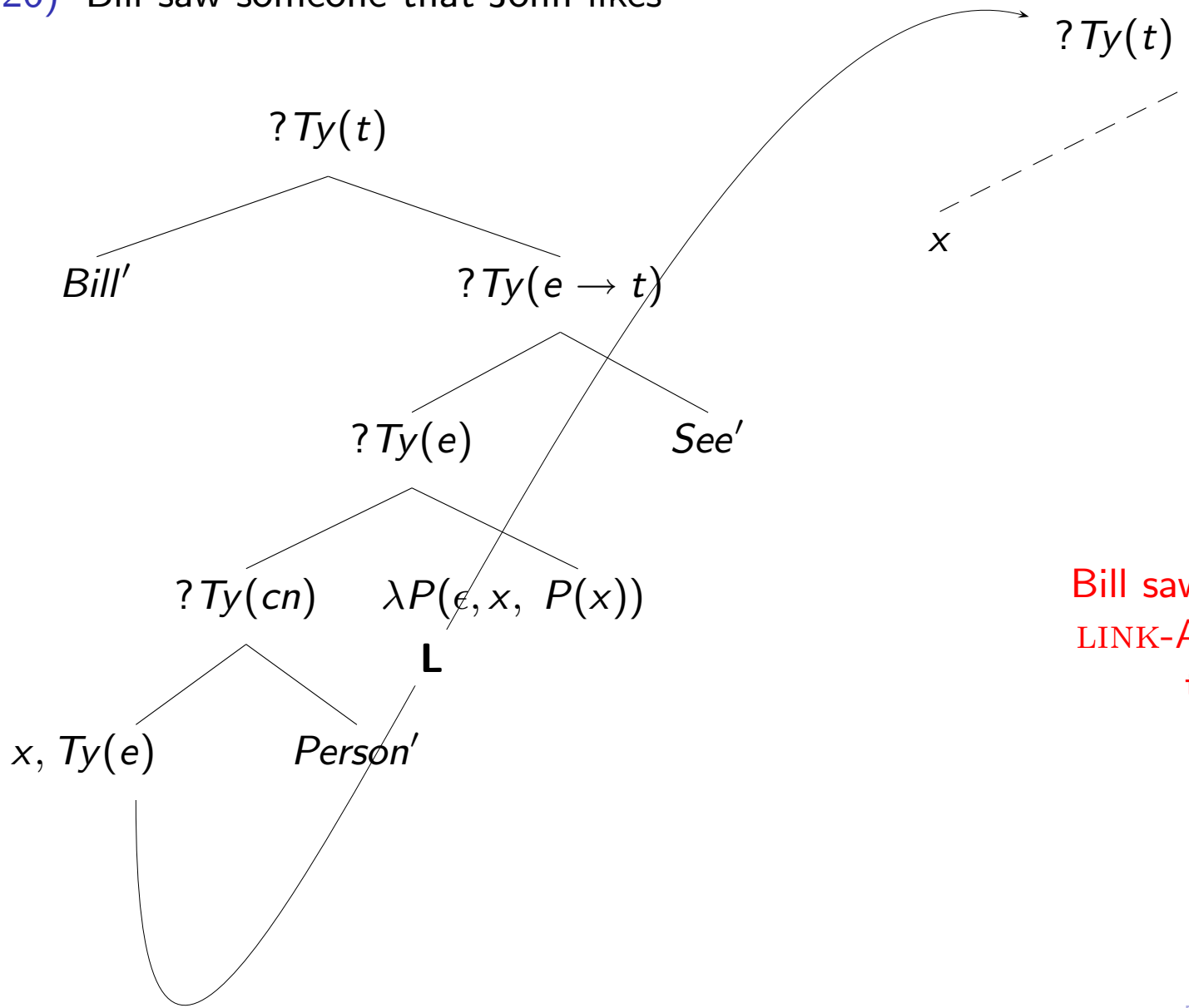

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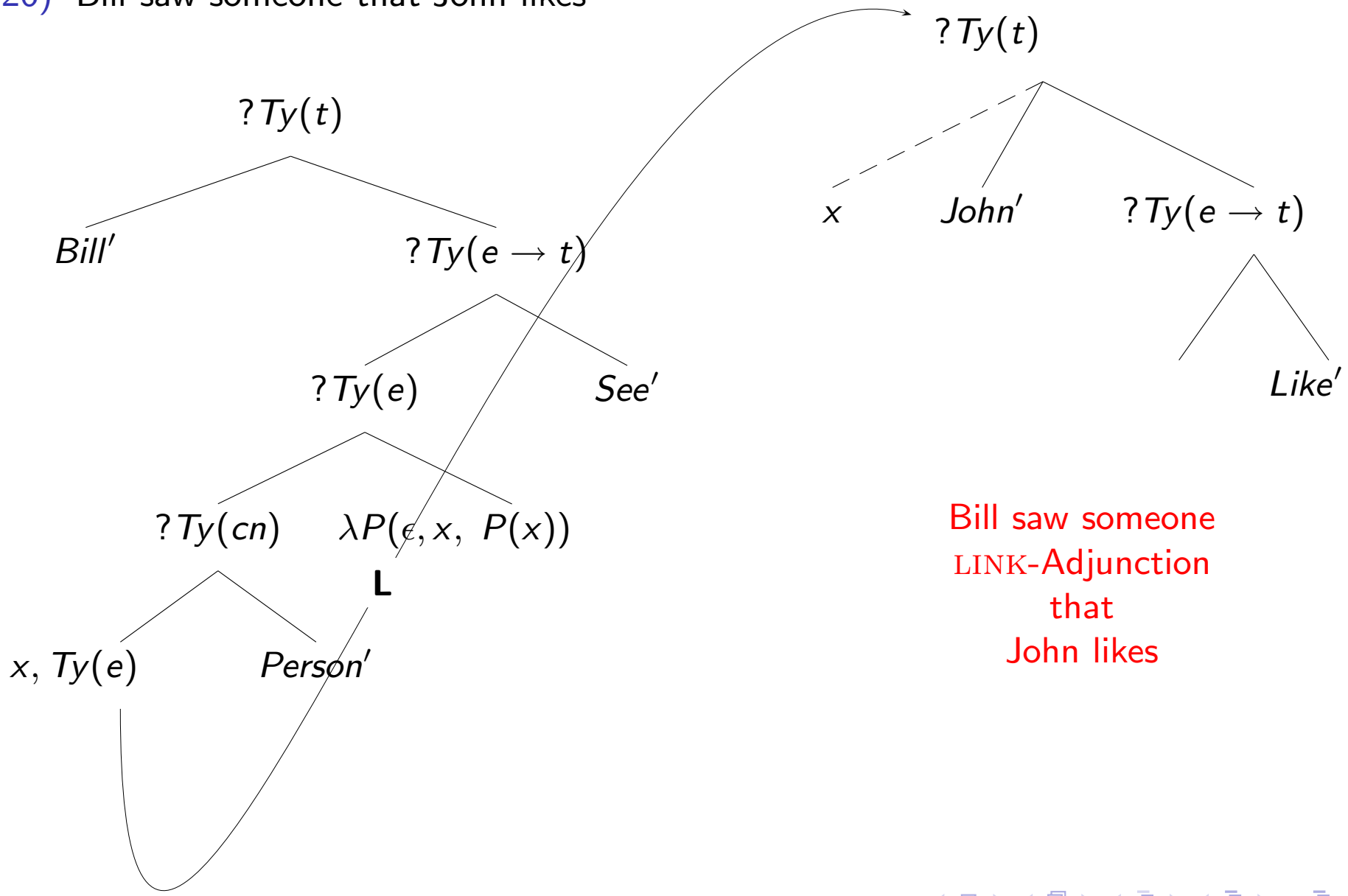

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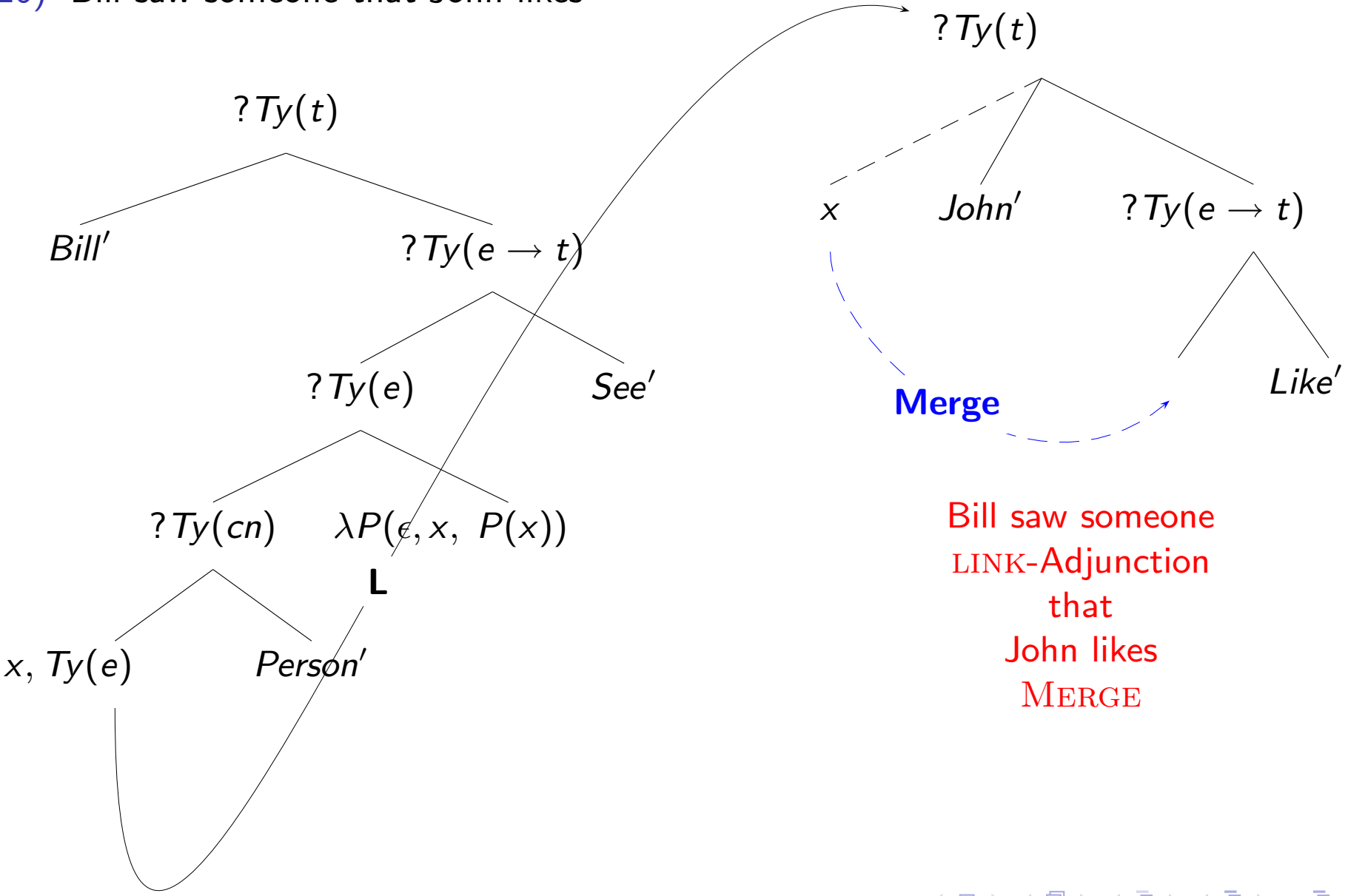

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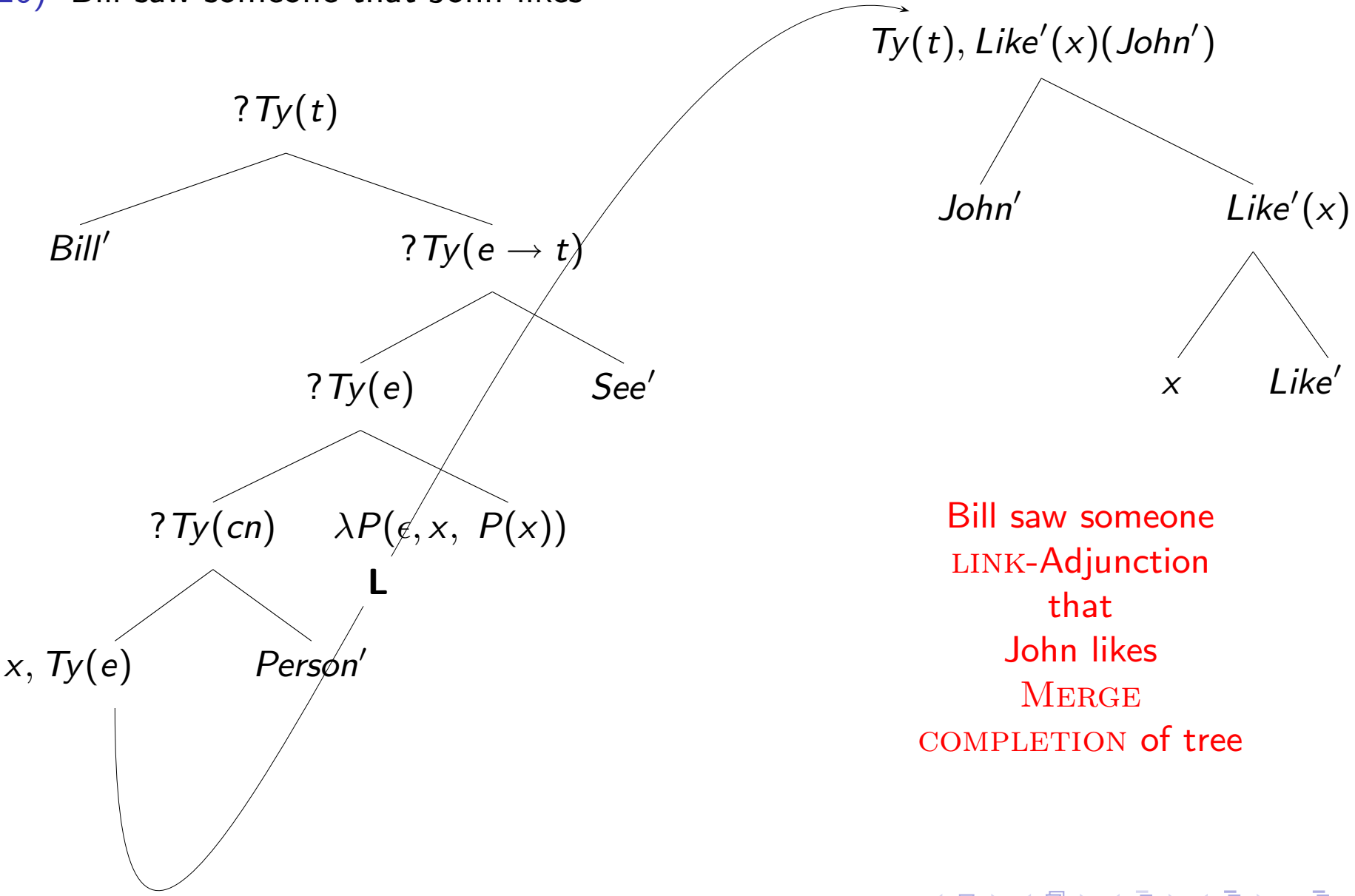
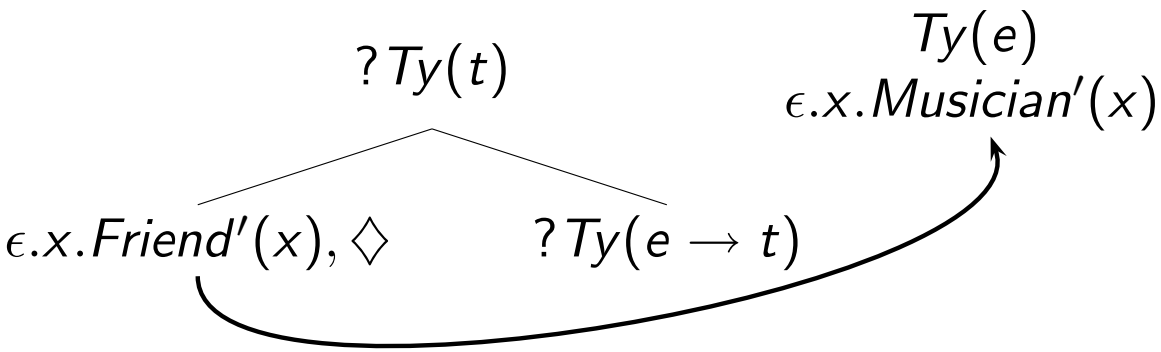


Bill saw someone
LINK-Adjunction
that
John likes
MERGE
COMPLETION of tree

Building up terms by direct adjunction: appositions

(27) A friend, a musician, is staying.

- Partial tree as context with term enriched by linked tree of same type
- Parsing *A friend, a musician*



Compiling linked nodes of type e yields composite term:

$\epsilon.x, Friend'(x) \wedge Musician'(x)$

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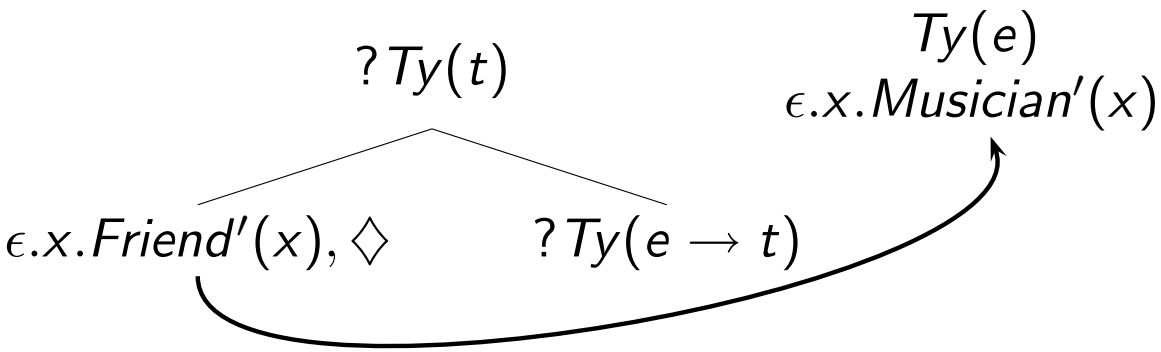


Compiling linked nodes of type e yields composite term:

$\epsilon.x, Friend'(x) \wedge Musician'(x)$

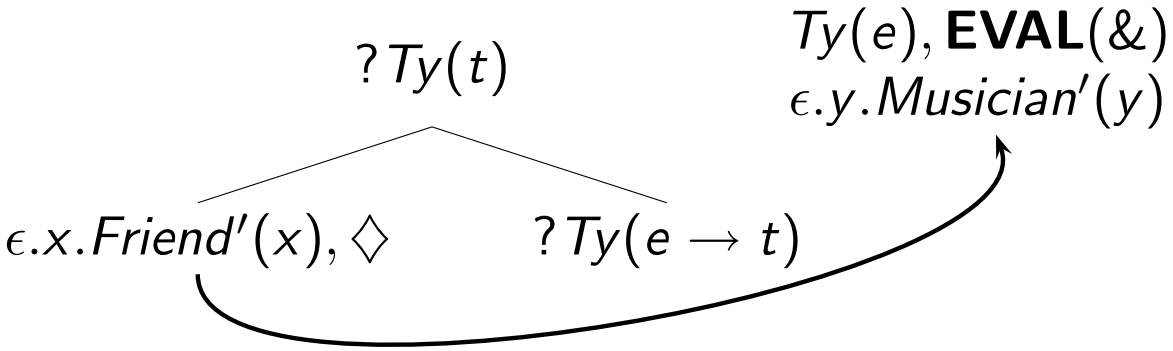
As with relative clause construals, this is part of construction algorithm, allowing reversed scope construals:

(28) A student, a Union rep, will be interviewing every professor.

Building up terms by direct adjunction: conjunctions

(29) A friend and a musician are staying.

- Partial tree as context with term enriched by linked tree of same type BUT with conjunction providing a different procedure for constructing plural term (Cann et al. 2005):
- Parsing *A friend and a musician*



Compiling linked nodes of type e via 'And evaluation' yields conjoined (group-denoting) term:

$(\epsilon, z, Group(z) \wedge (\epsilon, x, Friend'(x)) \leq z \wedge (\epsilon, y, Musician'(y)) \leq z)$

As part of construction algorithm, allowing reversed scope construals:

(30) A student and a musician will be interviewing every professor.

Context

- **Context**: a store of parse states, triples $\langle T, W, A \rangle$
- T - a (possibly partial) propositional tree,
  W - string so far parsed,
  A - set of actions for constructing T from W
- A GENERATOR STATE consists of:
- PARSE STATE derived by parsing this S,
  T_G, a GOAL TREE (ie the intended message)
- Generation thus characterised in exactly same terms as parsing, except in current parse state, current partial tree must *subsume*, $\sqsupseteq$, the goal tree.
- Context uniformly defined in parsing and generation: a set of parse states: (partial) tree structure, (partial) string, sequence of actions.

Ellipsis - Building up interpretation using Context

- With semantics as structural representations of content, syntax as the process of constructing representations, production and parsing as both using the same processes
- Context: a store of evolving structures + actions used to build up structure Purver et al 2007, Cann et al 2009
- hearers/speakers can retrieve actions stored in their own context and re-use them to build up interpretation, inducing effect of shared context

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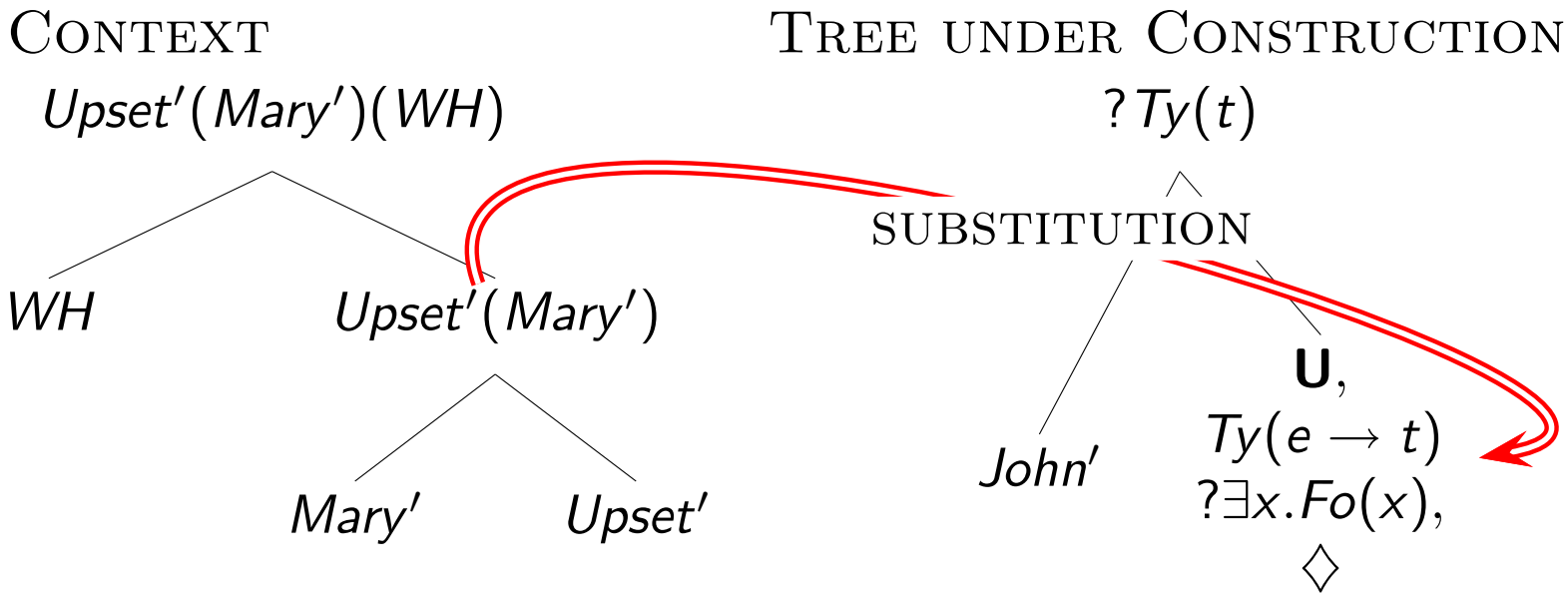
- hearers/speakers can retrieve actions stored in their own context and re-use them to build up interpretation, inducing effect of shared context
- Consequence: parallelism effects in ellipsis, structural and semantic.

Context-dependent processing: ellipsis (a)

- Ellipsis can select **terms** from (linguistic) context,

(31) Q: Who upset Mary? Ans: John did. (strict readings)

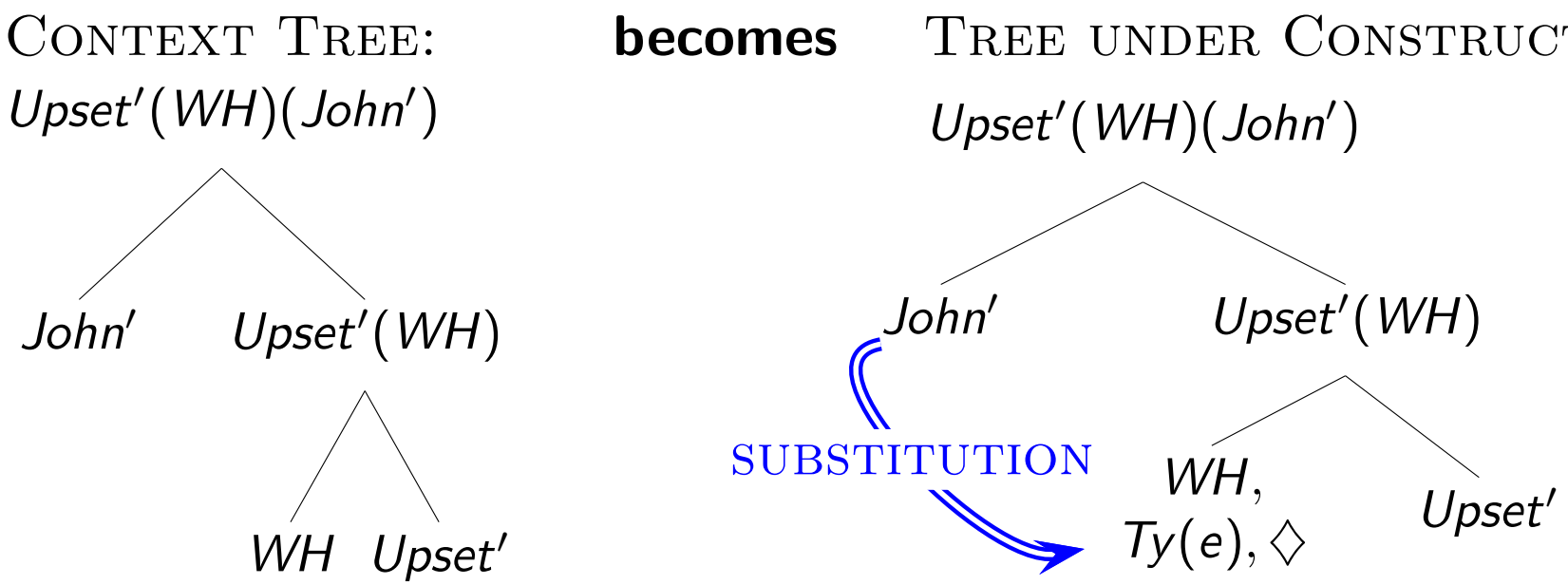


(32) Parent to teenage son with surf-board standing in shallows:
I wouldn't if I were you. The flag's flying, so it'll be dangerous

Ellipsis (b): re-use of structure

- Using **structure** from context - parser/generator starts from partial tree:

(33) Q: Who did John upset ? Ans: Himself.



(34) Q: Who did every woman ignore? Ans: Her husband.

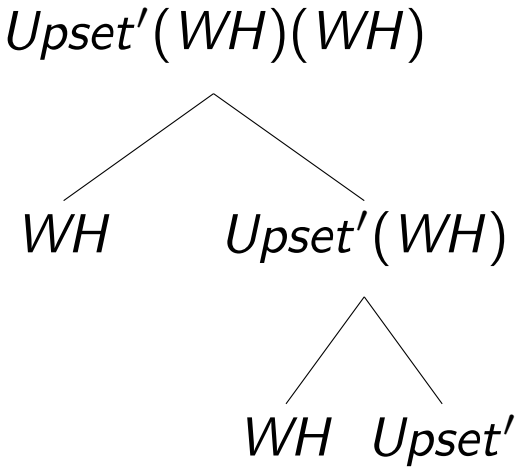
(35) Q: McWhirter's office? Ans: Second door on the left.

Ellipsis (c): re-using actions from context

Interpreting:

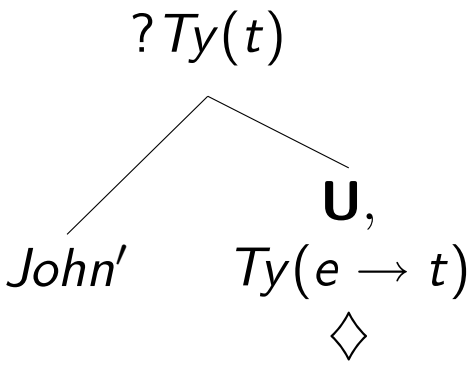
(36) Who hit himself? John did.

CONTEXT



CONTEXT ACTIONS TO RE-RUN

TREE UNDER CONSTRUCTION



actions of *upset*
actions of reflexive
completing/evaluating tree

Ellipsis: re-use of actions induces parallellism

- Using **actions** from context – *sloppy readings*:

(37) John upset his mother. Harry too.

(38) The man [who arrested *John*] failed to read *him his* rights.
The man who arrested Tom did too.

- Also more general parallellism effects: scope, construction type....

(39) Every professor met a new Party executive. Every senior administrator did too. (allows wide scope to indefinite relative to each conjunct: Steedman 2000)

(40) A man, I certainly wouldn't appoint. A friend of mine, I just might.

Ellipsis & Syntactic constraints – ACE

- Antecedent-contained ellipsis constraints emerge from encoded incremental growth

(41) Bill saw someone [that John did]

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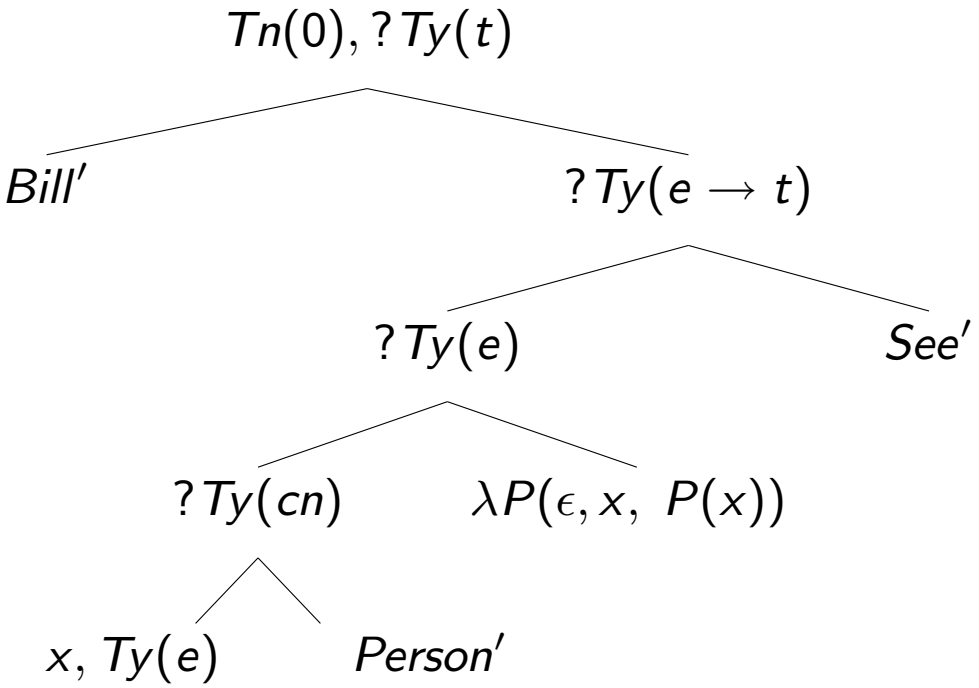

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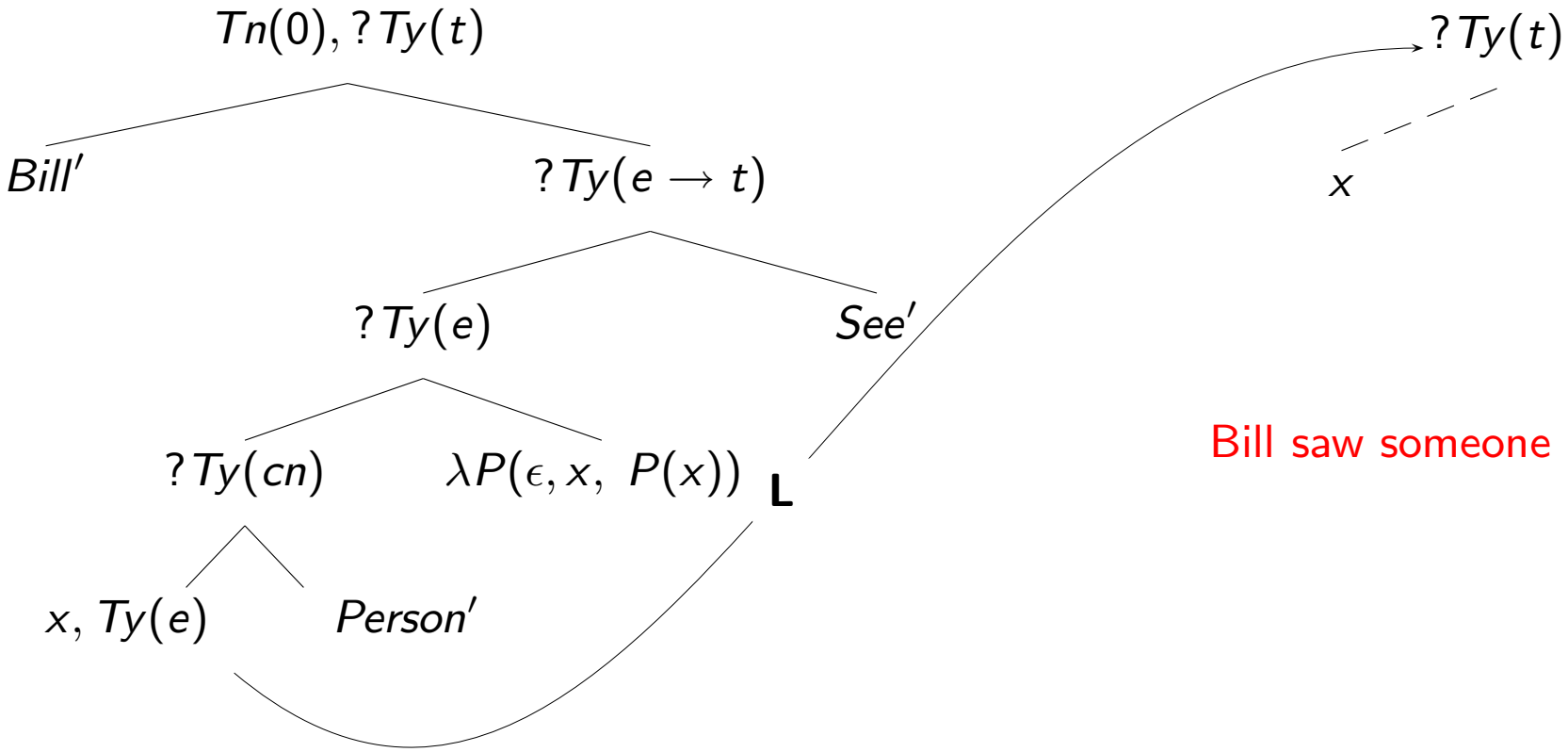

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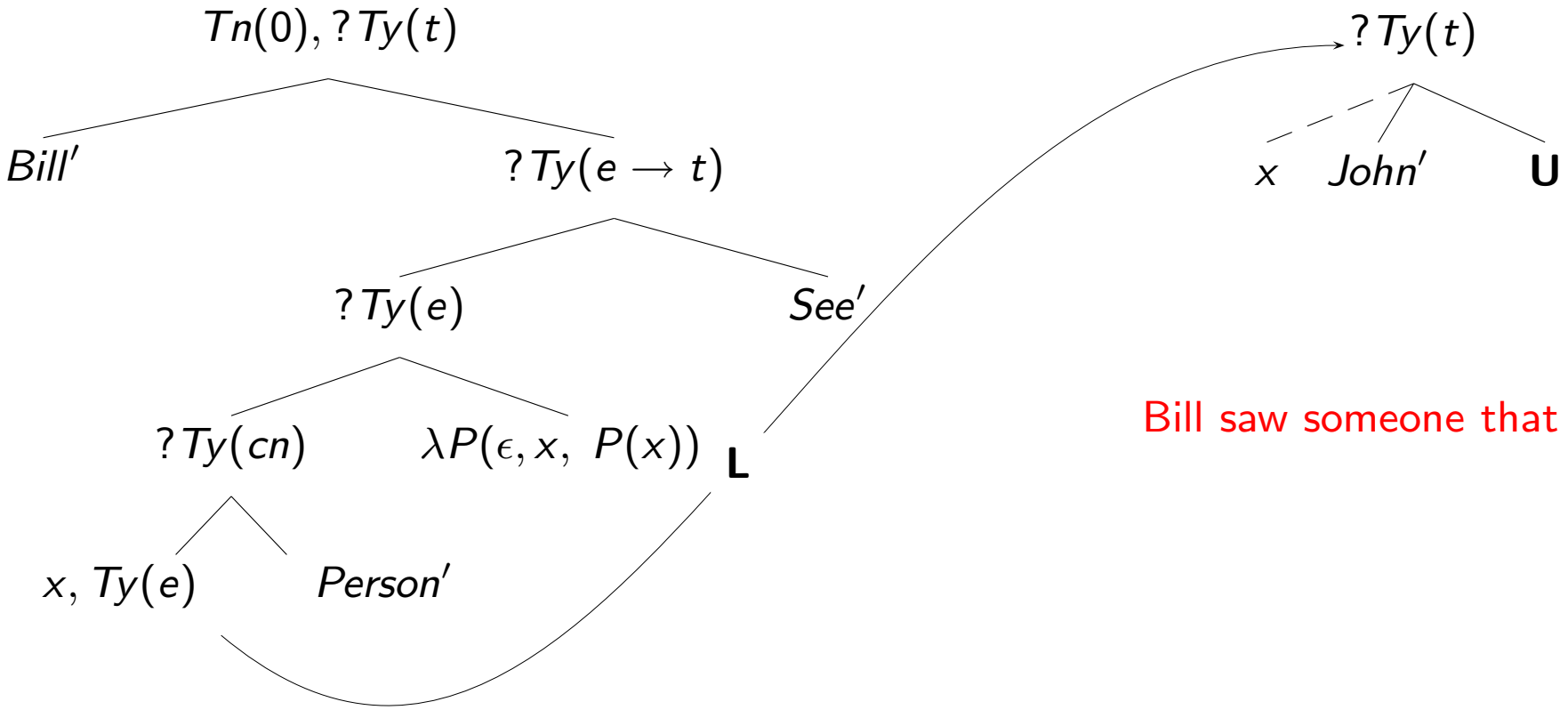

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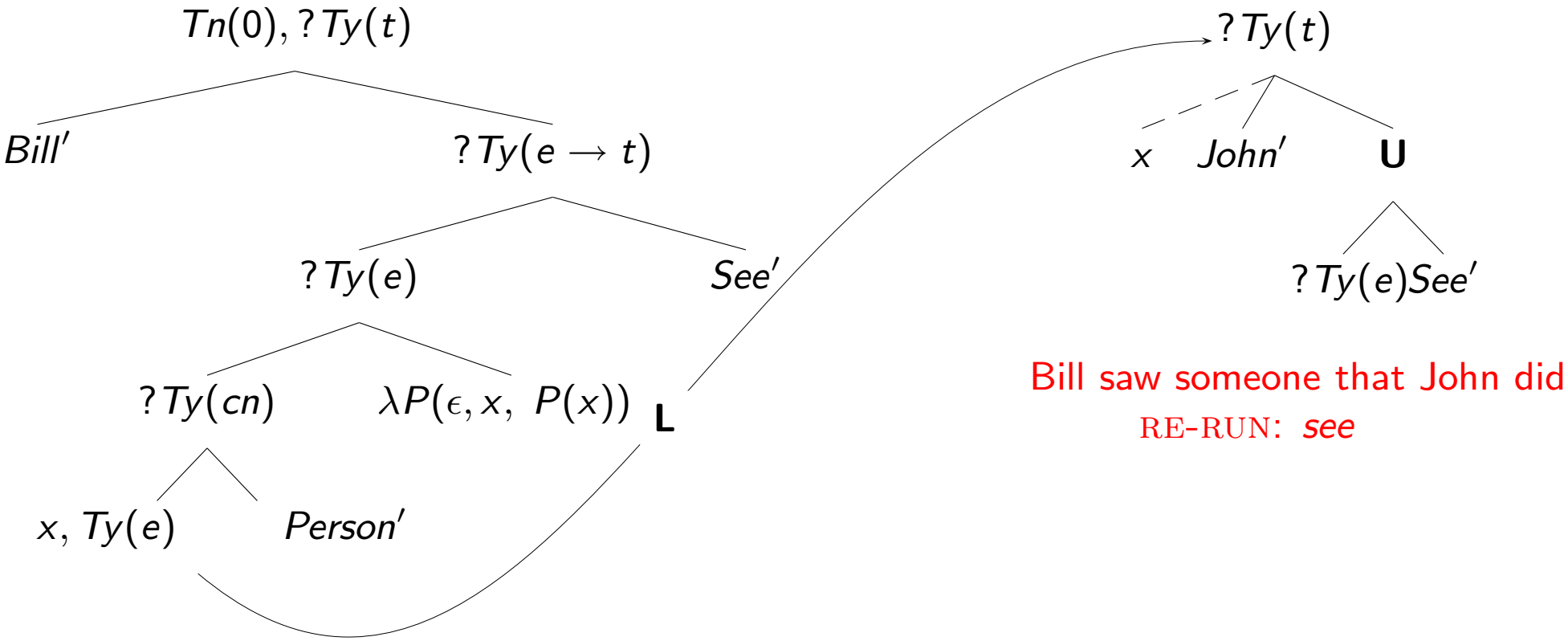

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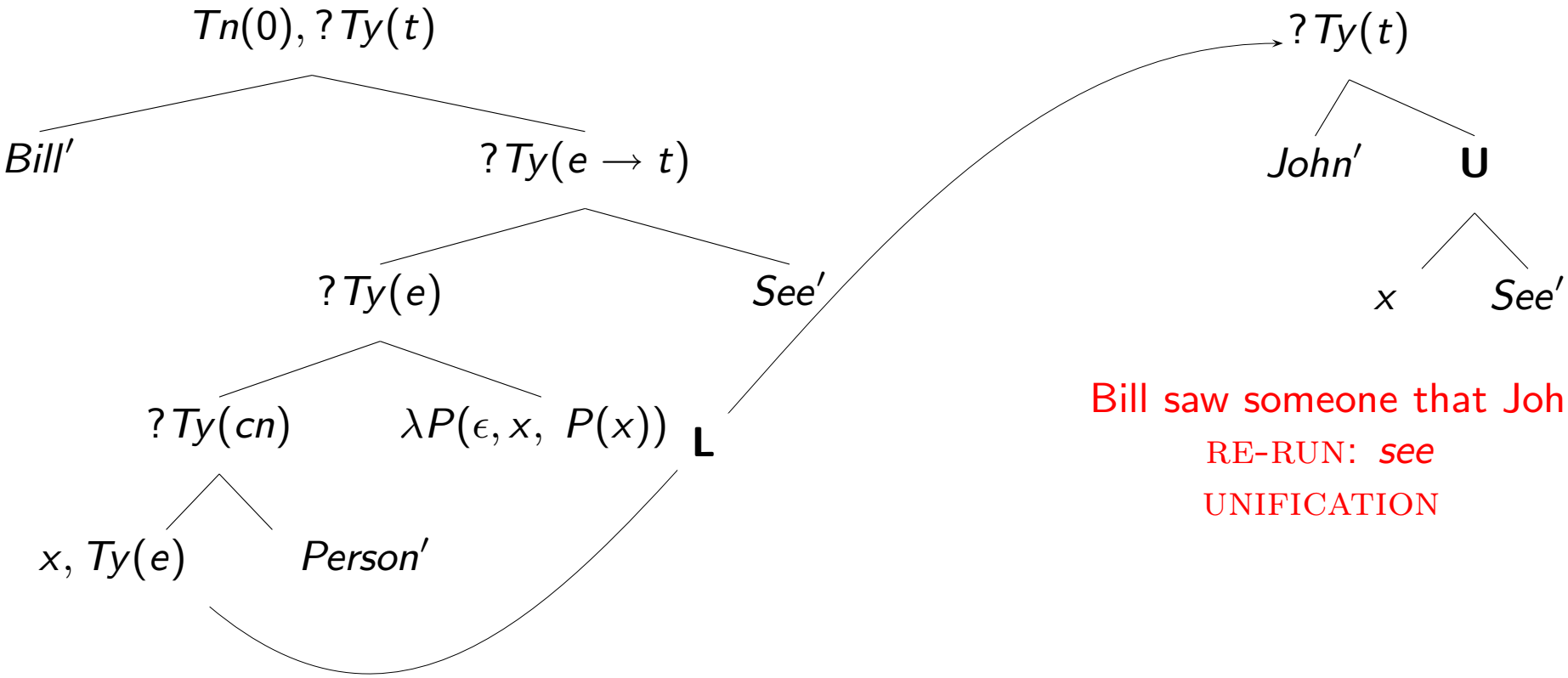

Bill saw someone that John did

RE-RUN: *see*

UNIFICATION

Ellipsis & Syntactic constraints – ACE

- Antecedent-contained ellipsis constraints emerge from encoded incremental growth

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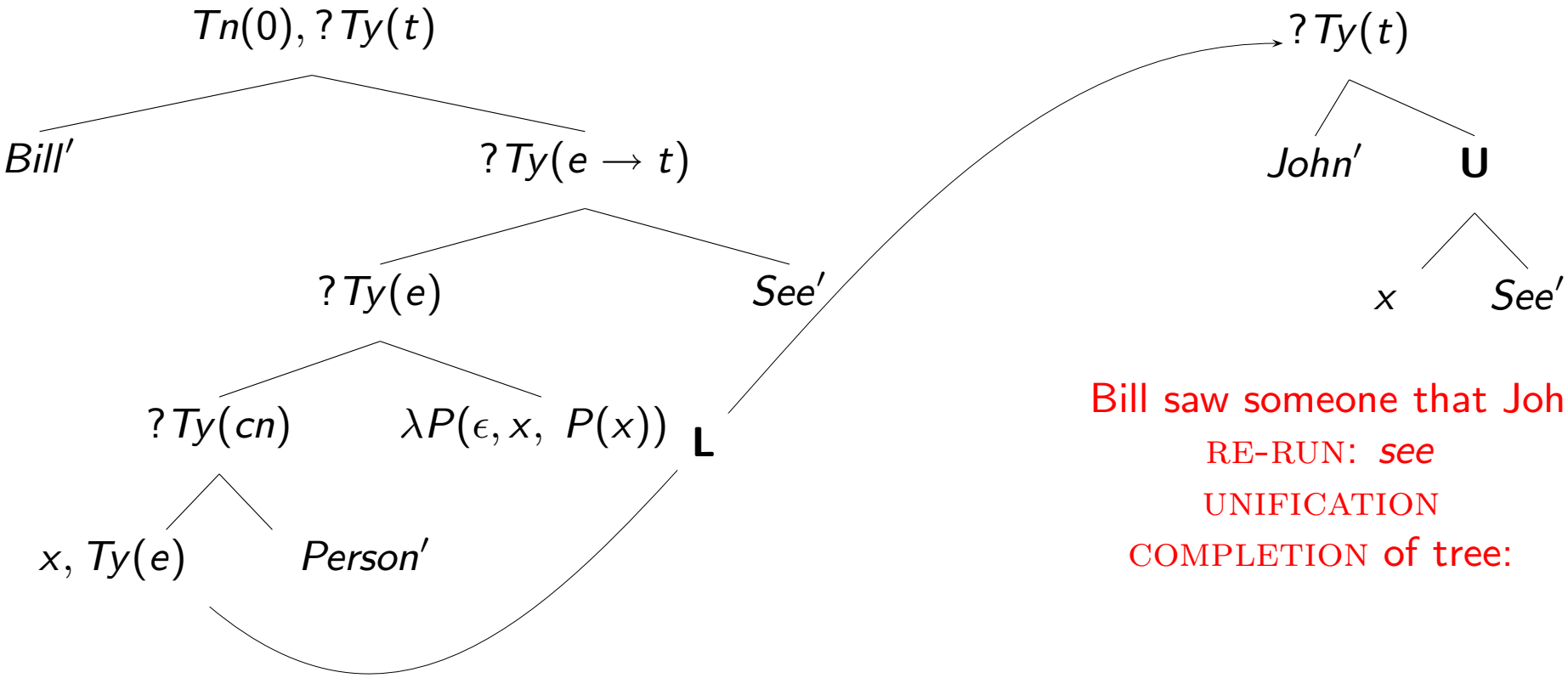


Bill saw someone that John did

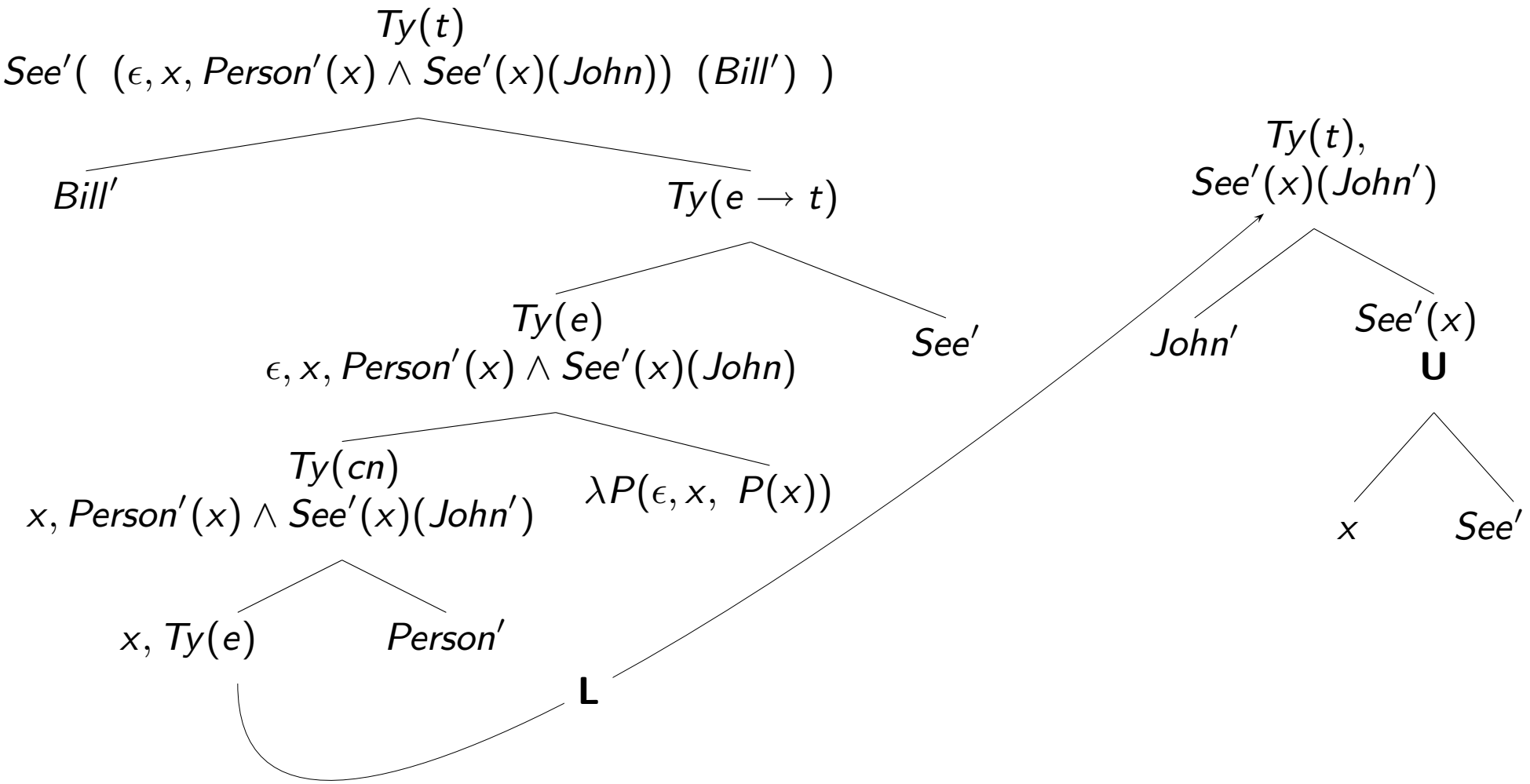
RE-RUN: *see*

UNIFICATION

COMPLETION of tree:

ACE update in main tree

(41) Bill saw someone that John did

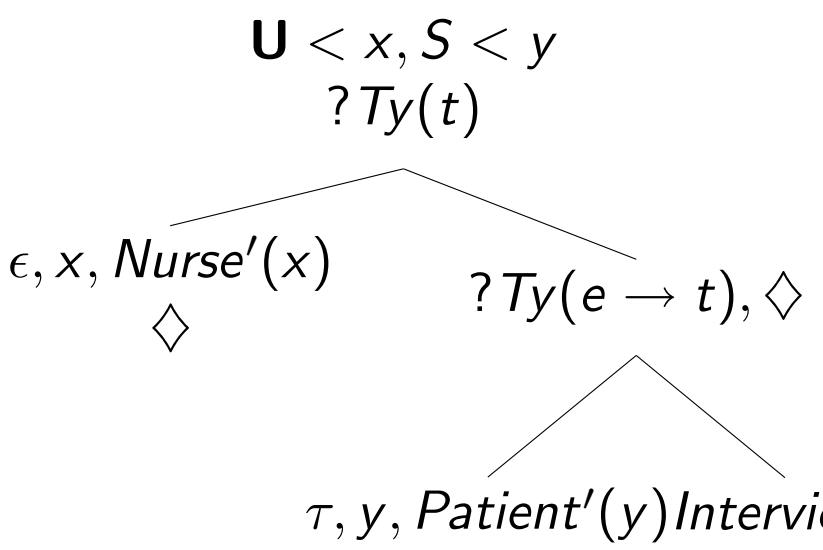


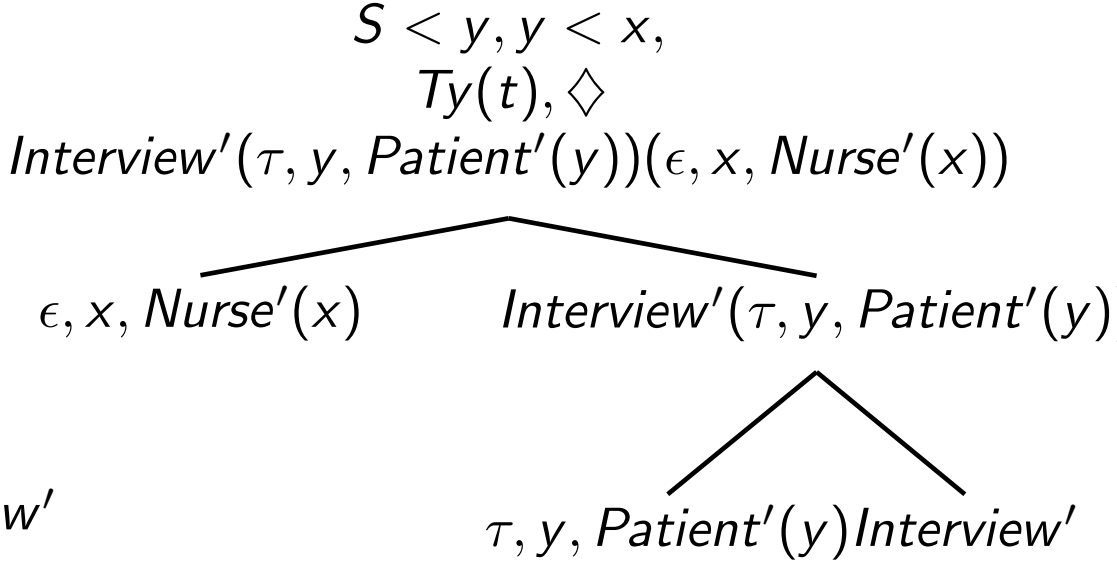
Parallelism effects of scope construal

Repeating actions of construal from immediate context including late selection for indefinite scope

(42) A nurse interviewed every patient. And a consultant.

Late fixing of scope construal for first sentence:





Construal of fragment involves re-use of these actions from parsing of subject on, including fixing of scope dependency

Dynamic Syntax: split utterances as a consequence

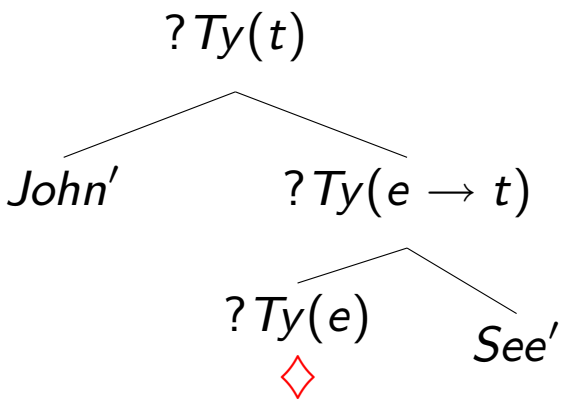
* Grammar: a set of procedures for real-time processing in context
* Underspecification-plus-enrichment as part of the procedures
* Production in Dynamic Syntax explained in terms of the same mechanisms as parsing but with an extra filter (subsumption of some richer "goal" tree)
* Generation and parsing equally context-dependent

Split utterances

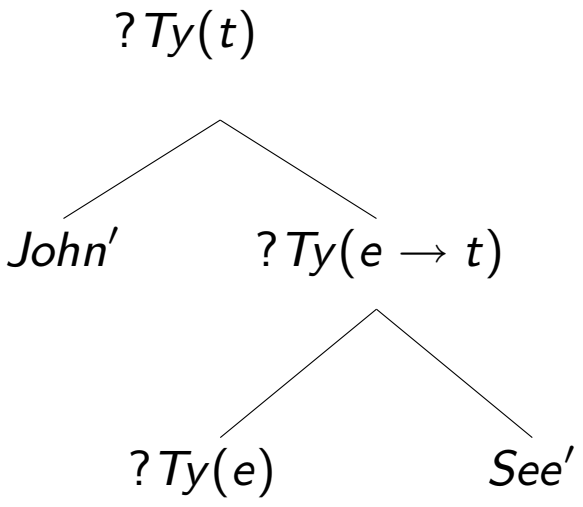
- Partial tree as context/input for speaker and hearer

(43) A: John saw ...
B: Bill.

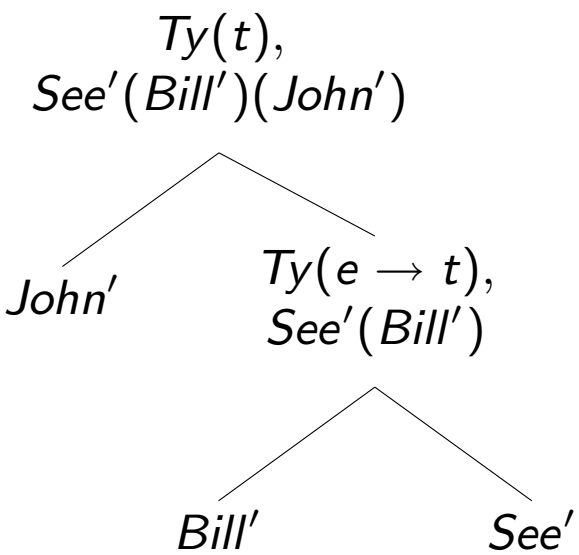
CONTEXT:



TEST/PARSE TREE:



GOAL TREE:



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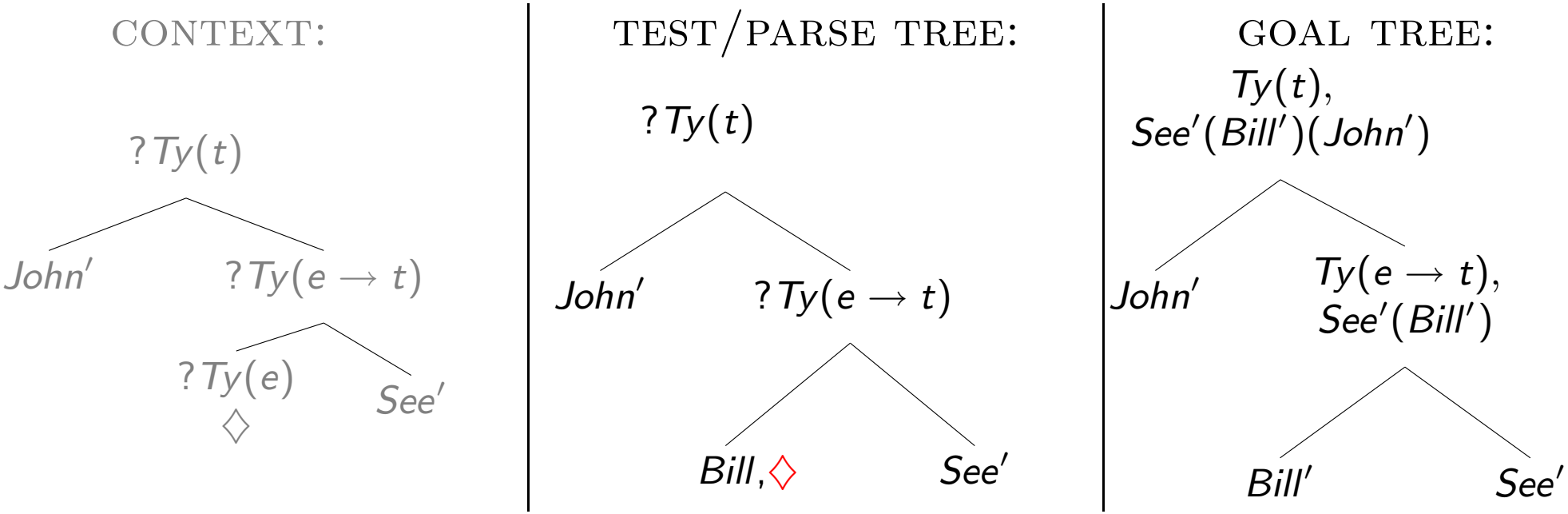
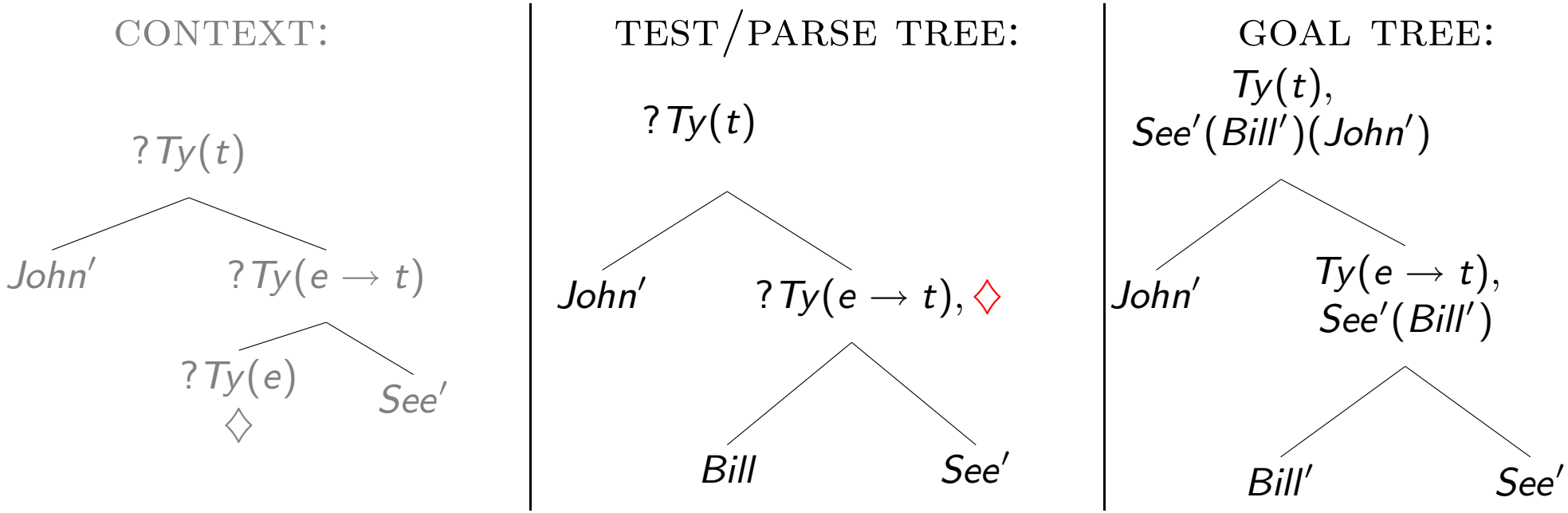


* Testing and producing *Bill*

Split utterances

- Partial tree as context/input for speaker and hearer

(43) A: John saw ...
B: Bill.



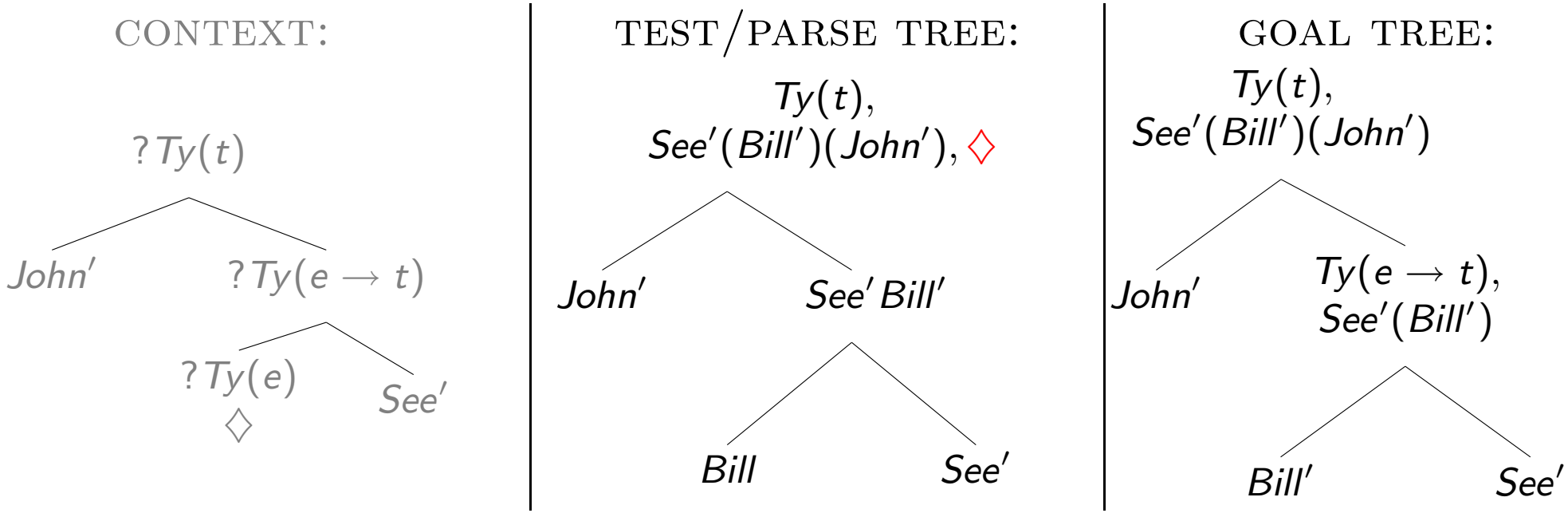
* Testing and producing *Bill*

* Pointer movement

Split utterances

- Partial tree as context/input for speaker and hearer

(43) A: John saw ...
B: Bill.



* Testing and producing *Bill*

* Pointer movement

* Completion

Split-utterance construal not string-based I

(44) Michael: Did you burn
Ruth: myself? No.

Michael/Ruth Context:

- *Did you burn*

$\longmapsto$

$?Ty(t), Q$

$\cancel{?Ty(e)}$, $Ty(e)$,
$\cancel{\mathbf{U}}$, $\cancel{?\exists \mathbf{x} Fo(\mathbf{x})}$, $Ruth'$

$?Ty(e \rightarrow t)$

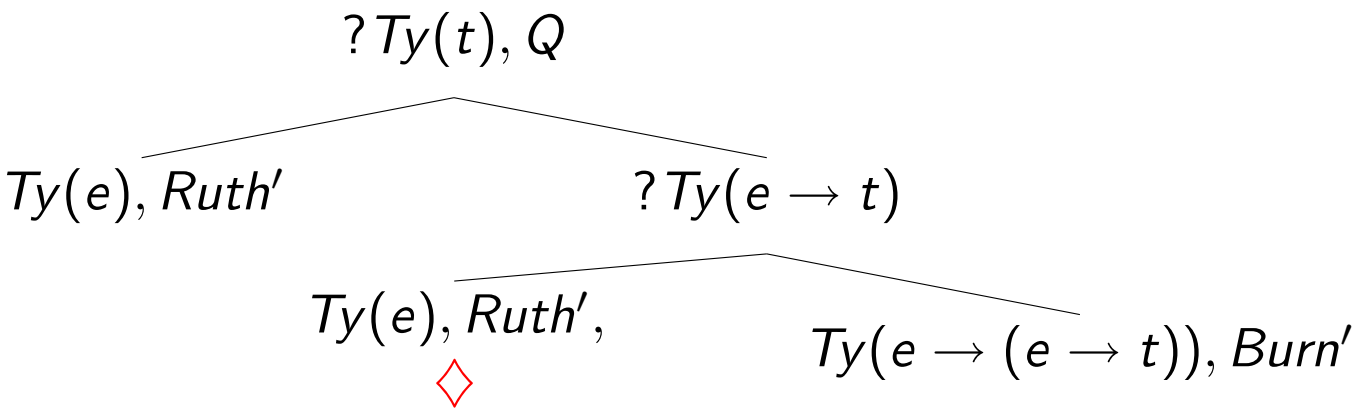
$?Ty(e), \Diamond$

$Ty(e \rightarrow (e \rightarrow t)), Burn'$

Split-utterance construal not string-based II

Ruth: myself?

- $\overset{\textit{myself}}{\longmapsto}$



- *myself*

IF	$\textsc{co-argument}(x) \wedge \textit{Speaker}'(x)$
THEN	$\texttt{Substitute}(\mathbf{U}, x)$
ELSE	ABORT

Interruptive clarification requests

The challenge of interruptive fragments, e.g. clarifications, without proposition yet available, modelled as cross-party apposition on the definite NP as an anaphoric expression:

(45) A: The doctor

B: Chorlton?

A: mmhm he examined me .....

B's processing: *The doctor*

B's Parse Tree:

The doctor $\longmapsto$

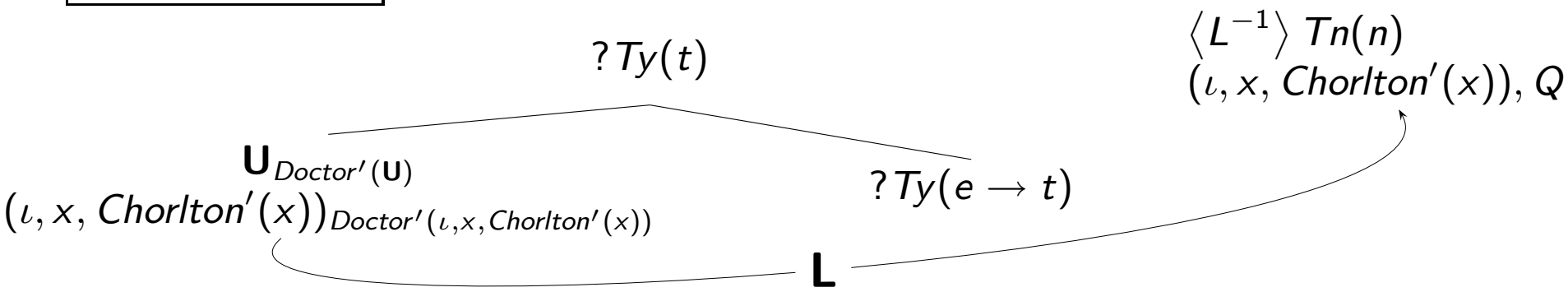
$?Ty(t)$

$\mathbf{U}_{Doctor'(\mathbf{U})}$
$?\exists x Fo(x), \Diamond$

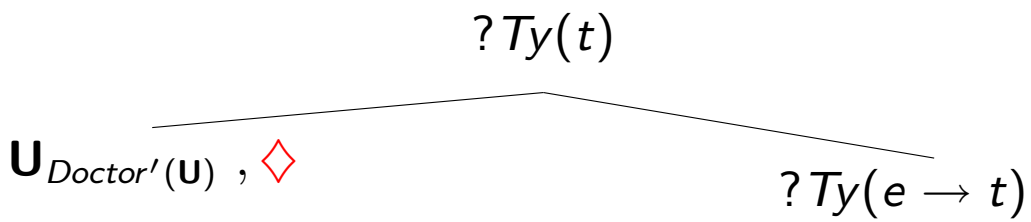
$?Ty(e \rightarrow t)$

Interruptions for clarification: A: The doctor B: Chorlton?

B's GOAL TREE:



B's TEST TREE for *Chorlton*:



Interruptions for clarification: A: The doctor B: Chorlton?

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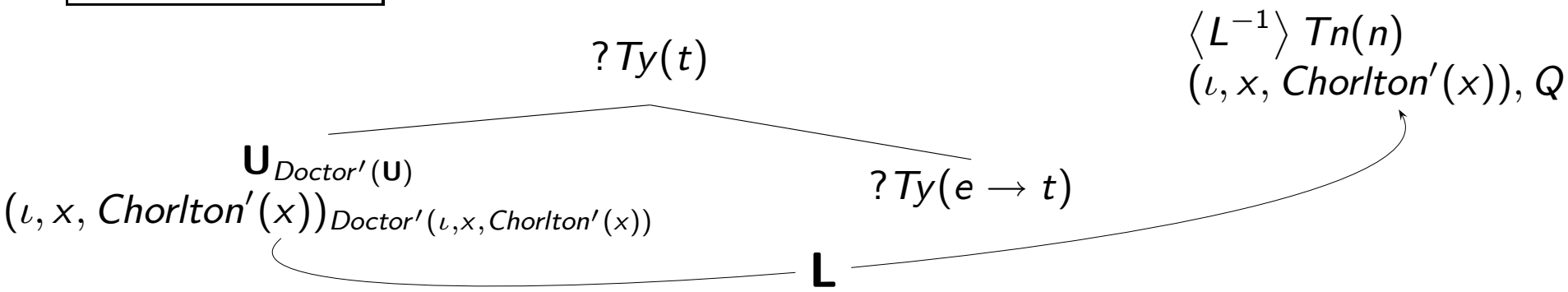

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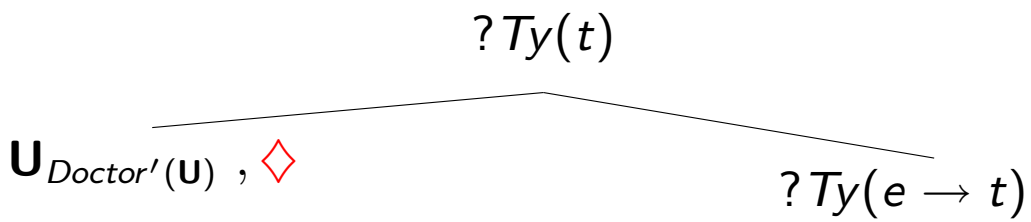
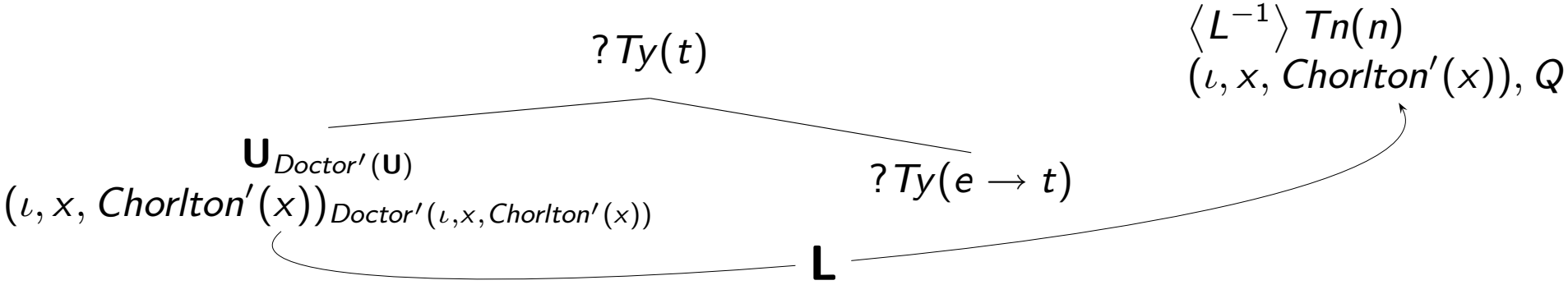


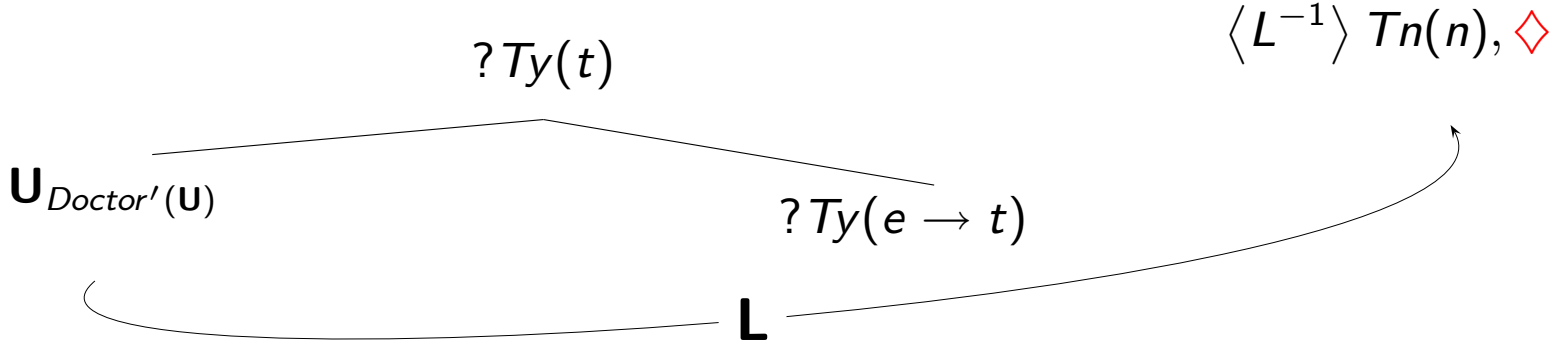
Having parsed *the doctor*

Interruptions for clarification: A: The doctor B: Chorlton?

B's GOAL TREE:



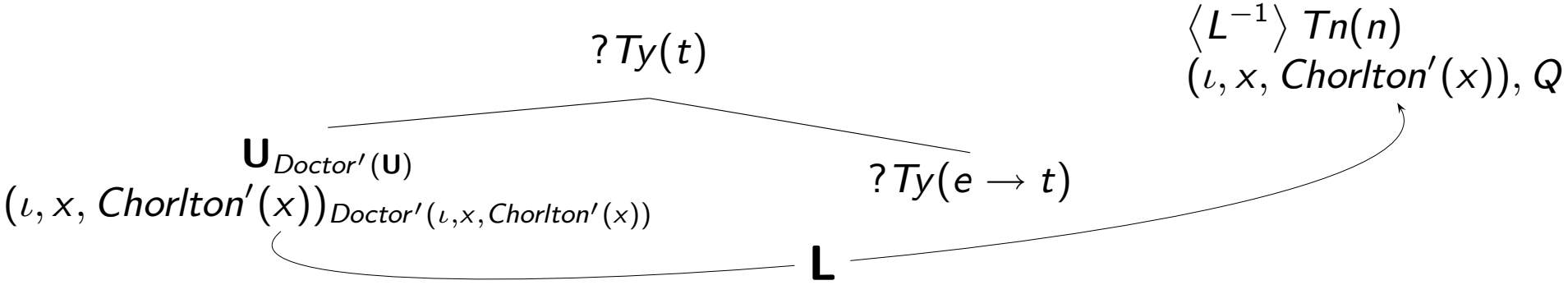
B's TEST TREE for *Chorlton*:



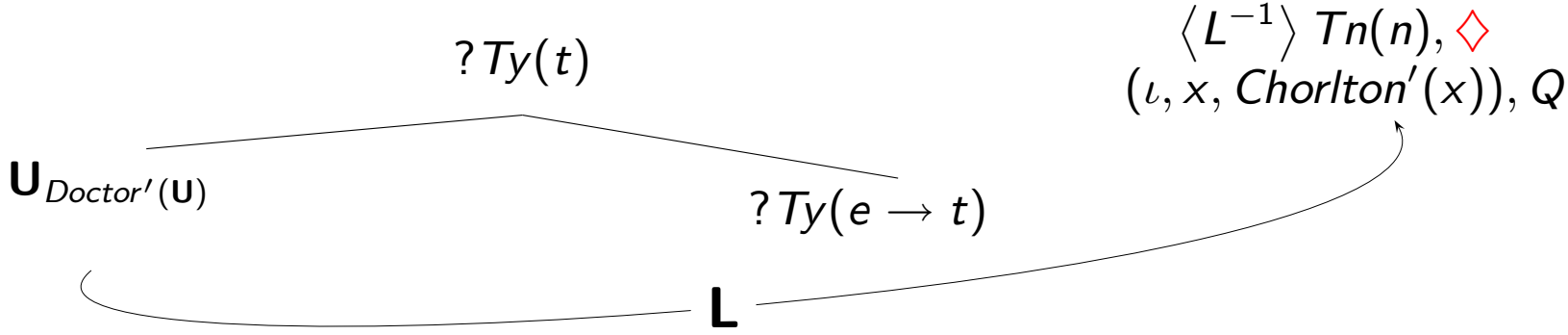
LINK-ADJUNCTION

Interruptions for clarification: A: The doctor B: Chorlton?

B's GOAL TREE:



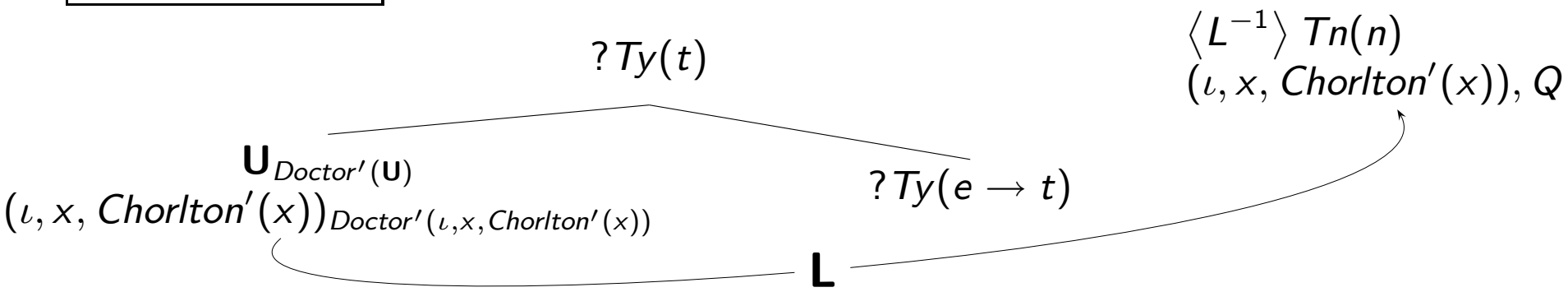
B's TEST TREE for *Chorlton*:



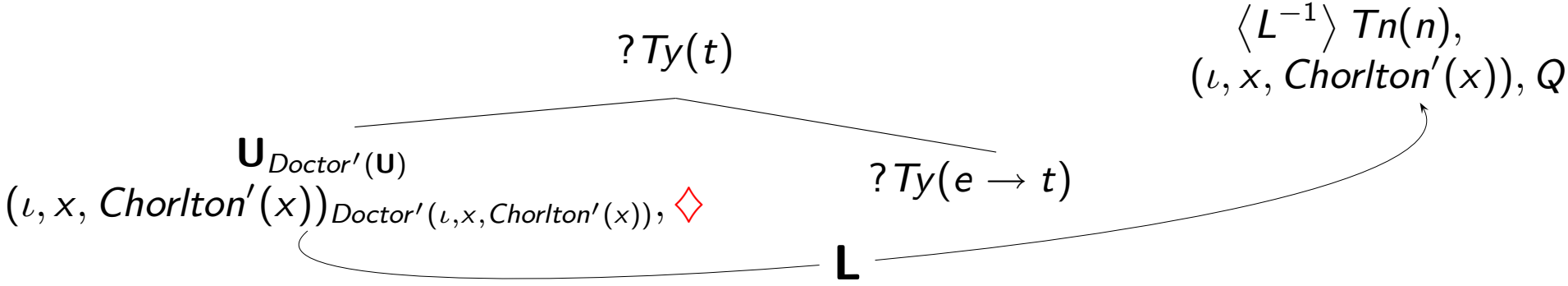
Parsing: *Chorlton?*

Interruptions for clarification: A: The doctor B: Chorlton?

B's GOAL TREE:



B's TEST TREE for *Chorlton*:



LINK-EVALUATION

Interruptions for clarification: A: The doctor B: Chorlton?

B's GOAL TREE:

$?Ty(t)$

$\langle L^{-1} \rangle Tn(n)$
$(\iota, x, Chorlton'(x)), Q$

$\mathbf{U}_{Doctor'(\mathbf{U})}$
$(\iota, x, Chorlton'(x))_{Doctor'(\iota, x, Chorlton'(x))}$

$?Ty(e \rightarrow t)$

$\mathbf{L}$

B's PARSE TREE:

$?Ty(t)$

$\langle L^{-1} \rangle Tn(n),$
$(\iota, x, Chorlton'(x)), Q$

$\mathbf{U}_{Doctor'(\mathbf{U})}$
$(\iota, x, Chorlton'(x))_{Doctor'(\iota, x, Chorlton'(x))}$

$?Ty(e \rightarrow t), \Diamond$

$\mathbf{L}$

pointer movement

Fragments as interruptions

- partiality of goal trees benefits both interlocutors in dialogue:
  - incrementality in production (Levelt 1989)
  - "speakers recraft their utterances mid-stream, taking into account the responses, or more often the lack of them, from recipients . . . As a result, what is produced is actually a joint production, which can hardly correspond to the speaker's own initial intention or goal." (Goodwin 1979; 1981)

  speakers can start out with only partial thought in mind

  speakers can intervene with some partial contribution to this emergent structure, incremental clarifications removing ambiguity
- Joint construction of turns emerging as the product of a dynamic process of interaction grounded on parsing/production interdependence
- Interactive exchange can constitute success in communication
- role of mutual knowledge/common ground computation minimised

Ellipsis: a unitary account

- With context as reflecting terms (content), structure and actions
- The account of ellipsis reflects directly the folk intuition
- Ellipsis parallels anaphora as intrinsically context-dependent
- Heterogeneity of resulting content captured
- Syntactic restrictions on ellipsis types expressible through tree growth dynamics
- Essentially not string-based.
- Essentially incremental.
- Its effectiveness in dialogue ensured through economy and incremental applicability

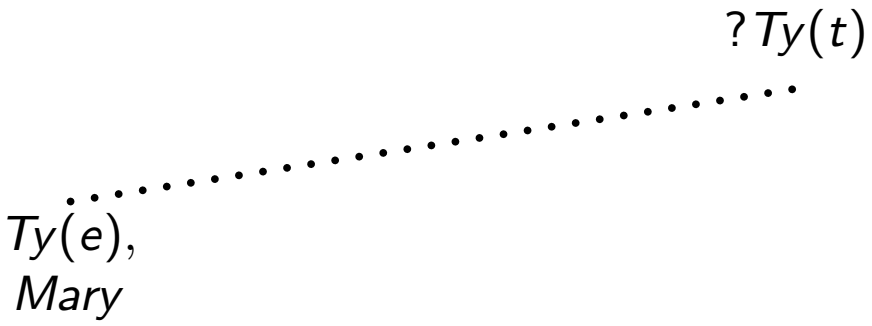
Extensions: tense as event term restrictor

- Constructing event terms, with tense as specifying restrictor

  All predicates gain an event term, with restrictor derived from tense/aspect/mood markers and aktionsart of main predicate (Cann fcmg):

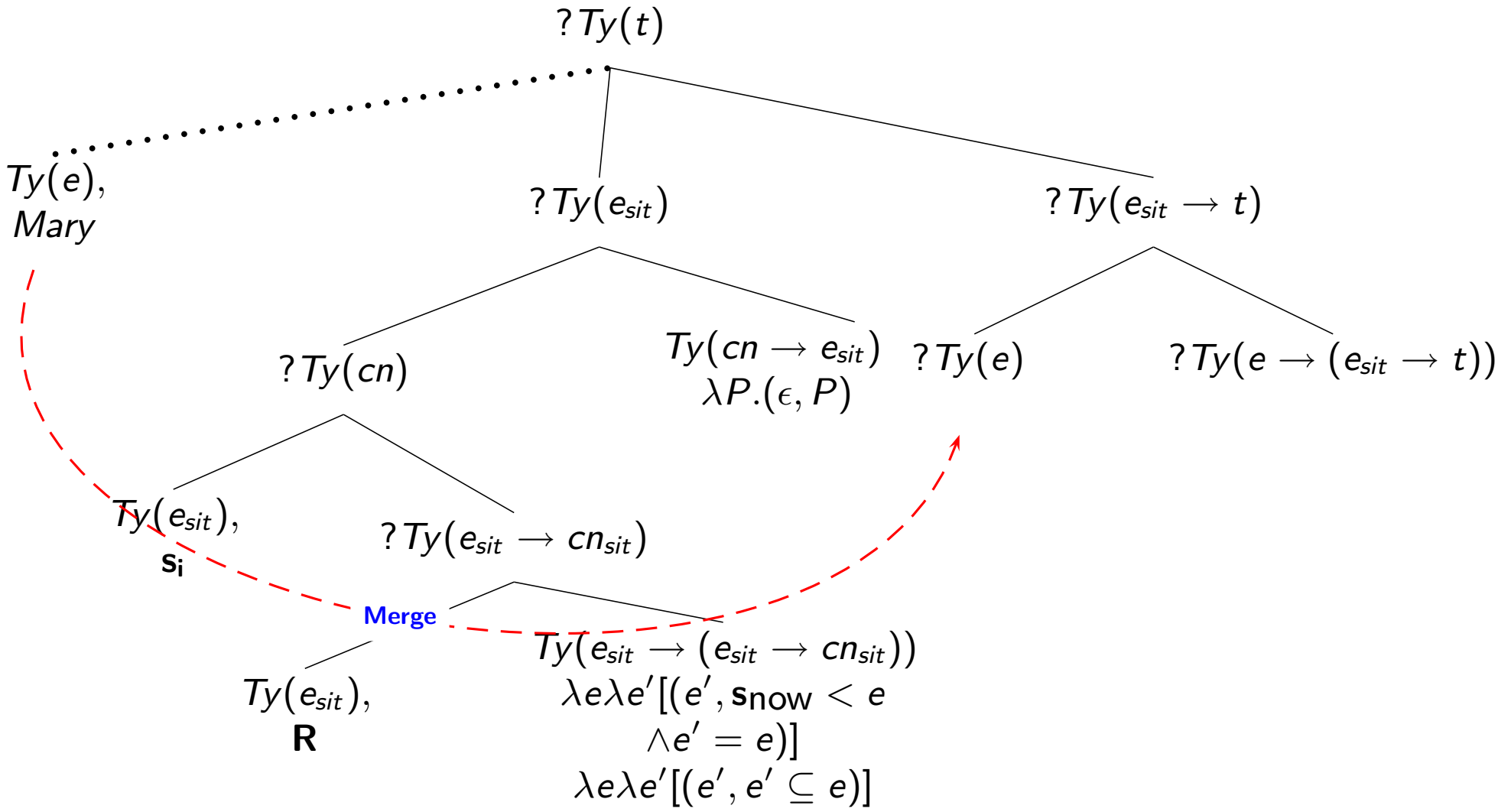
Extensions: tense as event term restrictor

(46) Parsing *Mary*



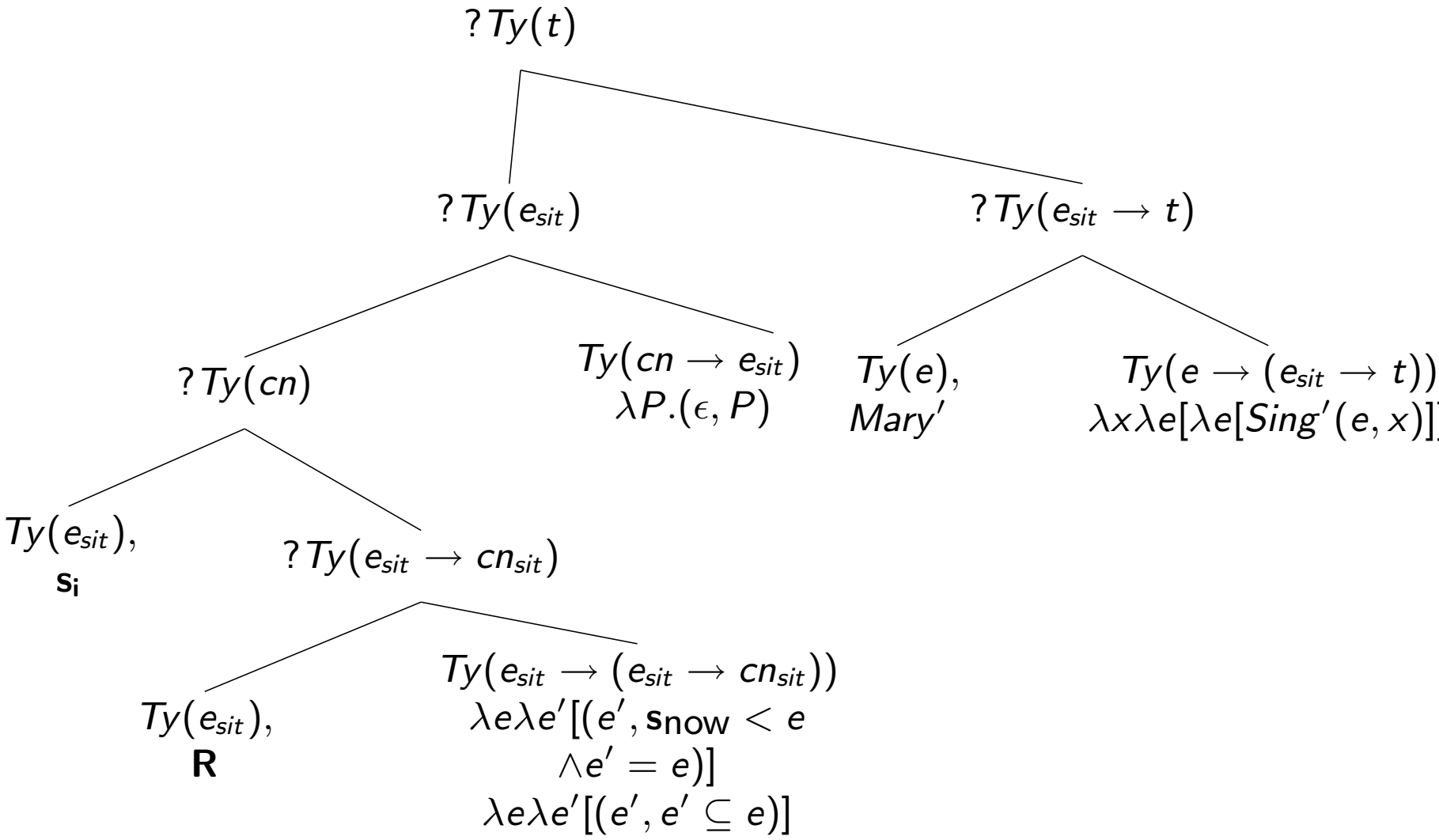
Extensions: tense as event term restrictor

(46) Parsing *Mary will*



Extensions: tense as event term restrictor

(46) Parsing *Mary will sing*



Extensions: Adjuncts as extensions to (event) term restrictors

- Adjuncts as appositional restrictors on (event or argument) terms (or terms contained within them).

(47) Yesterday, John watched birds
(48) Yesterday, all afternoon, John watched birds
(49) Yesterday, all afternoon, John watched birds, with his grandson.
(50) In a fluster, John ignored Mary
(51) In a fluster, John, with his grandson, ignored Mary.
(52) John ignored Mary in a fluster, with his grandson.

Extensions

- Plurals as terms denoting groups: articulation of subgroups as part of restrictor specification

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- *with rice* a conjoined LINK structure on *beans* (comitative *with* interpreted as conjunction, cf. Swahili, etc. , yielding group denoting term as subject of *go well (together)*: $(\epsilon, z, Group(z) \wedge (\epsilon, y,^{*} Bean'(y)) \leq z \wedge (\epsilon, x,^{m} Rice'(x)) \leq z)$

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- *balanced protein* interpreted as appositional on conjoined term:
  $(\epsilon, z, Group(z) \wedge (\epsilon, y,^{*} Bean'(y)) \leq z \wedge (\epsilon, x,^{m} Rice'(x)) \leq z \wedge Balanced\text{-}Protein'(z))$

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  - *and all that* interpreted as appositionally LINKed to unfolding propositional tree inviting any (and all) inferences over antecedent of *that* (*beans and rice*)

- All terms able to induce 'ad-hoc' concepts built incrementally

Outline

NL Grammar as mechanisms for constructing thought representations

Syntax

- meta-level constraints on tree growth, defined over partial trees
- two basic types reflecting two basic capacities:
  e for individuation, t for inference

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Quantification

- procedures for term construction
  - structural growth of restrictor specifications
  - resulting terms reflect containing structure (ad-hoc concepts)

What is Context?

- Evolving record of terms/structures/process
- Hence not only record of structures but also

  record of growth of structures

  as established by an individual
- Providing value for expressions assigned as part of construction algorithm (Kamp 1981, Recanati 2002)

  with no necessary mind-reading

Consequences for grammar/pragmatics interface

- Incrementality, predictivity and partiality in parsing/production minimises need for "guessing" speaker intentions in modelling split utterances
- role of mutual knowledge/common ground computation minimised contra all current pragmatic theories Grice, Kent Bach, Levinson, Asher and Lascarides, Sperber and Wilson
- but success in communication will rely on INCREMENTAL correction/clarification and sequential structure of dialogue (Arundale 2008)

NL Compositionality

- Two discrete concepts of compositionality
- Word by word incrementality
  - incremental and monotonic growth of partial trees reflecting growth of information content within any one derivation

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- strict compositionality of resultant structure
  - representations of thought structured by type theory and lambda calculus
- these LFs are the only level of structure induced by the grammar

Outline

On context and compositionality

- Shifting to a metalevel account of NL meaning
  - Denotational content not attributable directly to NL strings but established via construction process (and inference)
  - "Meaning" of an expression within NL system is its contribution to process of building representations of content
  - Structure defined over strings of words is epiphenomenal
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  - Structure defined over strings of words is epiphenomenal
  - Sentence meanings as truth conditions also epiphenomenal
- a radical contextualist view (Recanati 2002, 2009)?
  - context-sensitivity permeates even grammar mechanisms
  - Value assigned to metavariables identified from individual's own cognitive context
  - no necessary mind-reading
  - ad-hoc concept mechanism made available by grammar
  - grasping content of speaker's intentions not a pre-requisite

An essentially representationalist view

* No mapping onto denotations defined by grammar
* LOT assumed but not Fodorian (concepts, no encapsulation, not domain-specific)
* LOT level identified as the only structural level of the grammar
* structure as inhabited by words replaced by syntax as mechanisms for incrementally building LOT structure
* no multi-level representationalism
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- and not inferentialist (Brandom 1994)?
  * Lexical macros acquired through shared practices but routinisation involves individual's own use and re-use
  * Computational actions are what we do in real-time processing, not normative or reducible to social practices
  * Individuation is a pre-requisite for individual-agent processing: sub-propositional incrementality means mechanisms not reducible to inferential justification

Grammars reflecting processing AS linguistic knowledge

- Constraint-based grammars as mechanisms for utterance processing reflecting incrementality of parsing and production (cp categorial grammars: eg Steedman 1996, 2000) Hawkins 1994, 2004, Kempson et al 2001
- *Language is a tool-box for constructing formal languages*, a system with semantic flexibility in perpetual flux: Cooper and Ranta 2008, Larsson 2008
- Grammar as mechanisms for (conversational) interaction: underspecification and incrementality built directly into the syntax

  Gregoromichelaki et al 2009, contra Stanley and Williamson 2001

Looking ahead: Acquisition, Change, and Evolution?

- Structural/naming mechanisms evolved for interaction with external world :
  - lack of domain-specificity (phonology apart?) Clark & Lappin 2010
  - Underspecification/update determine flexible response
  - individuation essential to effective action Hurford 2007
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- Lexicon (what the child acquires) evolved through interaction with others in a shared practice:
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