Ad hoc grammatical categorisation in DS-TTR

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March 26, 2017

Structure of the talk

- What is the nature of **grammar**: the view from DS-TTR
  - no separate syntactic level of representation:
    - no syntactic categories for strings of words;
    - no phrase-structure rules;
    - no constructions
  - grammatical ontology of processes (rather than *representations*)
    - incrementality and underspecification as properties of grammar ("syntax")

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    - Quotation mechanisms and dialogue: Ginzburg & Cooper 2014
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    - Quotation mechanisms and dialogue: Ginzburg & Cooper 2014
    - Quotation and incrementality: DS-TTR
- Conclusion

Outline

underspecification in NL

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  - one subset of such phenomena traditionally known as *polysemy*
  - further phenomena known as *metaphor*, *metonymy* etc.
  - anaphora, ellipsis (bifurcated as "grammaticalised" vs "pragmatic/discourse"):

    (3) a. John likes himself vs. *him

    b. John likes everyone [Mary does] vs.
    *John likes everyone [Mary admires the man [who does]]

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  - syntactic structures/categories and combinatorial rules are abstractions due to the fact that strings of words can receive/induce variable specific interpretations
  - various "syntactic" phenomena explained as temporary structural underspecification

    (2) Who did you see?

underspecification in NL: quotation

- surface syntactic elements can receive variable construals:

(1) He is unmanipulable.
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underspecification in NL: quotation

- surface syntactic elements can receive variable construals:

(1) He is unmanipulable.
(2) 'Unmanipulable' is a word of English.
(3) He said "unmanipulable".
(4) He said, " 'A geometric method is presented to determine the unmanipulable singular configurations of a general class of mechanisms' is a sentence of English."
(5) He said that he was "unmanipulatitable" (as Donald would say).

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  - modify, delete, add fields while the rest stay the same (cf. modulation, Recanati)
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- model frequency and context effects as probabilistic type assignments

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- **record types** are sequences of label/type pairs:

$$\begin{bmatrix} l_1 & : & T_1 \\ l_2 & : & T_2 \\ l_3 & : & T_3 \end{bmatrix}$$

TTR: expressivity

- types can be **dependent** on earlier (higher-up) types:

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- **recursivity**: we can have *nested* records and record types:

$$\begin{bmatrix} l_1 & : & T_1 \\ l_2 & : & \begin{bmatrix} l_1' & : & T_1' \\ l_2' & : & T_2' \end{bmatrix} \\ l_3 & : & T_3(l_1, l_2.l_1', l_2.l_2') \end{bmatrix}$$

TTR: expressivity

- We can have **functional** record types:

$$\lambda \; r : \begin{bmatrix} l_1 & : & T_1 \\ l_2 & : & T_2 \end{bmatrix} \left(\begin{bmatrix} l_3 & : & T_3 \\ l_4 & : & T_4(r.l_1, r.l_2) \end{bmatrix} \right)$$

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- **parenthetical** insertion
  - does not respect constituency, even as flexible as defined by CCG:

(7) Hi, and welcome to New Books in Sociology, a podcast where we interview authors of interesting and influential books in the field of, you guessed it, sociology [New Books in Sociology podcast]

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- **split utterances**: any syntactic/semantic dependency can be split across change of turn:

(12) A: Oh, I am so sorry, did you burn
B: myself? No, its OK.

[*did you burn myself?]

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- combine TTR with Dynamic Sytax
- resulting architecture: DS-TTR

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- combine TTR with Dynamic Sytax
- resulting architecture: DS-TTR
- replace representational notions with processes/mechanisms: lexicon/syntax as procedures for ad hoc concept construction

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grammaticality

- degrees of grammaticality
- context-dependent grammaticality
- speakers adapt the language to new situations and domains, changing grammaticality judgements

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$\Rightarrow$(Cooper, 2015)

- A corpus of natural language data (even a single dialogue) not required to be consistent in terms of grammaticality or meaning since it represents output based on a collection of related grammars rather than a single grammar.

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- **comprehension**: active prediction and subsequent integration of the (linguistic) stimulus
- **production**: testing/monitoring parsing consequences of stimulus before production

grammar as action: implications

- (grammaticalised) goal-directedness is crucial (to drive predictions and reduce massive ambiguity)
- timing (incrementality) is crucial
- (syntactic/lexical) representations are "emergent" or "epiphenomenal"

$\Rightarrow$ **grammar**: a set of routinised domain-general predictive mechanisms for dynamic interaction with others and the environment

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$\Rightarrow$ **grammar**: a set of routinised domain-general predictive mechanisms for dynamic interaction with others and the environment

$\Rightarrow$ linguistic **words** (and other multimodal signals/cues): "affordances" to which interlocutors are "attuned"

underspecification

- to model context-dependency, mechanisms of underspecification and update are needed *in the grammar*

- (predicting and storing) underspecified constructs as the basis for modelling
  not only anaphora, ellipsis, multimodal contributions,
  but also syntactic phenomena, e.g. discontinuous dependencies

DS-TTR: parsing and generation

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John arrived $\longmapsto$

$$\Diamond, Ty(t), \left[\begin{array}{lcl} x & : & john' \\ p & : & arrive'(x) \end{array}\right]$$

$$Ty(e), \left[\begin{array}{lcl} x & : & john' \end{array}\right] \qquad Ty(e \rightarrow t), \lambda \left[\begin{array}{lcl} x & : & e \end{array}\right] . \left[\begin{array}{lcl} x & : & e \\ p & : & arrive'(x) \end{array}\right]$$

DS-TTR: actions

- building tree structure (syntactic/lexical):
  - go [treenode]
  - `make`[treenode]
  - `put`[field/value/label/...]
  - `IF` [value] `THEN` [actions], `ELSE` [...]

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- manipulating complex type articulation
  - add[fields]
  - remove[fields]
  - test[subtyping relation]
  - ...
- exploring the context:
  - freshput[variable/metavariable]
  - find[value/label/...],
  - substitute[values for metavariables]
  - ...

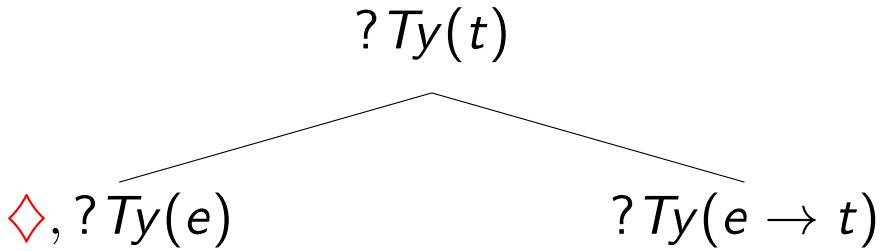
incremental construction

[START] ... PREDICTION $\longmapsto$

$\Diamond, ?Ty(t)$

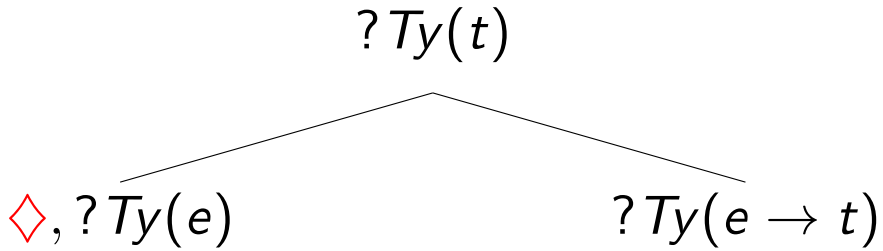
incremental construction

PREDICTION $\longmapsto$



incremental construction

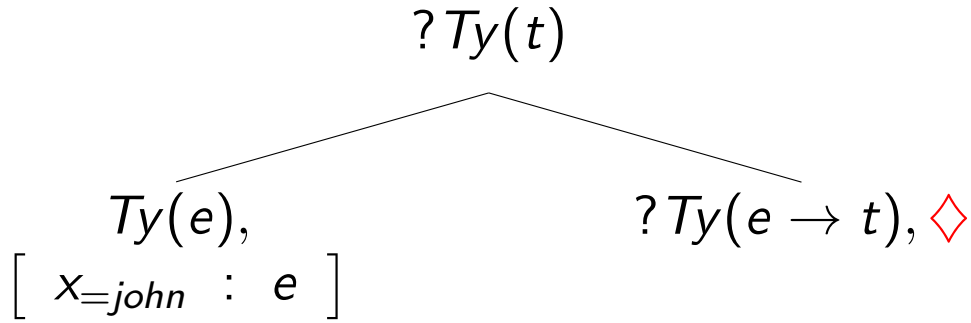
John $\longmapsto$



John	IF	?Ty(e)
	THEN	put(Ty(e))
		put([$x_{=john}$: e])
	ELSE	abort

incremental construction

John,...,POINTER-MOVEMENT $\longmapsto$



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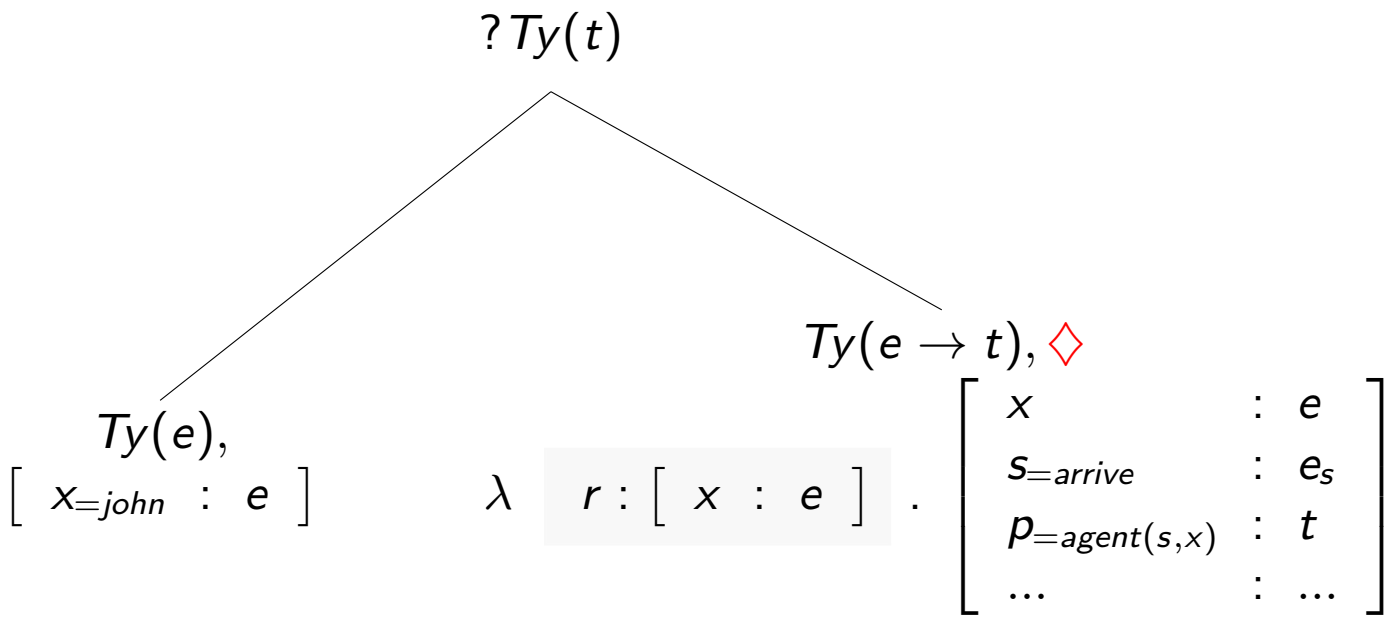
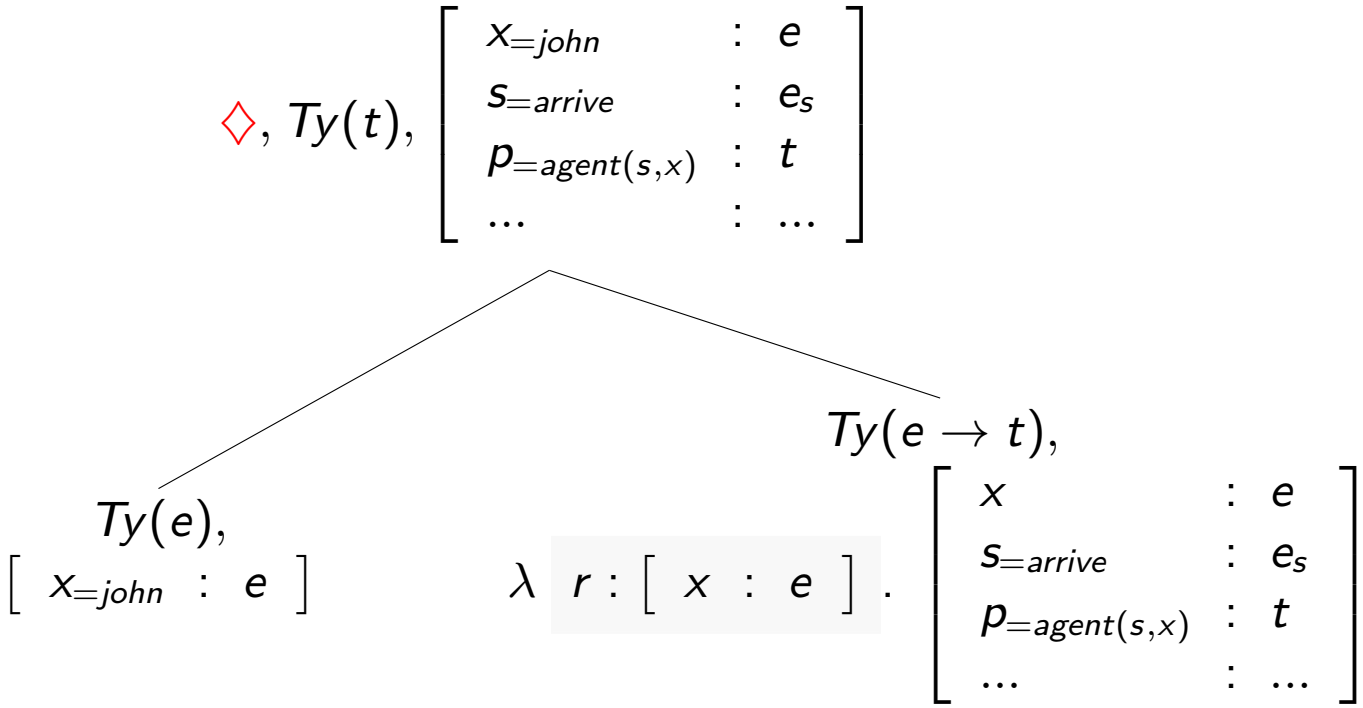
incremental construction

..., ..., *arrives* $\overrightarrow{}$



incremental construction

...[TENSE, ...], $\xrightarrow{}$ COMPLETION



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- Processing **non-contiguous dependencies**
  - e.g. 'Mary, John upset'

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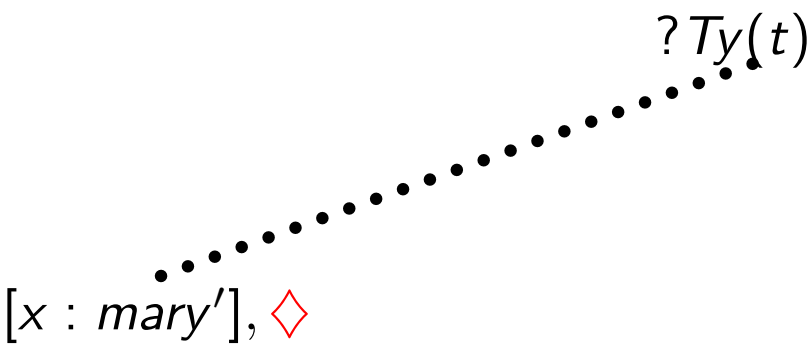

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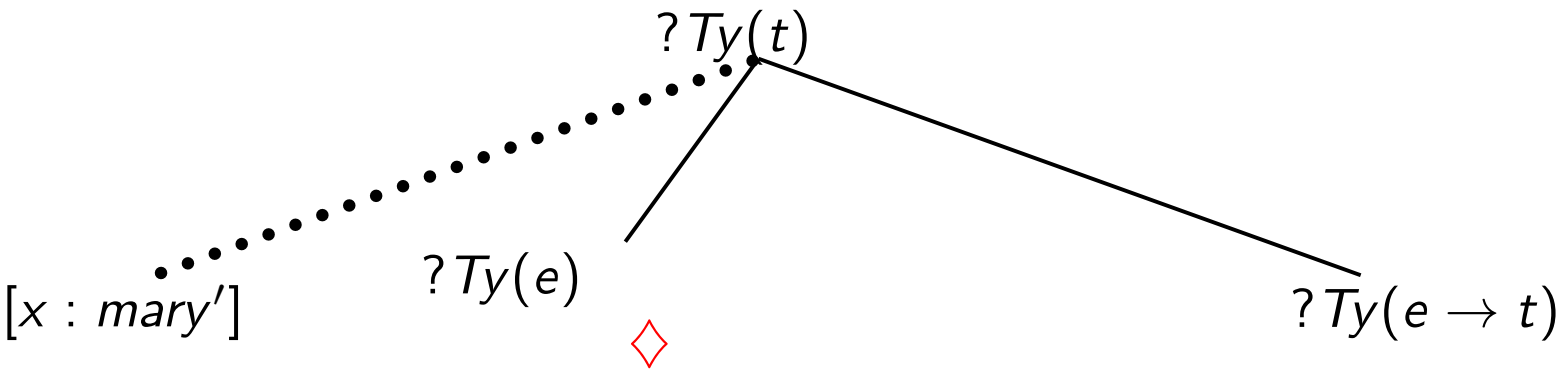

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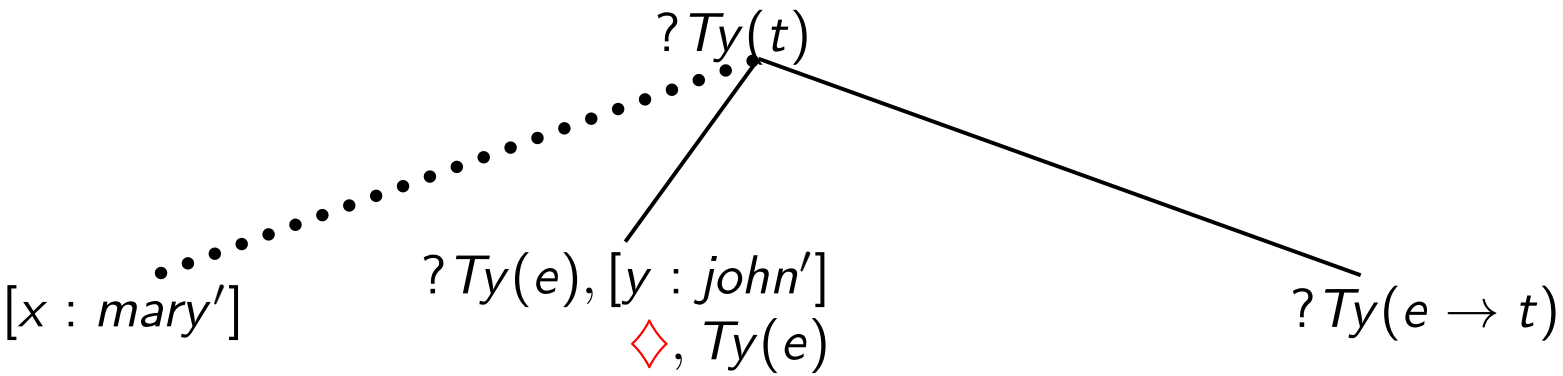

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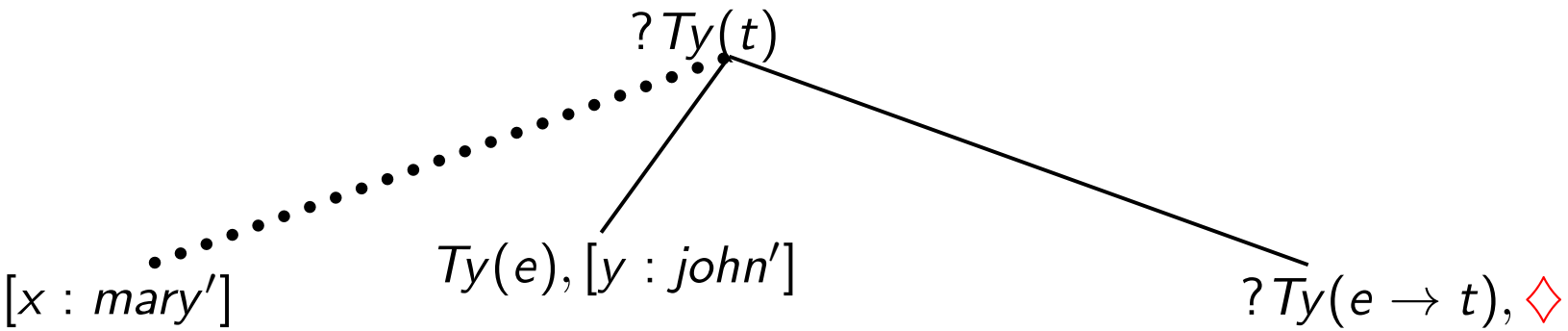

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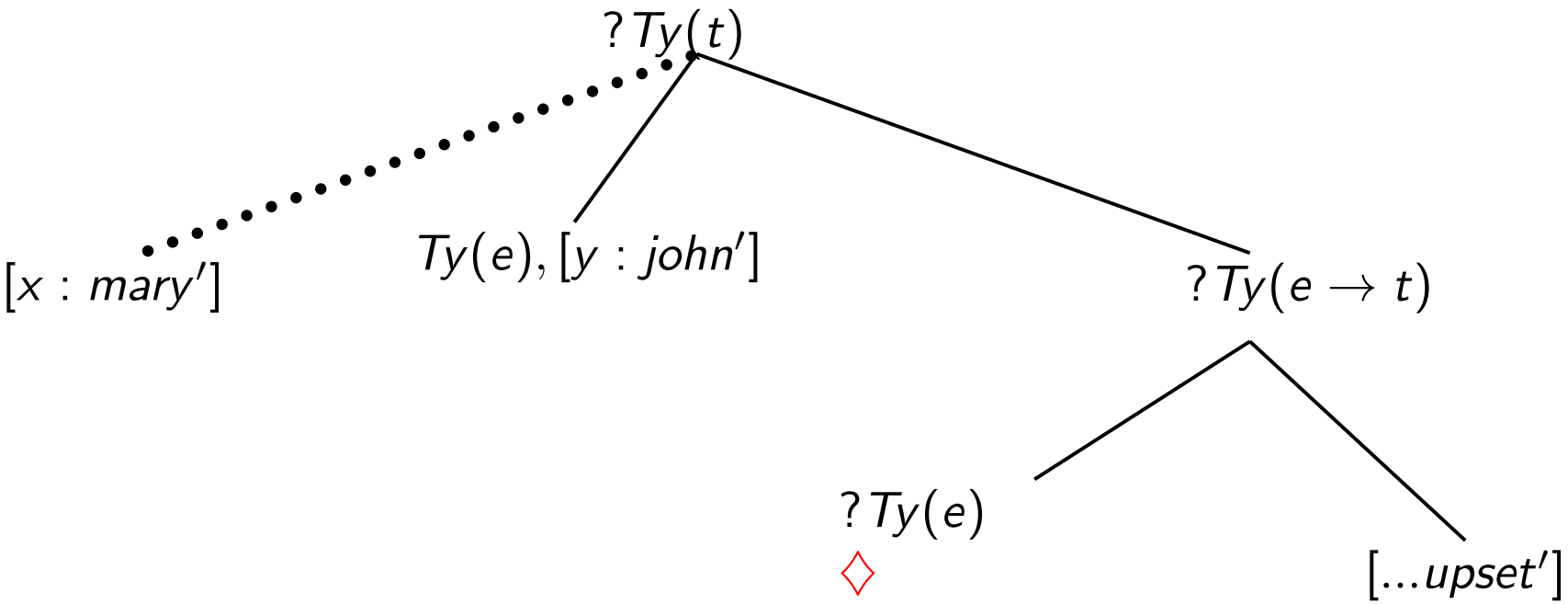

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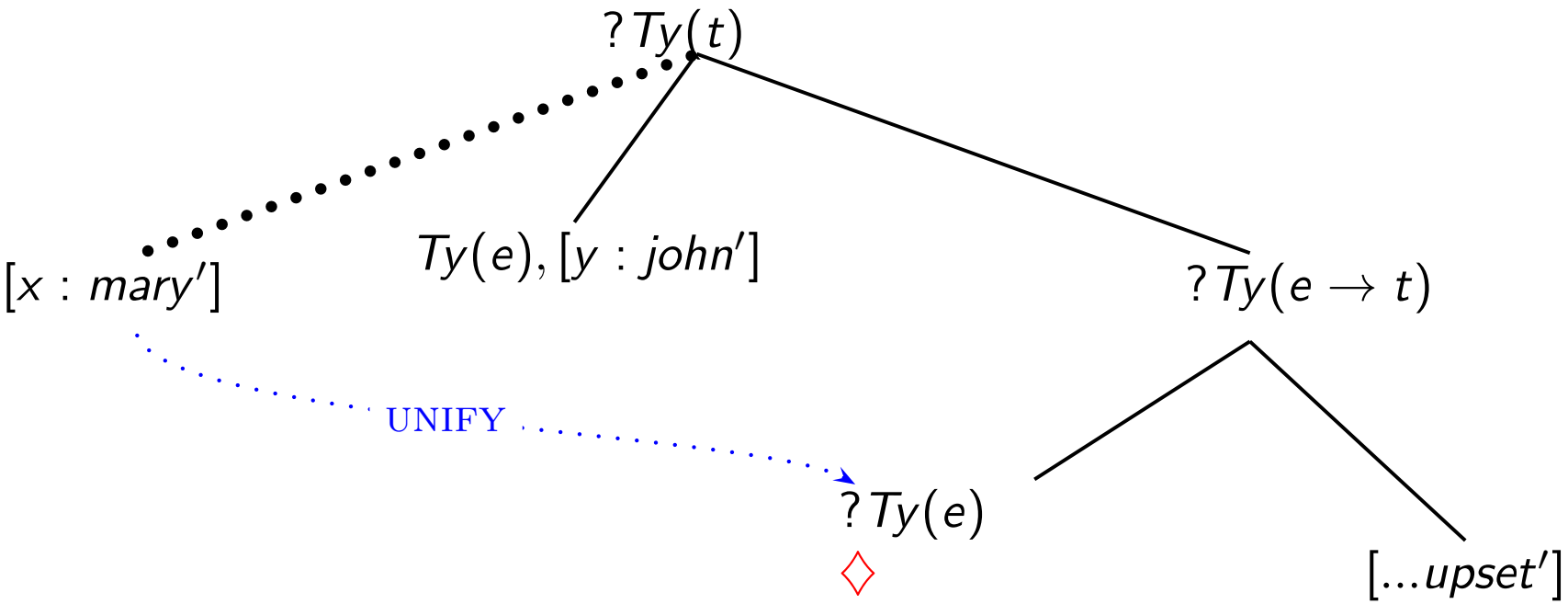

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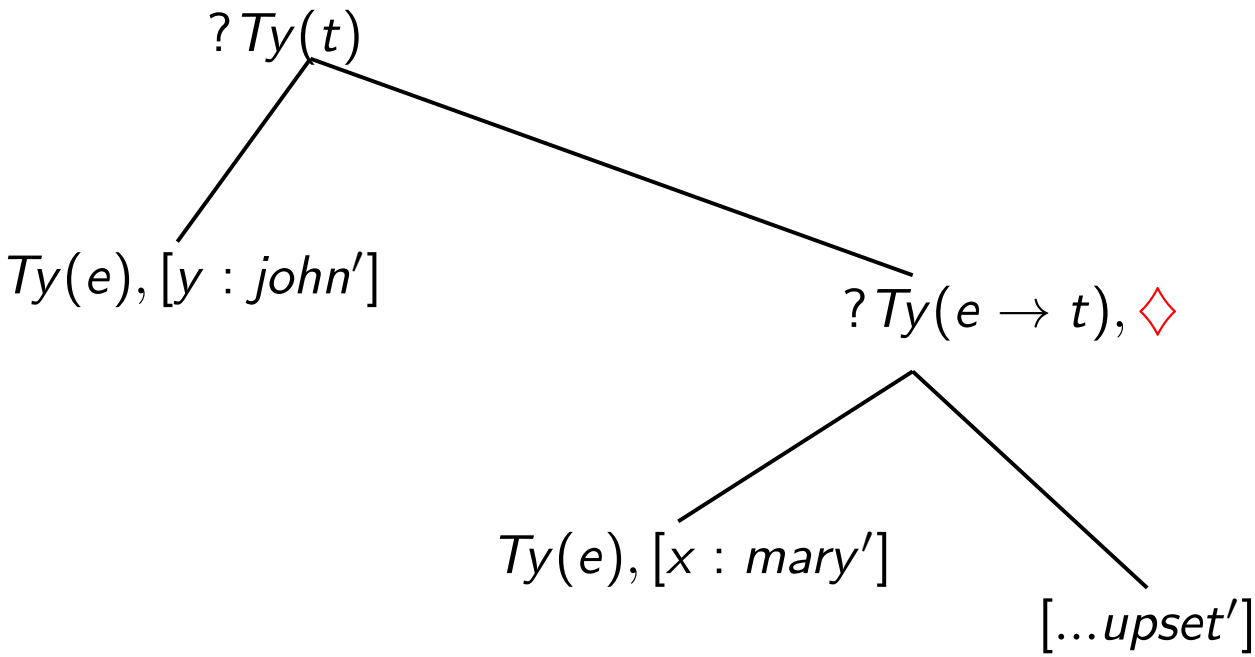

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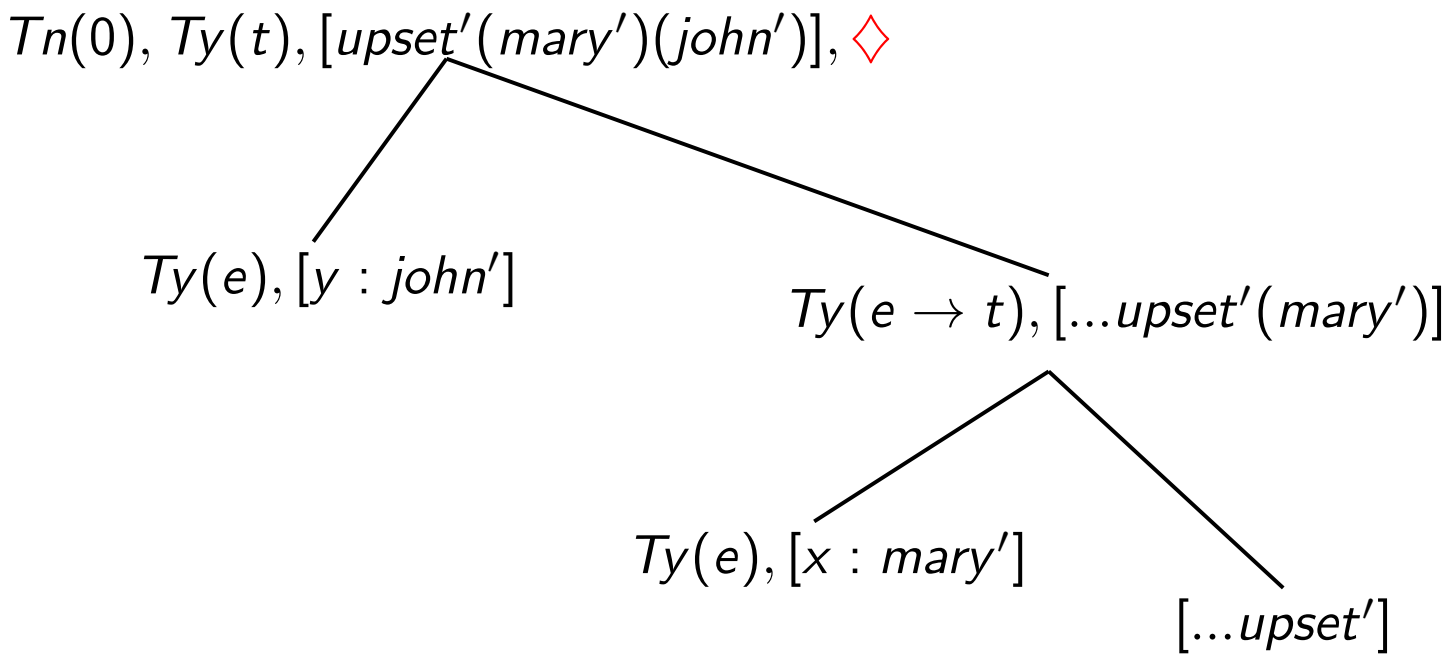

utterance micro-events

$$\Diamond,\ Ty(t),\ \begin{bmatrix} \text{CONTEXT} : u_1 \oplus u_2 \\ \text{CONTENT} : \begin{bmatrix} x : e \\ p : f(x) \end{bmatrix} \end{bmatrix}$$

$$Ty(e),\ \begin{bmatrix} \text{CONTEXT} : u_2 \\ \text{CONTENT} : \begin{bmatrix} x : e \end{bmatrix} \end{bmatrix}$$

$$Ty(e \rightarrow t),\ \begin{bmatrix} \text{CONTEXT} : u_1 \\ \text{CONTENT} : \lambda \begin{bmatrix} x : e \end{bmatrix} . \begin{bmatrix} x : e \\ p : f(x) \end{bmatrix} \end{bmatrix}$$

including contextual parameters

John arrived $\longmapsto$

$$\Diamond,\ Ty(t),\ \left[\begin{array}{ll} \text{CONTEXT}: & \left[\begin{array}{lll} a & : & participantA \\ b & : & participantB \\ \ldots & : & \ldots \\ u_1 & : & utt-event \\ s_{s1} & : & spkr(u_1, a) \\ s_{a1} & : & addr(u_1, b) \\ u_2 & : & utt-event \\ s_{s2} & : & spkr(u_2, a) \\ s_{a2} & : & addr(u_2, b) \\ \ldots & : & \ldots \end{array}\right] \\ \text{CONTENT}: & \left[\begin{array}{lll} x & : & john \\ p & : & arrive(x) \end{array}\right] \end{array}\right]$$

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$Ty(e)$,

$$\left[\begin{array}{ll} \text{CONTEXT}: & \left[\begin{array}{lll} u_2 & : & utt-event \\ \ldots & : & \ldots \\ s_{s2} & : & spkr(u_2, a) \\ \ldots & : & \ldots \end{array}\right] \\ \text{CONTENT}: & \lambda[x].\left[\begin{array}{lll} p & : & arrive(x) \end{array}\right] \end{array}\right]$$

$Ty(e \rightarrow t)$,

A : John ...

B : arrives $\mapsto$

$$\begin{bmatrix} \text{CONTEXT} : \\ u_{1\oplus 2} & : utt-event \\ s_1 & : spkr(A,u_1) \\ s_2 & : spkr(B,u_2) \\ \dots \end{bmatrix}$$

$$\begin{bmatrix} \text{CONTENT} : \\ Ty(t), \\ \begin{bmatrix} s_{=now} & : e_s \\ x_{=john} & : e \\ p_{=arrive(s,x)} & : t \end{bmatrix} \end{bmatrix}$$

$$\begin{bmatrix} \text{CONTEXT} : \\ u_1 & : utt-event \\ s_1 & : spkr(A,u_1) \\ \dots \\ \mathbf{G} & : l-use \end{bmatrix}$$

$$\begin{bmatrix} \text{CONTENT} : \\ Ty(e), \\ \begin{bmatrix} x_{=john} & : e \end{bmatrix} \end{bmatrix}$$

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utterance event parameters - indexicals

I:

IF	$?Ty(e), \left[\text{CONTEXT} : \left[s_s : spkr(\mathbf{u}, \mathbf{x}) \right] \right]$
THEN	put($Ty(e)$)
	put(($\mathbf{x}$))
ELSE	abort

myself:

IF	$?Ty(e), \left[\text{CONTEXT} : \left[s_s : spkr(\mathbf{u}, \mathbf{x}) \right] \right],$
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utterance event parameters - indexicals

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A: Did you burn ...

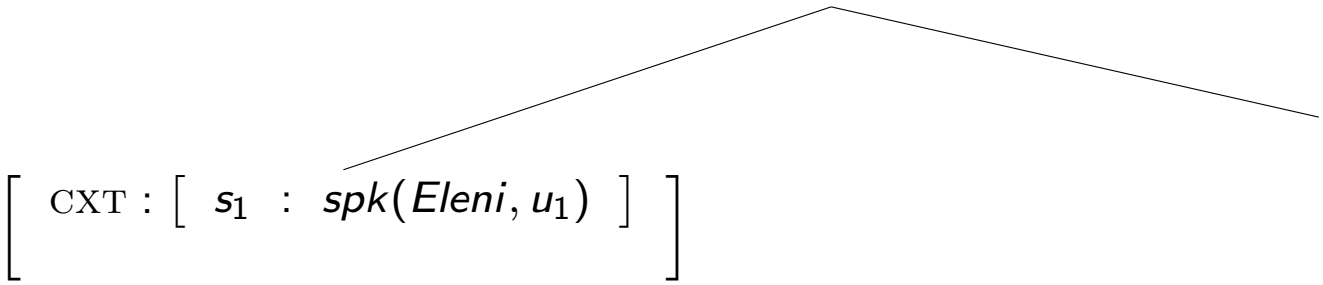
B: myself?

Split utterances with indexicals

Eleni: I burnt . . .
Bill: yourself!

Split utterances with indexicals

Eleni: |



Split utterances with indexicals

Eleni: I

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IF	$?Ty(e), [\ \text{CONTEXT} : [\ s_s : spkr(\mathbf{u}, \mathbf{x})\ ]\ ]$
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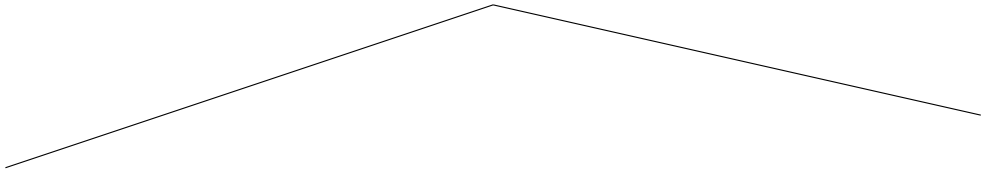
ELSE	$\texttt{abort}$



$$\left[\begin{array}{ll} \text{CXT} : \left[\ s_1 \ : \ spk(Eleni, u_1)\ \right] \\ \text{CNT} : \left[\ x_{=Eleni} \ : \ e\ \right] \end{array}\right]$$

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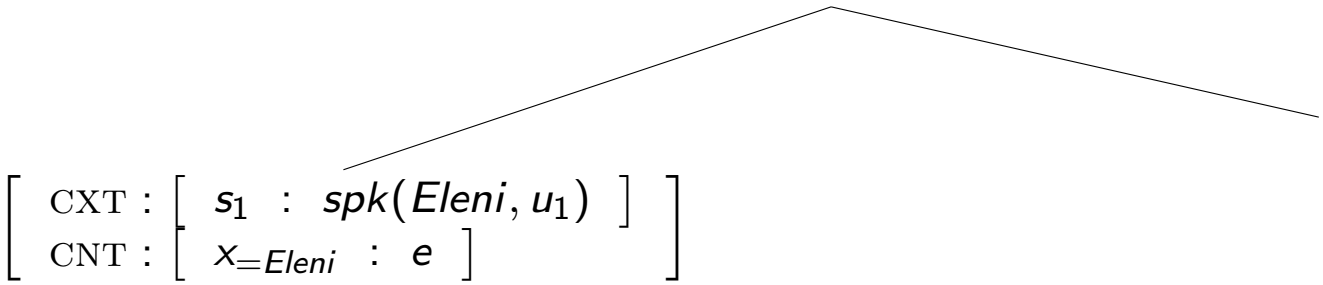

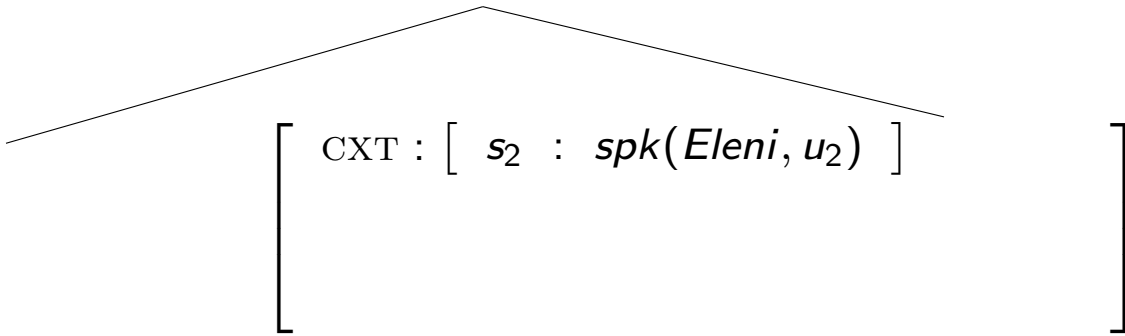

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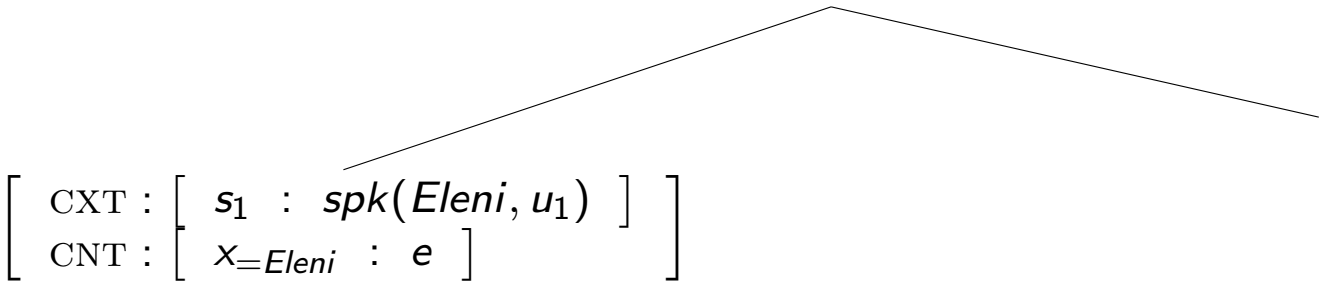

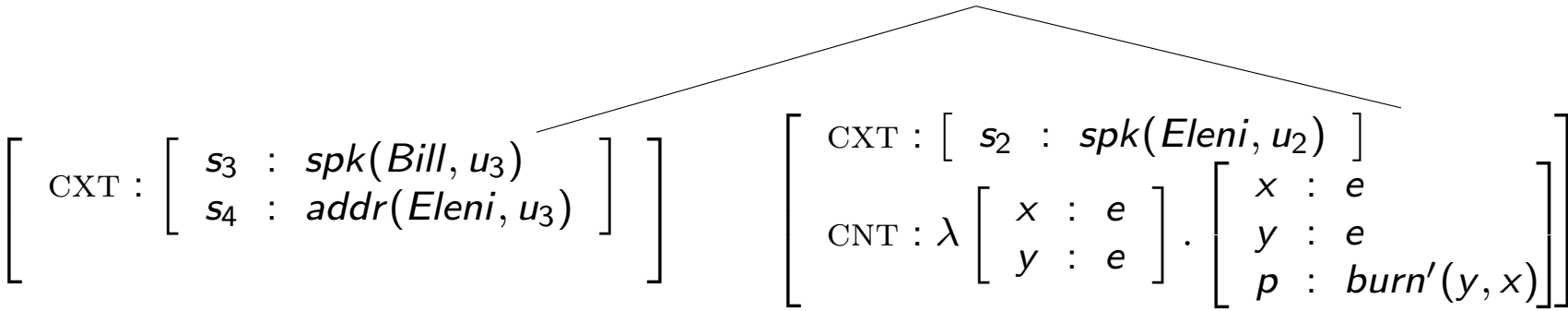

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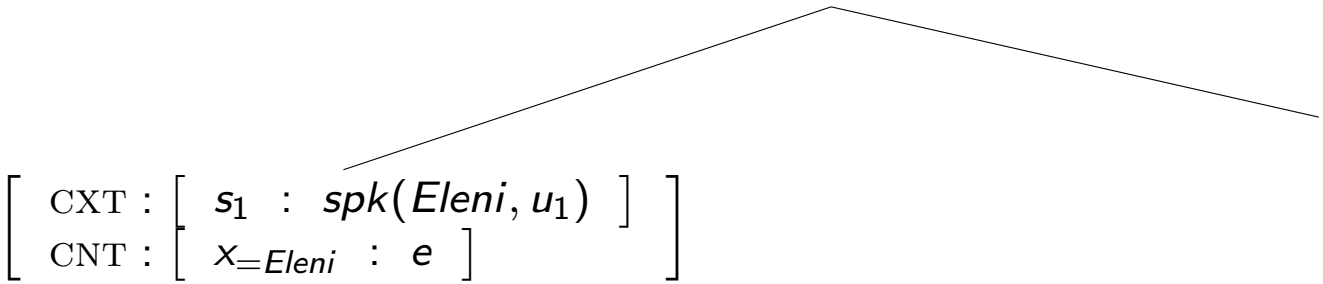

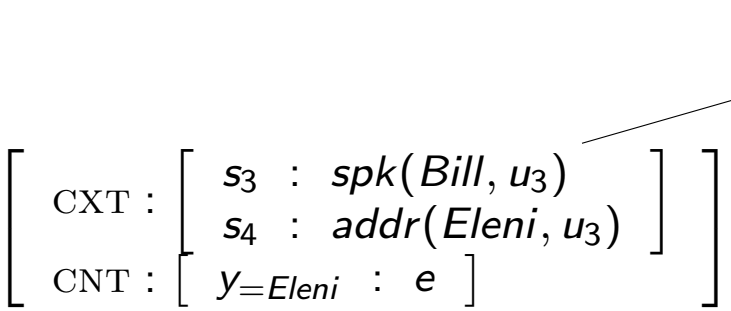

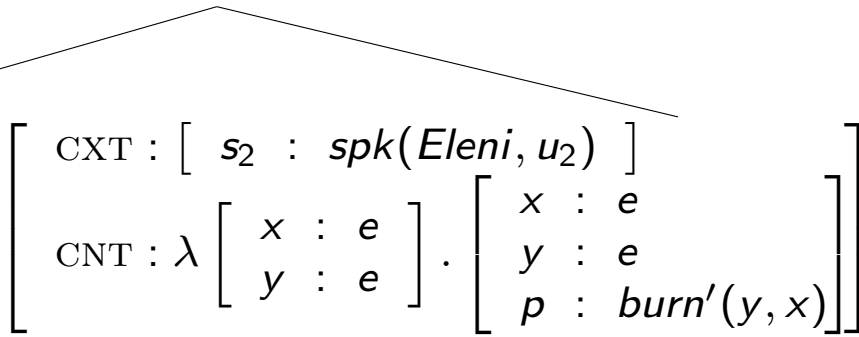

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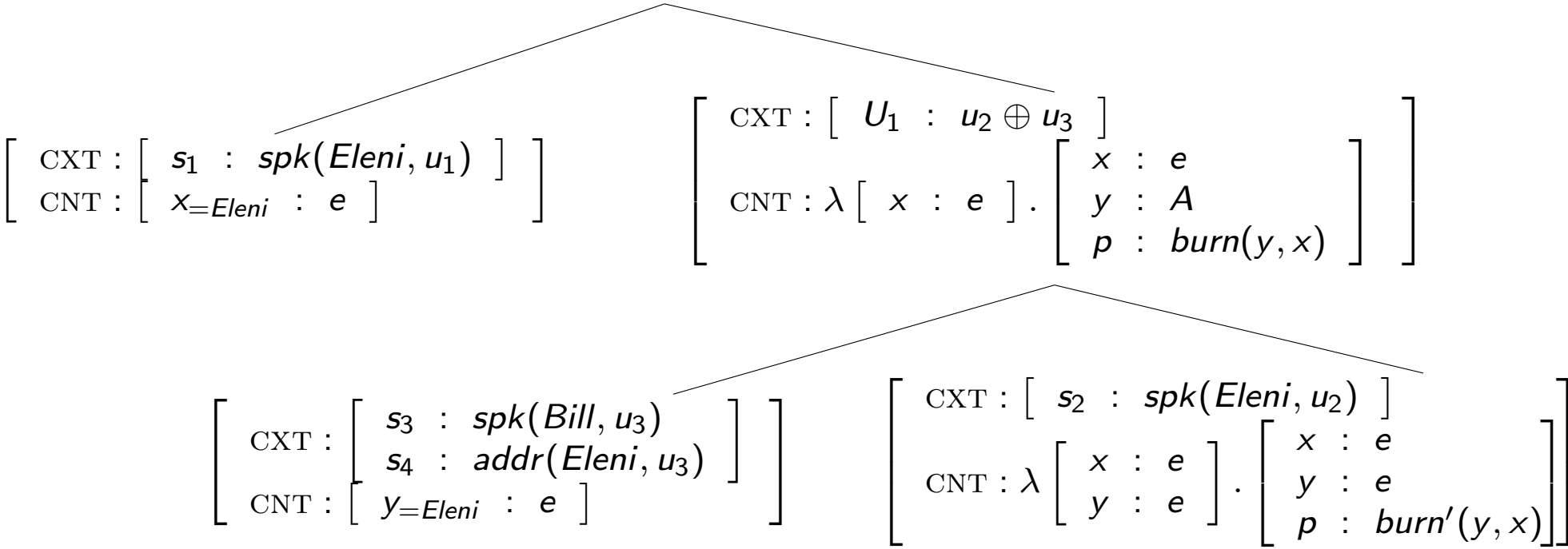

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$$Ty(t), \left[\begin{array}{ll} \text{CONTEXT}: & \left[\begin{array}{lll} \ldots, U_0 & : & u_1 \oplus u_2 \oplus u_3 \ldots \end{array}\right] \\ \text{CONTENT}: & \left[\begin{array}{lll} x_{=Eleni} & : & e \\ y_{=Eleni} & : & e \\ p & : & burn(x,y) \end{array}\right] \end{array}\right]$$

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anaphora/ellipsis: re-running actions

- context also stores **processing actions**

anaphora/ellipsis: re-running actions

- context also stores **processing actions**
- actions are first-class citizens in the model:
  the grammar includes means for referring to sequences of actions already stored in the CONTEXT, reasoning over them, or reemploying them again in subsequent steps
- **action rerunning** used in cases of sloppy readings in ellipsis/anaphora and repairs

ellipsis: rerunning of actions induces parallellism

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

(1) John upset his mother. Harry too.

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

(3) The man who gave his paycheck to his wife was wiser than the one who gave it to his mistress.[Karttunen, 1969]

dialogue phenomena

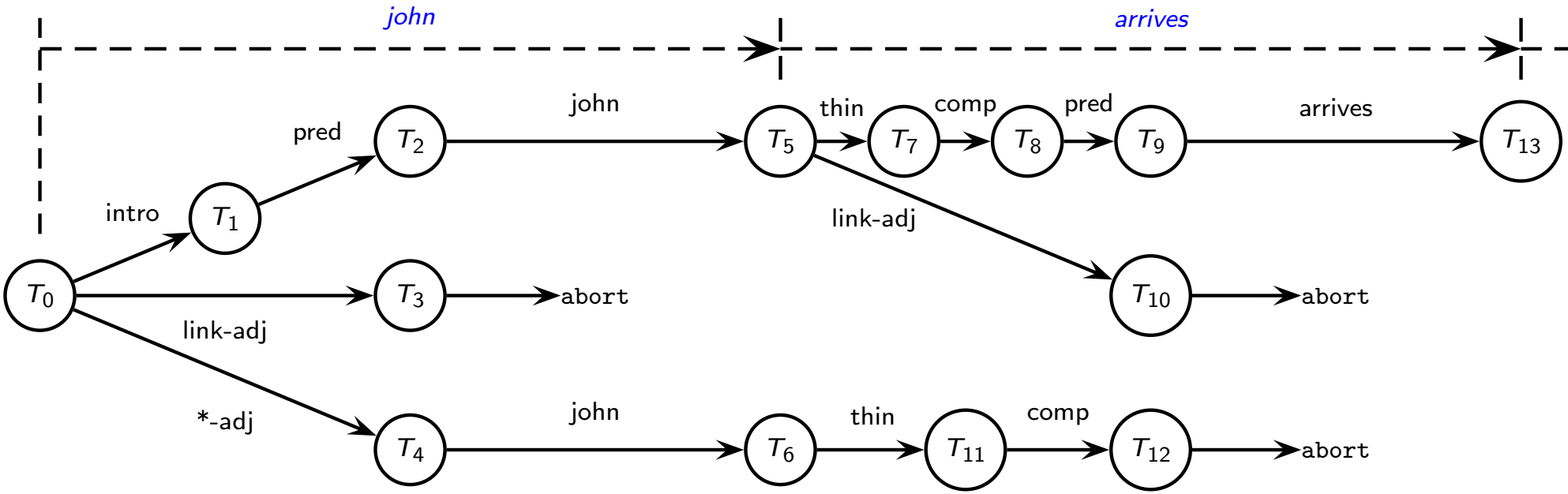
- self-**repair**

  A: Peter went swimming with Susan, um, or rather, surfing, yesterday. ['Peter went surfing with Susan yesterday']

- other-repair, **clarification** (echoing)

  A: Peter went swimming with Susan
  B: Susan?

parsing-paths context DAG



- actions (edges) are transitions between partial trees (nodes)
- processing paths probabilistically ranked

Outline

quotation

- we use natural language to talk about the world.
- one of the things that exist in the world is language: sometimes we use language to talk about our and others' use of language.

- this phenomenon is called (controversially) **quotation**. (other terms: direct/indirect discourse, direct/indirect reports, citation, use/mention, etc.)

quotation as a broader phenomenon

- NL sentences seamlesssy integrate incrementally foreign language elements, non-linguistic symbols, non-verbal noises:

(13) a. We met under the Eiffel tower, and the first thing he said was "je m'appelle John"
b. John saw the spider and was like "ahh!" [in a scared voice]
c. John was eating like [gobbling gesture with hands and face]
d. She went "Mm Mmmrn Mphh"
e. ⊙ is a heptapod logogram
f. the @-sign

⇒ indicates need for multimodal processing, composite signals

quotation: standard accounts

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  $\Rightarrow$

  elements between (possibly implicit) quotation marks need not be generated by the syntax or addressed by the semantics.

quotation: standard accounts

- However

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  - quotation is fully productive and systematic
  - "metalinguistic" uses involved in mundane processing, e.g. proper names, clarification questions
  - interpretation of quotations is needed for the interpretation of anaphora and ellipsis:

(17) a. "I talk better English than the both of youse!" shouted Charles, thereby convincing me that he didn't.

b. Mary said "I will come", and she did.

c. The sign says 'George Washington slept here', but I don't believe he really did.[Partee (1973)]

(current) grammatical accounts

- Potts (2007) suggests a two-dimensional semantics: one dimension for the usual semantic value, the other for the utterance of the expression.
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  - G&C do not use ad hoc devices to account for quotational phenomena.
  - HPSG grammar does not model incremental parsing/production, hence the continuity of quotational mechanisms is not accounted for.

"varieties of quotation": standard classification

- **Pure Quotation**

  (18) "Life is difficult" is grammatical.

- **Direct Quotation**

  (19) John said "My life is difficult"

- **Indirect Quotation**

  (20) John said that his life is difficult.

"varieties of quotation": standard accounts

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- Recanati (2010) distinguishes between 'open' and 'closed' quotation

direct/indirect quotation: problems of classification

difficulty grammatically distinguishing between
direct/**indirect** types in many languages besides English:

(23) (a) Peter sagte, dass er das nicht machen könne.[Indirect]
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(b) Peter sagte, dass er das nicht machen kann.[Indirect]
(c) Peter sagte, er könne das nicht machen.[Direct?]
(d) Peter sagte, er kann das nicht machen.[Direct?]

direct/indirect quotation: problems of classification

- intermediate cases

Free Direct Discourse:

(25) Hilary crept into the back room. She saw the curtains, dragged together roughly, as if - as if - There's someone behind them. I'm sure there's someone behind them. I must stay calm. - She reached for the light.

(26) Stop that, John! "Nobody likes me", "I am miserable" Don't you think you exaggerate a bit?

direct/indirect quotation: problems of classification

- intermediate cases

- **Free Indirect Discourse**:

(27) Marie felt relieved. If John came tomorrow, she would be saved.

(28) Marie was wondering. Did her brother arrive?

"varieties of quotation": problems of classification

- **Mixed Quotation**:

  a phenomenon intermediate between direct and indirect quotation:

  (29) Alice said that life is "difficult to understand".

- indirect report including "verbatim" report of one's utterance

⇒ can include vocabulary ("code-switching") and other elements from the reported speaker's perspective (context-shift)

"varieties of quotation": problems of classification

scare quotation:

(30) George is a "sanitation engineer."

(31) Paul says he's due to present his work in the "paper session". [Paul calls 'paper session' the 'poster session']

(32) James says that "Quine" wants to speak to us. [James thinks that McPherson is Quine]

mixed quotation: problems for grammars

– **indexicals** can shift as in direct quotation:

(33) Of course Wright won't disclose how much the Nike deal is worth, saying only that "they treat me well".
[The Face, September 93: 55]

(34) Bill Watterson said that reality "continues to ruin my life".

mixed quotation: problems for grammars

– quotation of **non-constituents**:

(35) She allowed as how her dog ate "strange things, when left to its own devices."

(36) Writing that book, Doyle felt himself "a slave to reality. I was just dying to write a big book, and to have a bit of fun". [Independent Arts, 17 September 2004]

(37) Tim Marlow of London's White Cube gallery suggested that such self-censorship was now common, though "very few people have explicitly admitted" it. [www.guardian.co.uk/commentisfree/2008/oct/01/religion.islam]

mixed quotation: problems for grammars

– **shift of language**/idiolect within single clause:

(38) A doctor tells him [Gustave Flaubert] he is like a "vieille femme hysterique"; he agrees.
[TLS online, 18 December 1998]

(39) Palin tweeted that "peaceful Muslims" should "refudiate" the mosque being built at Ground Zero.

quotation and linguistic processing

- quotational puns:

(40) The menu says that this restaurant serves "breakfast at any time" so I ordered French toast during the Renaissance. [Steven Wright joke]

(41) 'Marriage' is not a word, it's a sentence.

⇒ the **grammar** needs to be able to keep track of abandonned **parsing paths** as well as current viable ones.

quotation and dialogue: split utterances

quotational phenomena interact with split utterances too:

(42) Jem: Mary, whatever it is you think you know you mustn't speak of it.
Not if you want to stay safe.
Mary: says the horse-thief [*Jamaica Inn*, BBC Transcripts]

(43) A: SOMEONE is keen
B: says the man who slept here all night [BBC Transcripts *A-Word*]

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(45) A: SOMEONE is keen
B: says the man who slept here all night [BBC Transcripts *A-Word*]

the grammar needs to model
(a) how context shifts as interlocutors exchange roles, and
(b) how asserted contents can be transformed to quotations

conclusions: quotation and grammar design

⇒ we need a **unified account of quotational phenomena** since there seems to be gradation, no sharp distinctions (⇒ construction grammar unsuitable)

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⇒ the grammar needs combinatorial mechanisms that license stings consisting of words, gestures, sounds etc (**multi-modal grammar**).

(52) The car engine went [brmbrm], and we were off.

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(54) The car engine went [brmbrm], and we were off.

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⇒ the grammar needs to allow for **language-shift** (not only for quotation but for code-switching).

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$\Rightarrow$

- we need a non-standard type of syntax that does **not** rely on **sentences/propositions**

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- **incrementality** of parsing/production needs to be modelled within the grammar
- **context-dependence** (incl 'point-of-view', 'perspective') needs to be modelled within the grammar
- availability of various **alternative parsing/generation options** needs to be included and stored as part of the context within the grammar model

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- to account for context change, e.g. indexicals,
  at each word-utterance event, the **parameters** of **context** need to be reset.

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- to account for context change, e.g. indexicals, **at each word-utterance event**, the **parameters** of **context** need to be reset.
- incrementality means that (Kaplanian) **word "characters"** check the context and contribute conceptual content accordingly (no 'characters' for whole sentences)
- a **sentential representation** (a tree, or a "character" for the whole sentence) is never derived – the grammar only derives **conceptual representations**.

conclusions: quotation and grammar design

- to account for language shift, we need to include, as part of the context, a parameter Γ for the **grammar/idiolect being used** at each processing stage (Recanati 2010; Ginzburg and Cooper, 2014)

grammar parameter

grammar parameter

A: John ...

B: arrives $\mapsto$

$$\left[\begin{array}{ll} \text{CONTEXT}: & \\ u_{1\oplus 2} & : utt-event \\ s_1 & : spkr(A,u_1) \\ s_2 & : spkr(B,u_2) \\ \ldots & \end{array}\right]$$

$$\left[\begin{array}{l} \text{CONTENT}: \\ Ty(t), \\ \left[\begin{array}{ll} s_{=now} & : e_s \\ x_{=john} & : e \\ p_{=arrive(s,x)} & : t \end{array}\right] \end{array}\right]$$

$$\left[\begin{array}{ll} \text{CONTEXT}: & \\ u_1 & : utt-event \\ s_1 & : spkr(A,u_1) \\ \ldots & \\ \mathbf{G} & : l-use \end{array}\right] \qquad \left[\begin{array}{ll} \text{CONTEXT}: & \\ u_2 & : utt-event \\ s_2 & : spkr(B,u_2) \\ \ldots & \\ \mathbf{G} & : l-use \end{array}\right]$$

$$\left[\begin{array}{l} \text{CONTENT}: \\ Ty(e), \\ \left[\begin{array}{ll} x_{=john} & : e \end{array}\right] \end{array}\right]$$

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natural languages as formal languages– quotation

- Cooper (2015):
  - "A corpus of natural language data (even a single dialogue) not required to be consistent in terms of grammaticality or meaning since it represents output based on a collection of related grammars rather than a single grammar."
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- to these I would add:
  - **Not even a single sentence** is "required to be consistent in terms of grammaticality or meaning since it represents output based on a collection of related grammars rather than a single grammar."

grammar reification

- however, DS's notion of "**grammar**" is different: no specification of 'expressions' but of processing actions

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- however, DS's notion of "**grammar**" is different: no specification of 'expressions' but of processing actions

$\Rightarrow$ **quotation** involves the meta-procedure to `run` *some* grammar g (not necessarily the current one), perhaps with contextual parameters specified by a salient utterance event

$\Rightarrow$ for quotations that are 'echoic' or report somebody's speech act/thought, we need to introduce as part of the context, besides the **current speech event**, a variable for another event, u_r, the **event that is being reported** (and metavariables that target it).

conclusions: quotation and grammar design

Formalisation of quotation mechanisms: a sketch

- grammar architecture: **DS-TTR**

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  - **incremental licensing** of strings and immediate derivation of conceptual interpretations
  - words and syntactic (combinatory) rules modelled as 'actions' within a dynamic logic
  - parsing and generation modelled in parallel and as part of the grammar
  - **actions are 'first-class' citizens** in the model and can be invoked to resolve ellipsis/anaphora
  - alternative parsing and generation paths stored in context and available for use later

quotation: action reification

Pure Quotation

(1) "John was loud" is grammatical / a sentence of English

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IF	$?Ty(\mathbf{x}_{\in\{e,cn,\ldots\}})$
THEN	$\mathtt{put}\ Ty(\mathbf{x})$
	$\mathtt{put}\ (u_{q=\mathtt{run_g}(\langle \mathbf{a}_i,\ldots,\mathbf{a}_{i+n}\rangle)}\colon \mathrm{e}_s)$
ELSE	$\mathtt{abort}$

the grammatical action involves cataphoric reference to upcoming actions through rule-level metavariables.

Echoing Quotation

(2) “John” was a bit loud

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- content values invoke the operation of (someone's) grammar
- specify the existence of an another utterance event, and its agent:
- contextual parameters (partially) set by invoked event

IF $?Ty(\mathbf{x}_{\in\{e,cn,\ldots\}}),\ \left[\ \text{CONTEXT}\ :\ \left[\ldots\left[\ \mathbf{u}\ :\ e_s\ \right]\right]\ \right]$

THEN put $Ty(\mathbf{x})$

put $(u_{q=\mathtt{run_g}\ \left[\text{CONTEXT}\ :\ \left[\ \mathbf{u}\ :\ e_s\ \right]\right]\ (\langle \mathbf{a}_i,\ldots,\mathbf{a}_{i+n}\rangle)}\ :\ e_s)$

ELSE abort

quotation: echoing - direct reports

(3) John said "I was loud"

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(3) John said "I was loud"

- involves demonstration of an event by the current speaker
- content values invoke the generation of a string by the agent of the saying verb (contextual parameters reflect this)
- actions induced by such verbs can license object-drop

IF $?Ty(e \rightarrow t), \left[\text{CONTEXT} : \left[\ldots \left[\begin{array}{l} \mathbf{u} : e_s \\ s : spkr(\mathbf{u}, \mathbf{x}) \end{array} \right] \right] \right]$

THEN
$$\left\{ \begin{array}{l} \left\{ \begin{array}{l} (\ [\texttt{go(subject-node)} \ldots], \ldots, \texttt{put}(?[\ \mathbf{x} : e\ ])\ ), \\ (\ [\texttt{go(predicate-node)} \ldots], \\ \texttt{put}(Ty(e \rightarrow t), \lambda[xy]. \left[\begin{array}{ll} x & : e \\ y & : e_s \\ p_{=say(x,y)} & : t \end{array} \right])\ ) \\ (\ [\texttt{make(object-node)} \ldots], \texttt{put}([\ \mathbf{U} : e_s\ ])\ ), \\ \qquad\qquad \ldots \end{array} \right\}, \\ \left(\left[\begin{array}{l} \texttt{make}(< L >), \texttt{go}(< L >)\ , \\ \texttt{put}\ (u_{q=\texttt{run}_\mathbf{g}} \left[\text{CONTEXT} : \left[\mathbf{u} : e_s \right] \right]^{(\langle \mathbf{a}_i, \ldots, \mathbf{a}_{i+n} \rangle)} : e_s) \end{array} \right] \right) \end{array} \right\}$$

ELSE abort

quotation: reuse of actions

Recycling Quotation

(5) A: You are loud
B: says the rudest woman in the world...

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(5) A: You are loud
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IF $?Ty(e \rightarrow t), \left[\text{CONTEXT} : \left[\ldots \left[\begin{array}{l} \mathbf{u} : e_s \\ s : spkr(\mathbf{u}, \mathbf{x}) \end{array} \right] \right] \right]$

THEN
$$\left\{ \begin{array}{l} \texttt{([go(subject-node) ...],..., put(?[x : e])),} \\ \texttt{([go(predicate-node)...],} \\ \texttt{put(} Ty(e \rightarrow t), \lambda[xy]. \left[\begin{array}{ll} x & : e \\ y & : e_s \\ p_{=say(x,y)} & : t \end{array} \right] \texttt{)),} \\ \\ \texttt{([make(object-node)...], put(} \left[\begin{array}{l} \mathbf{U} : e_s \\ \ldots \end{array} \right] \texttt{)),} \end{array} \right\}$$

quotation: echoing/scare

Mixed Quotation

(4) John said that I am “loud and rude”

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IF $?Ty(\mathbf{x}),$

THEN put $Ty(\mathbf{x})$,

put $\left(\begin{array}{ll} \text{CONTEXT} : & \left[\ldots\left[\begin{array}{ll} \mathbf{u}_{=\mathtt{run_g}(\langle \mathbf{a}_i,\ldots,\mathbf{a}_{i+n}\rangle)} : & e_s \\ y_{=\mathbf{u}.[\text{CONTENT}]} : & \mathbf{x} \end{array}\right]\ldots\right] \\ \text{CONTENT} : & \left[\begin{array}{ll} u_{q=\mathtt{run_g}(\langle \mathbf{a}_i,\ldots,\mathbf{a}_{i+n}\rangle)} : & e_s \\ z_{=u_q.[\text{CONTENT}]} : & \mathbf{x} \end{array}\right] \end{array}\right)$

ELSE abort

quotation: invocation of actions

Indirect Quotation

(1) A: John says (that) I am loud and rude.

Indirect Quotation

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

$$\left[\ \text{CONTEXT} : \left[\ \ldots \left[\begin{array}{ll} \mathbf{u}_{=\mathtt{rung}(\langle \mathbf{a}_i,\ldots,\mathbf{a}_{i+n}\rangle)} : & e_s \\ s : & spkr(\mathbf{u},\mathbf{x}) \\ \mathbf{q}_{=\mathbf{u}.[\text{CONTENT}]} : & t \end{array}\right]\right]\ \right]$$

THEN [go(subject-node)...], put(?[$\mathbf{x} : e$])
[go(predicate-node)...], put($Ty(e \rightarrow t)$)
[make(object-node)...],
put($?Ty(t)$, $?\left[\ \text{CONTENT} : \left[\begin{array}{ll} \mathbf{P}_{=\mathbf{u}.[\text{CONTENT}]} : & t \\ w : & \mathbf{P} \in \mathbf{W_x} \end{array}\right]\ \right]$)

ELSE abort

conclusions: quotation and grammar design

- In order to account for the full range of quotation/metalinguistic/echoing/reporting phenomena we need formalisation in terms of **mechanisms** rather than (fixed) syntax-semantics-pragmatics mappings (constructions)

- Mechanisms (macros of DS-actions) freely combine to yield various effects in context resulting in the observed continuity of the phenomenon

Outline

action-based grammar

- NL conceptual representations not domain-specific, common to action/perception

  syntax, lexicon = set of actions that predict, induce, develop structured contexts

- interaction/coordination is an effect achievable directly from grammar-defined procedures, [Gregoromichelaki et al 2011]

  i.e. from low-level non-conceptual mechanisms
  (cf. Hurley, 2008; Pezzulo, 2011, 2014; Butterfill & Apperly 2013)

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  i.e. from low-level non-conceptual mechanisms
  (cf. Hurley, 2008; Pezzulo, 2011, 2014; Butterfill & Apperly 2013)

- no necessary intention recognition or mind reading
- no separate parsing/production modules related solely via central system/reasoning

Thanks!

And thanks to:

Ellen Breitholtz, Ronnie Cann, Stelios Chatzikyriakidis, Robin Cooper, Arash Eshghi, Jonathan Ginzburg, Andrew Gargett, Pat Healey, Christine Howes, Ruth Kempson, Wilfried Meyer-Viol, Greg Mills, Matt Purver, Yo Sato, Graham White.

Outline

Re-running actions – ACE

- Antecedent Contained Ellipsis

e.g. Bill saw someone [that John did]

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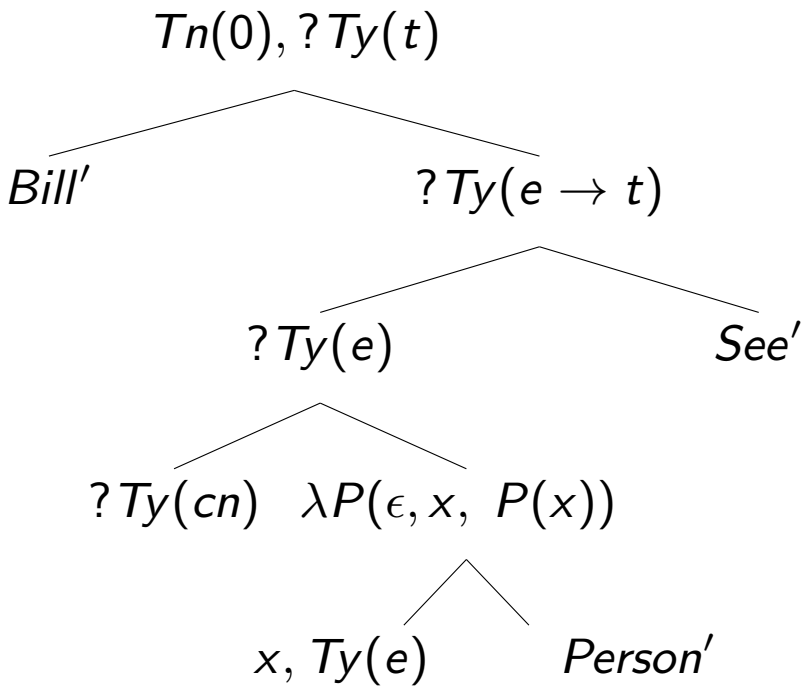

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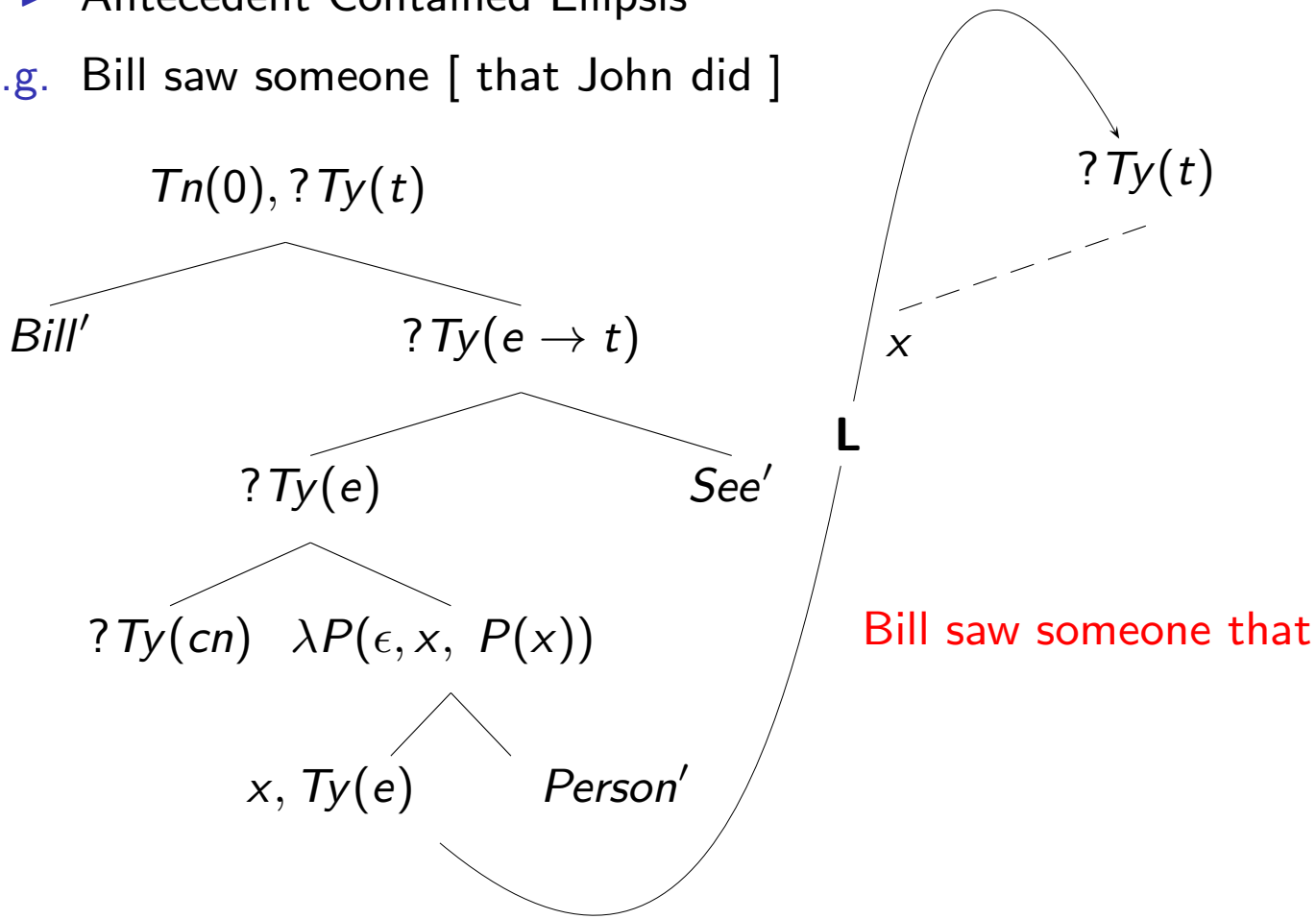

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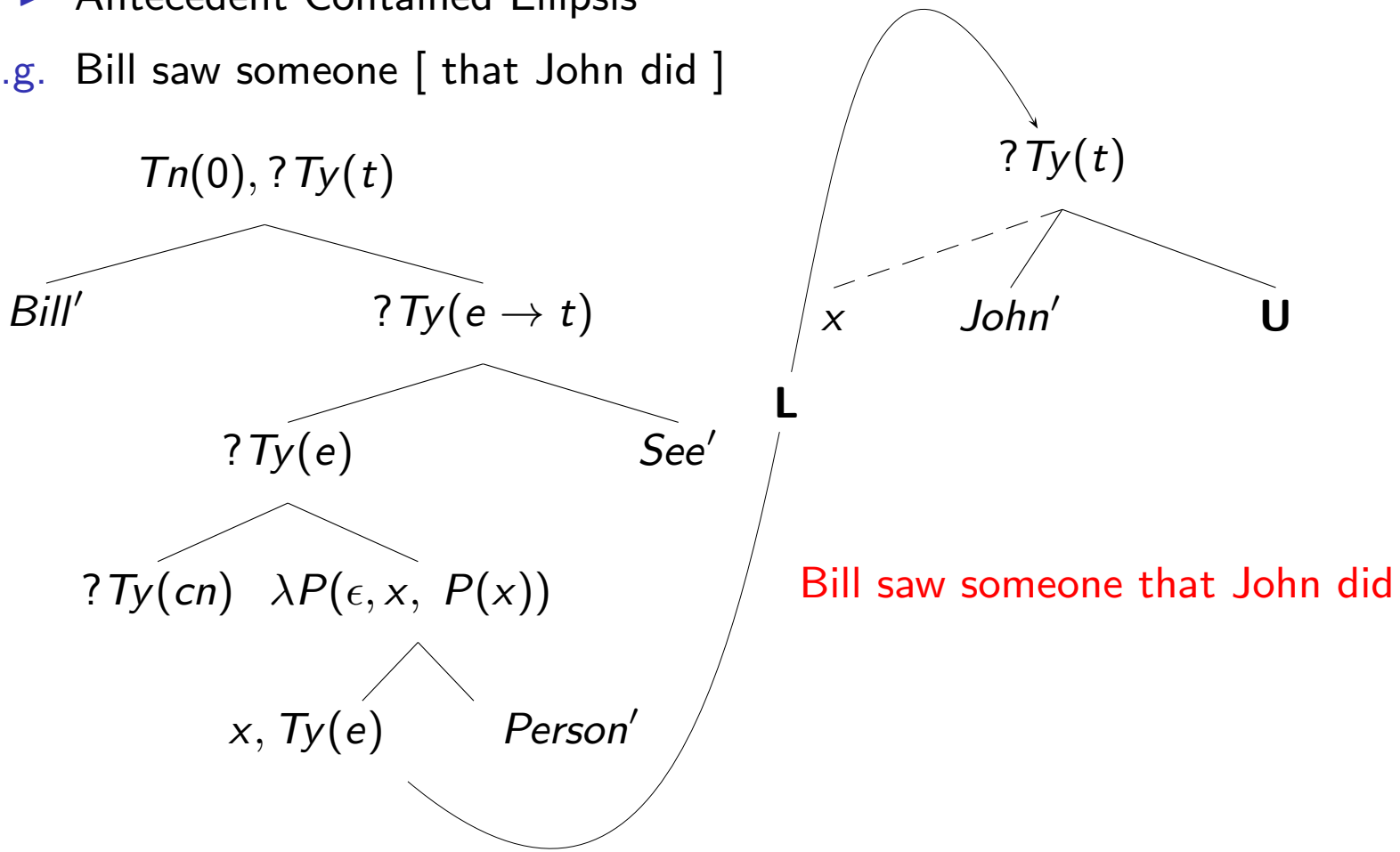

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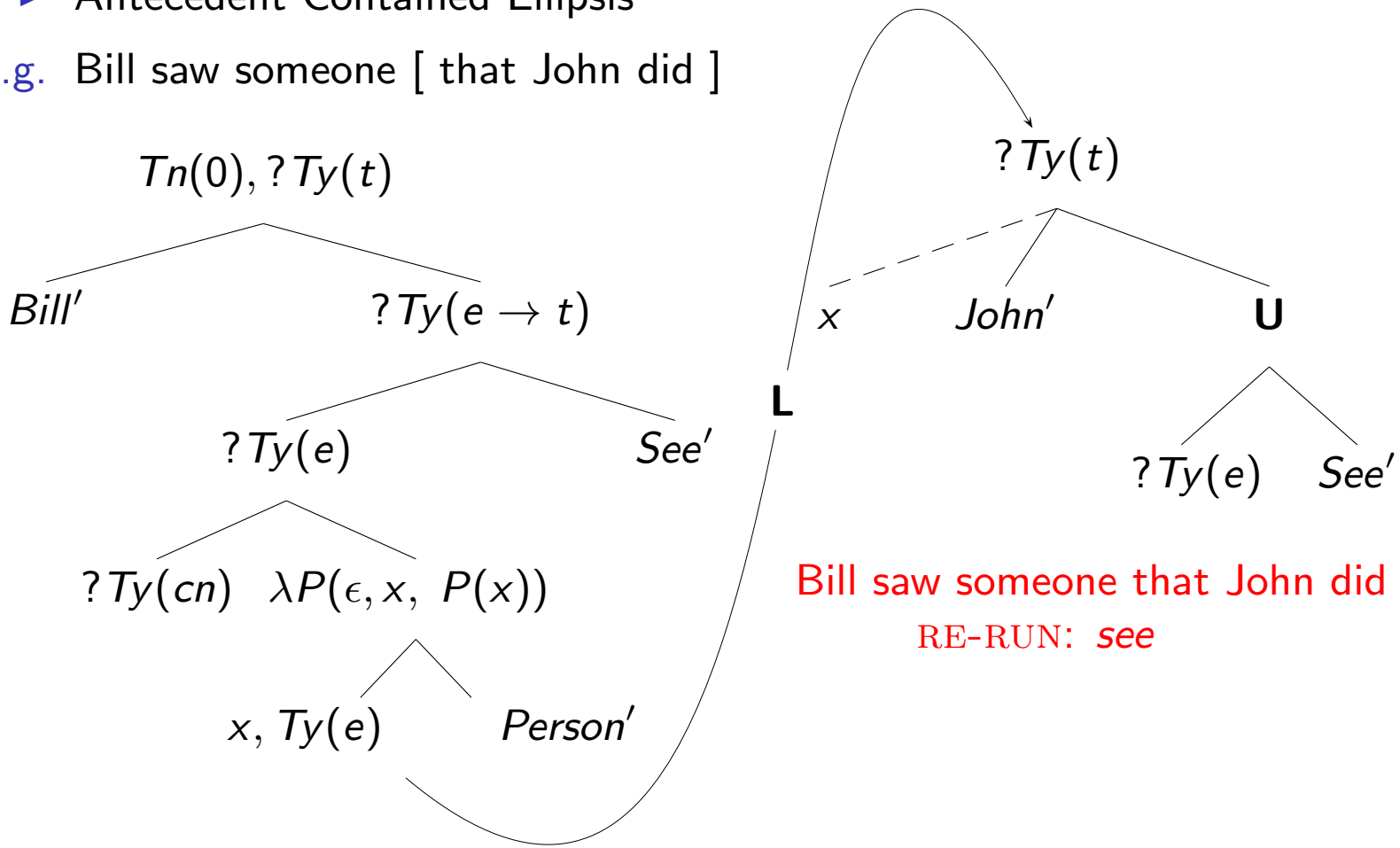

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RE-RUN: *see*

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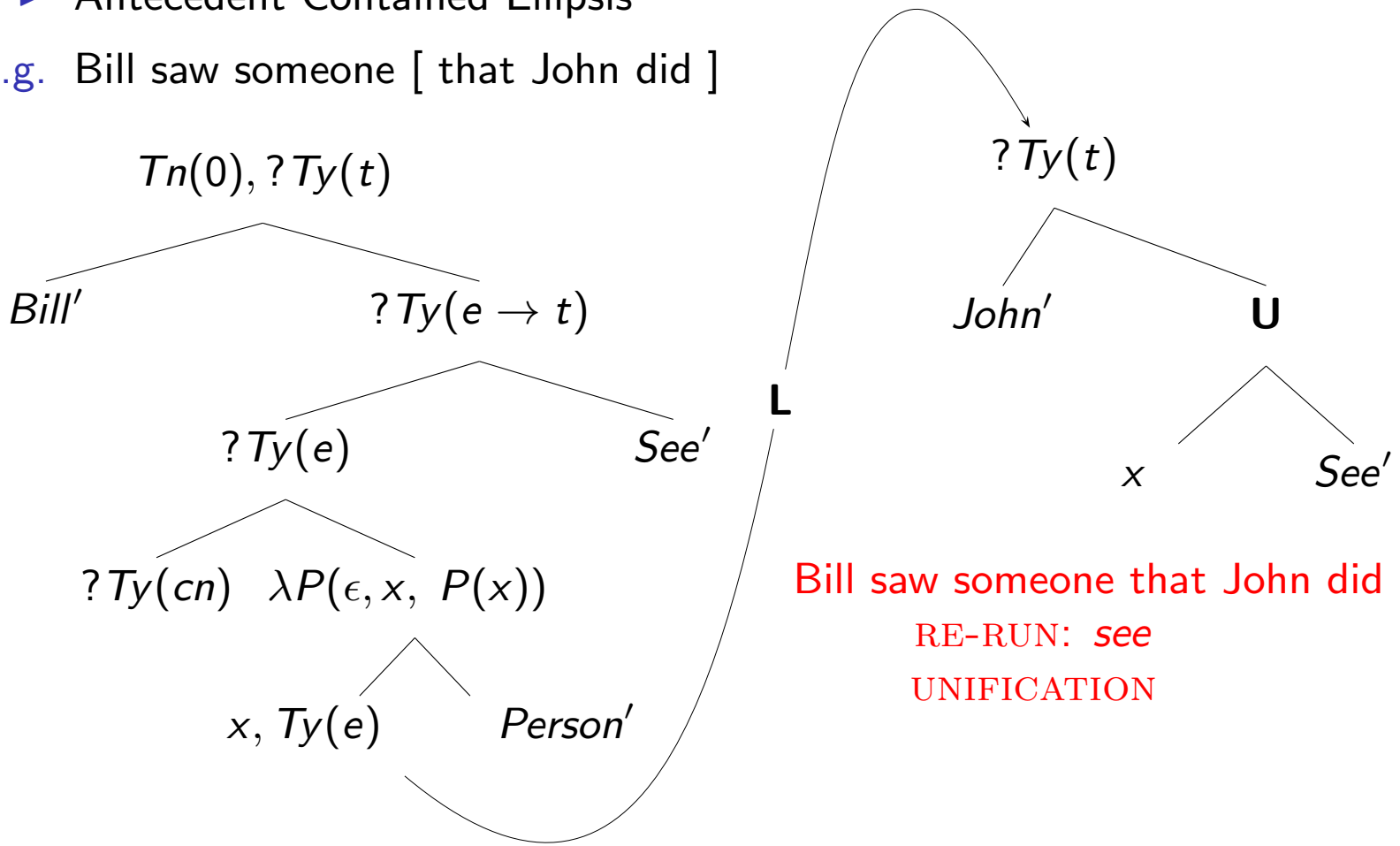

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UNIFICATION

Re-running actions – ACE

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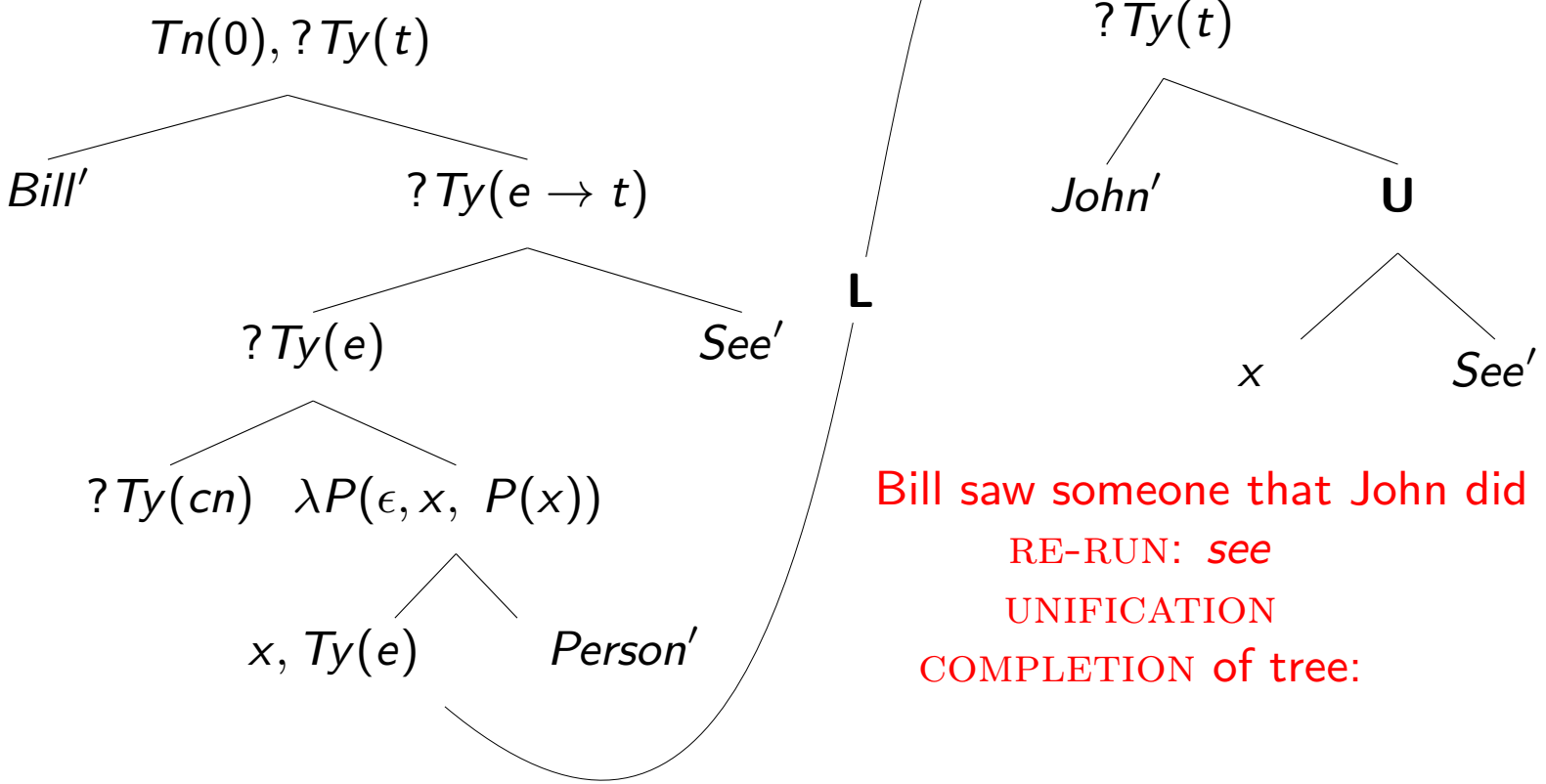

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RE-RUN: *see*

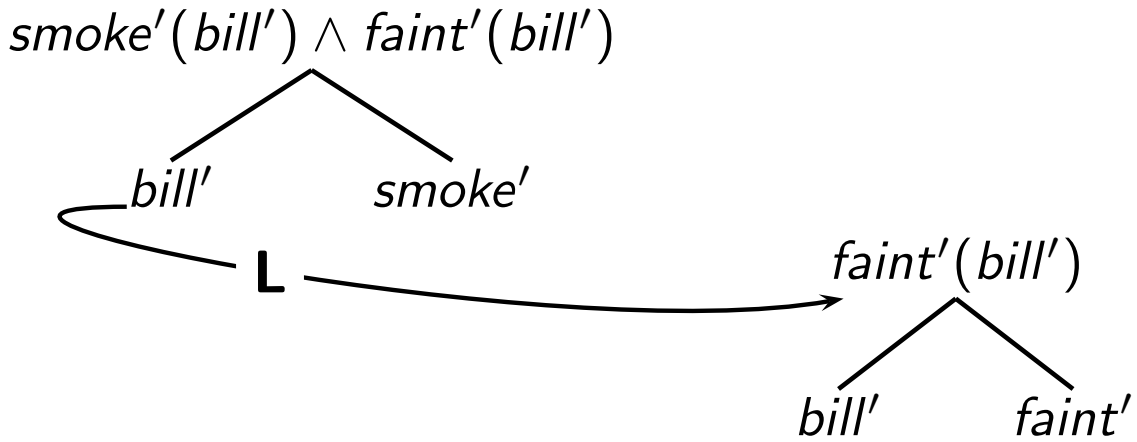
UNIFICATION

COMPLETION of tree:

LINKed Trees

- **Relative clauses**: pairs of LINKed trees evaluated as conjunction

  e.g. Bill, who fainted, smokes.



- Also used for apposition, clarification and confirmation, implicatures . . .

quotation and linguistic processing

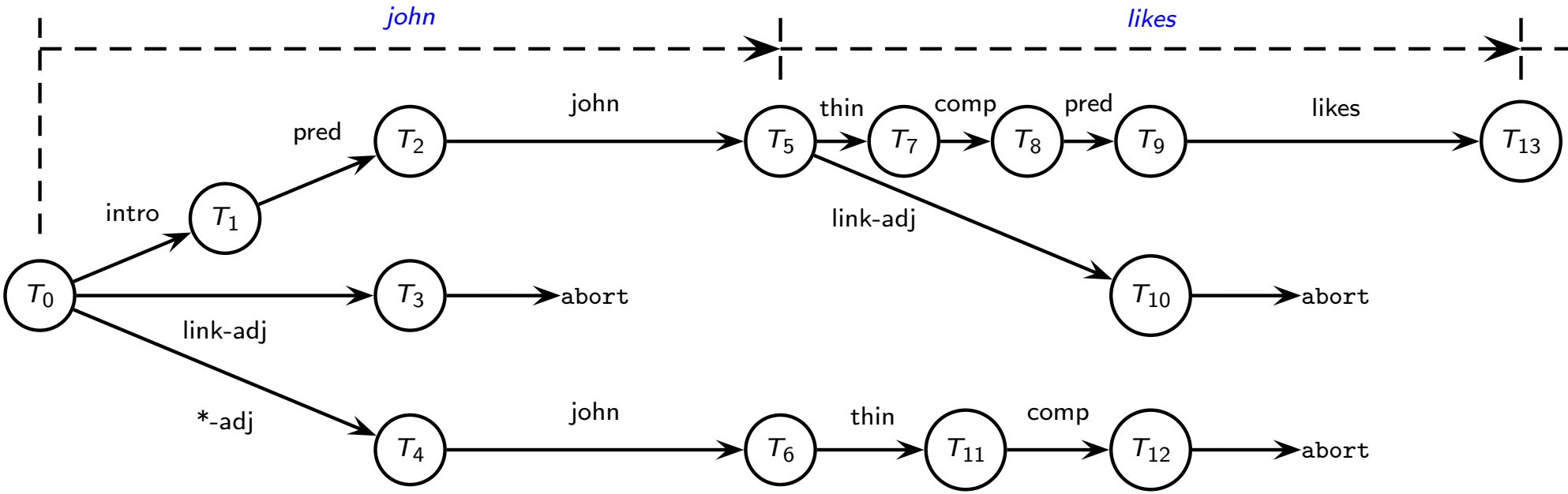
- quotational puns:

(56) The menu says that this restaurant serves "breakfast at any time" so I ordered French toast during the Renaissance. [Steven Wright joke]

(57) 'Marriage' is not a word, it's a sentence.

⇒ the **grammar** needs to be able to keep track of abandonned **parsing paths** as well as current viable ones.

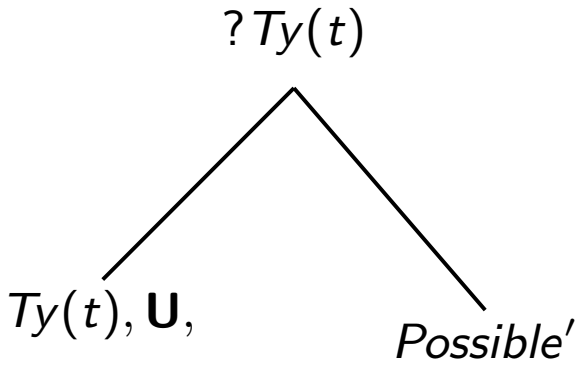
parsing-paths context DAG



- actions (edges) are transitions between partial trees (nodes)
- processing paths probabilistically ranked

grammaticalised cataphora - expletives

It is possible that I am wrong



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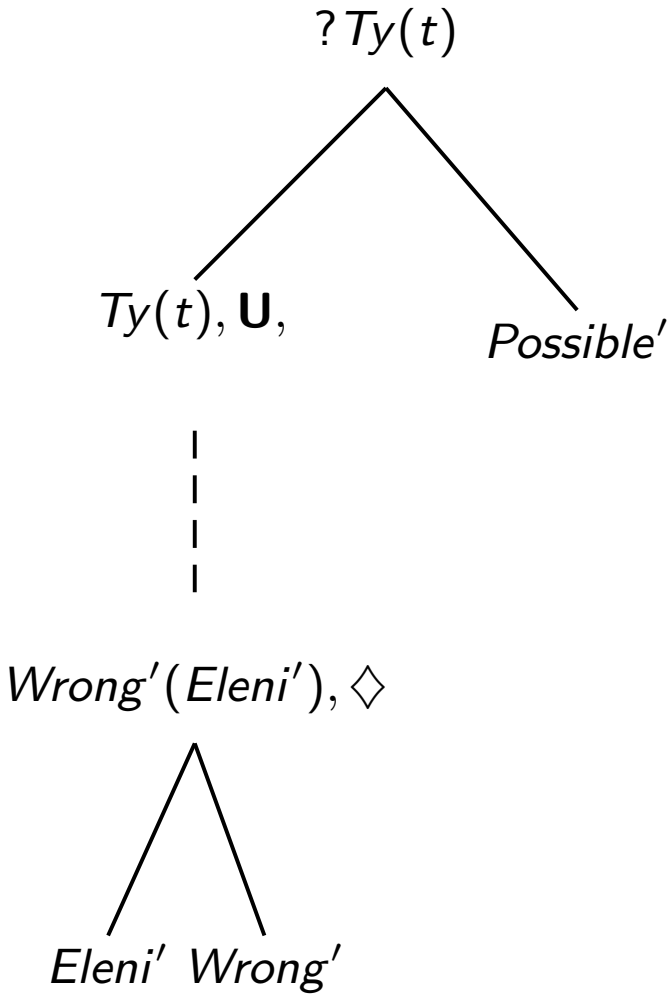

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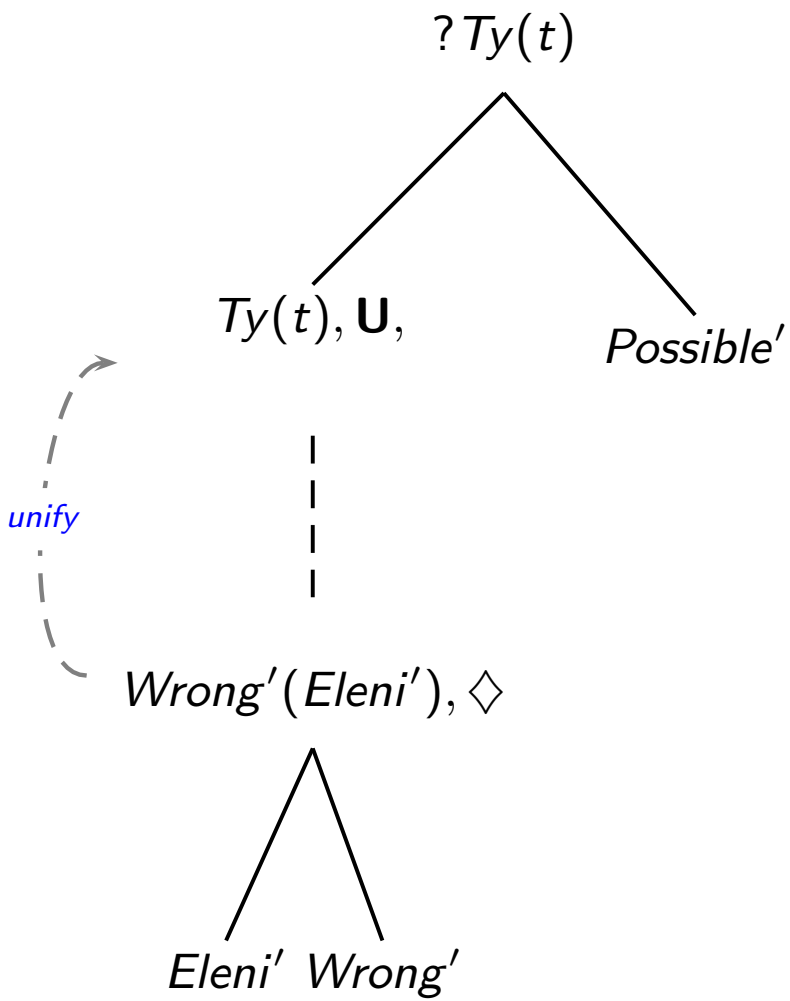

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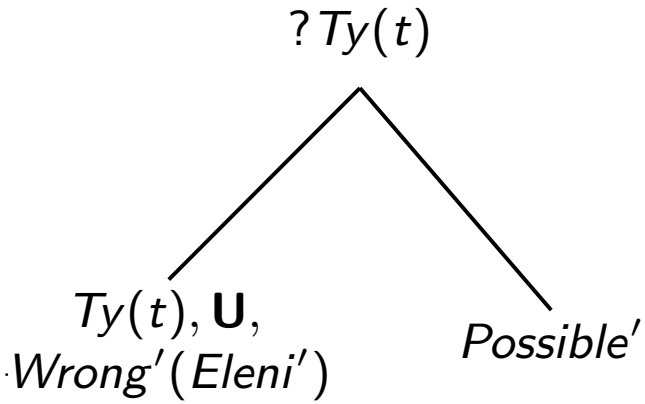

quotation and dialogue: split utterances

split-utterances: grammatically relevant context shift - any syntactic/semantic dependency can be split across change of turn:

(58) A: Oh, I am so sorry, did you burn
myself? No, its OK.

(59) A: Have you read ...
B: any of your chapters? Not yet.

quotation and dialogue: split utterances

split-utterances: grammatically relevant context shift - any syntactic/semantic dependency can be split across change of turn:

(61) A: Oh, I am so sorry, did you burn myself? No, its OK.

(62) A: Have you read ...
B: any of your chapters? Not yet.

(63) # Have you read any of your chapters?

quotation and dialogue: split utterances

split-utterances: grammatically relevant context shift - any syntactic/semantic dependency can be split across change of turn:

(64) A: Oh, I am so sorry, did you burn
myself? No, its OK.

(65) A: Have you read ...
B: any of your chapters? Not yet.

(66) # Have you read any of your chapters?

⇒ The grammar needs to be able to express
(a) the incremental licensing and interpretation of NL strings, and
(b) the context shift within a single clause,
without needing to license whole sentences/propositions first