A Computational Implementation of Syntactic Binding Theory in the Minimalist Program

Sandiway Fong
Departments of Linguistics and Computer Science
University of Arizona
Tucson AZ USA

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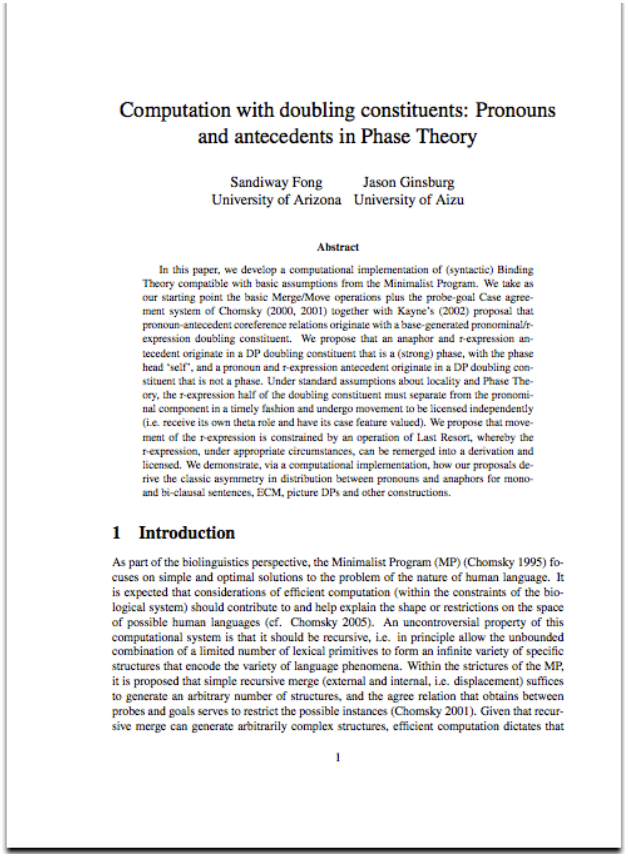
Joint work with *Jason Ginsburg*
(University of Aizu, Japan)

Paper and Derivations Available

from my homepage

- (*just google my first name*)
- http://dingo.sbs.arizona.edu/~sandiway/mpp/



Computation with doubling constituents: Pronouns and antecedents in Phase Theory

Sandiway Fong University of Arizona Jason Ginsburg University of Aizu

Abstract

In this paper, we develop a computational implementation of (syntactic) Binding Theory compatible with basic assumptions from the Minimalist Program. We take as our starting point the basic Merge/Move operations plus the probe-goal Case agreement system of Chomsky (2000, 2001) together with Kayne's (2002) proposal that pronoun-antecedent coreference relations originate with a base-generated pronominal/r-expression doubling constituent. We propose that an anaphor and r-expression antecedent originate in a DP doubling constituent that is a (strong) phase, with the phase head 'self', and a pronoun and r-expression antecedent originate in a DP doubling constituent that is not a phase. Under standard assumptions about locality and Phase Theory, the r-expression half of the doubling constituent must separate from the pronominal component in a timely fashion and undergo movement to be licensed independently (i.e. receive its own theta role and have its case feature valued). We propose that movement of the r-expression is constrained by an operation of Last Resort, whereby the r-expression, under appropriate circumstances, can be remerged into a derivation and licensed. We demonstrate, via a computational implementation, how our proposals derive the classic asymmetry in distribution between pronouns and anaphors for mono- and bi-clausal sentences, ECM, picture DPs and other constructions.

1 Introduction

As part of the biolinguistics perspective, the Minimalist Program (MP) (Chomsky 1995) focuses on simple and optimal solutions to the problem of the nature of human language. It is expected that considerations of efficient computation (within the constraints of the biological system) should contribute to and help explain the shape or restrictions on the space of possible human languages (cf. Chomsky 2005). An uncontroversial property of this computational system is that it should be recursive, i.e. in principle allow the unbounded combination of a limited number of lexical primitives to form an infinite variety of specific structures that encode the variety of language phenomena. Within the strictures of the MP, it is proposed that simple recursive merge (external and internal, i.e. displacement) suffices to generate an arbitrary number of structures, and the agree relation that obtains between probes and goals serves to restrict the possible instances (Chomsky 2001). Given that recursive merge can generate arbitrarily complex structures, efficient computation dictates that

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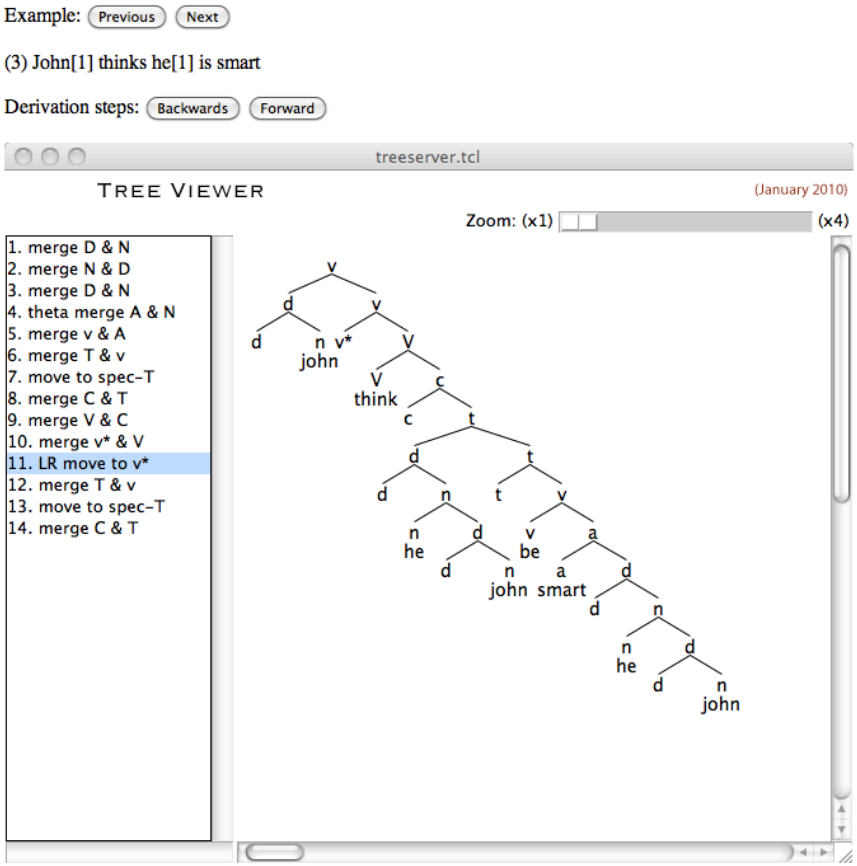


Introduction: Data

- Classic Binding Theory data:

  *John$_i$ praises him$_i$

  John$_i$ praises himself$_i$

  John$_i$ thinks he$_i$ is smart

  *He$_i$ thinks John$_i$ is smart

  *John$_i$ thinks himself$_i$ is smart

  *John$_i$ thinks that Mary likes himself$_i$

  John$_i$ considers himself$_i$ to be intelligent

  *John$_i$ considers him$_i$ to be intelligent

Introduction: Data

- Classic Binding Theory data:

  John$_i$ likes his$_i$ dog

  *John$_i$ likes himself$_i$'s dog

  ?*Hannah$_i$ found a picture of her$_i$

  Hannah$_i$ found a picture of herself$_i$

  ?*Hannah found Peter$_i$'s picture of him$_i$

  Hannah found Peter$_i$'s picture of himself$_i$

  Hannah$_i$ found Peter's picture of her$_i$

  Hannah$_i$ found Peter's picture of herself$_i$

Note: *picture*-DP judgments from Keller & Asudeh's (2001) study

Binding Conditions: A, B and C

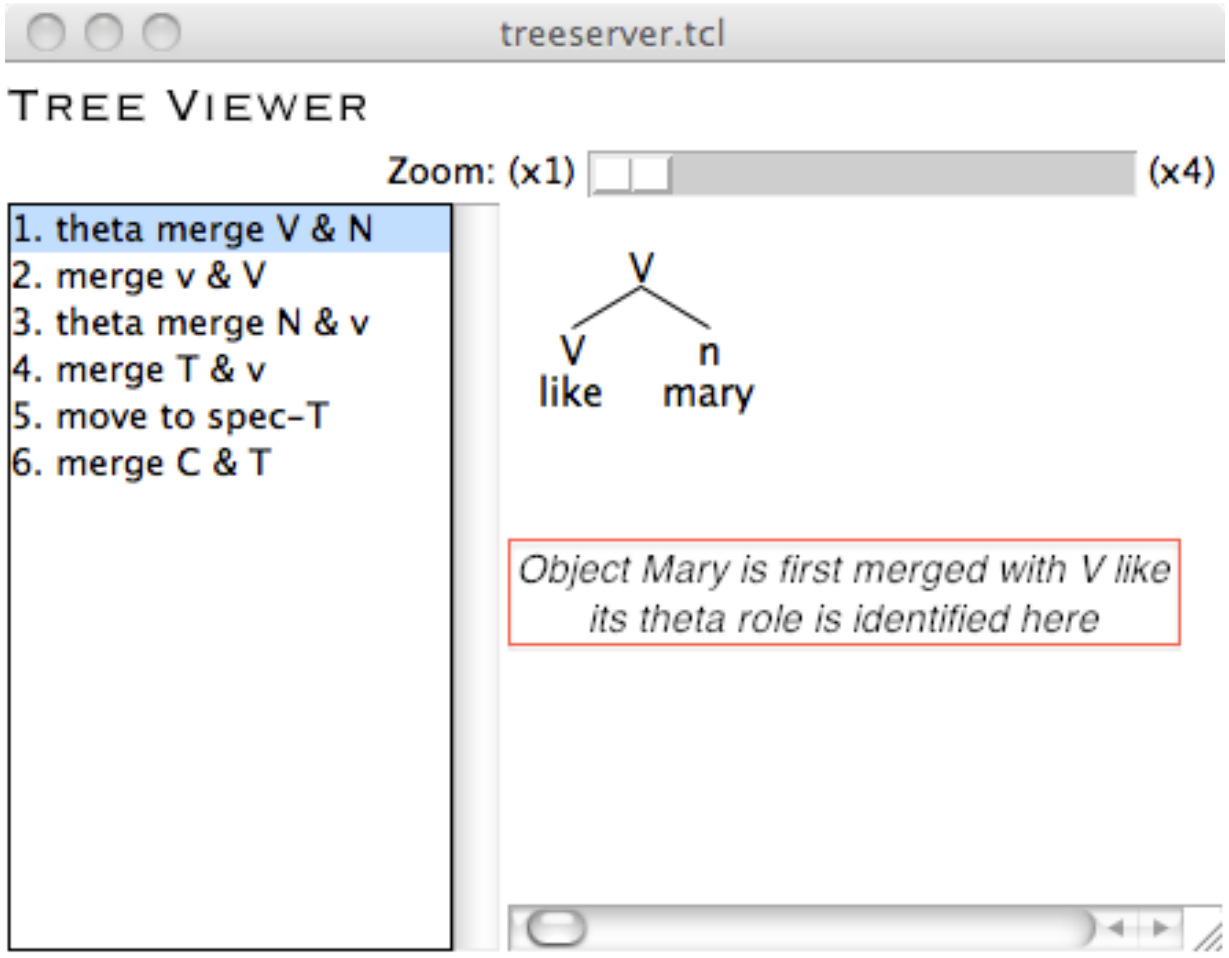
Introduction: Theory

Assumptions:

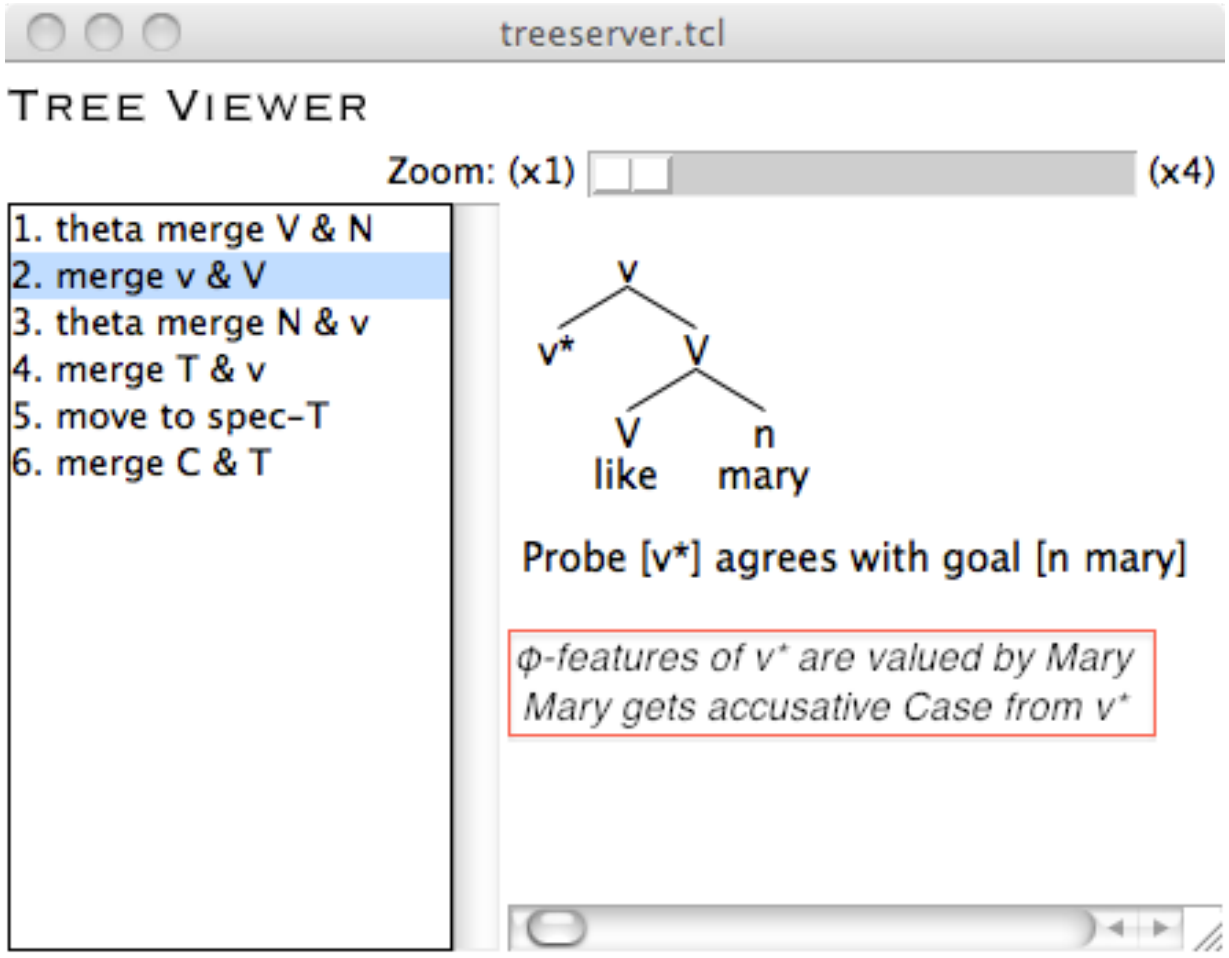
- Minimalist Program Chomsky (2000, 2001)
  - merge (external/internal)
  - uninterpretable/interpretable features
  - probe-goal search
  - (strong) phase boundaries (v*, c)

add: d headed by *self*
possessive *'s*
"sufficiently complex"

Introduction: Theory



Introduction: Theory



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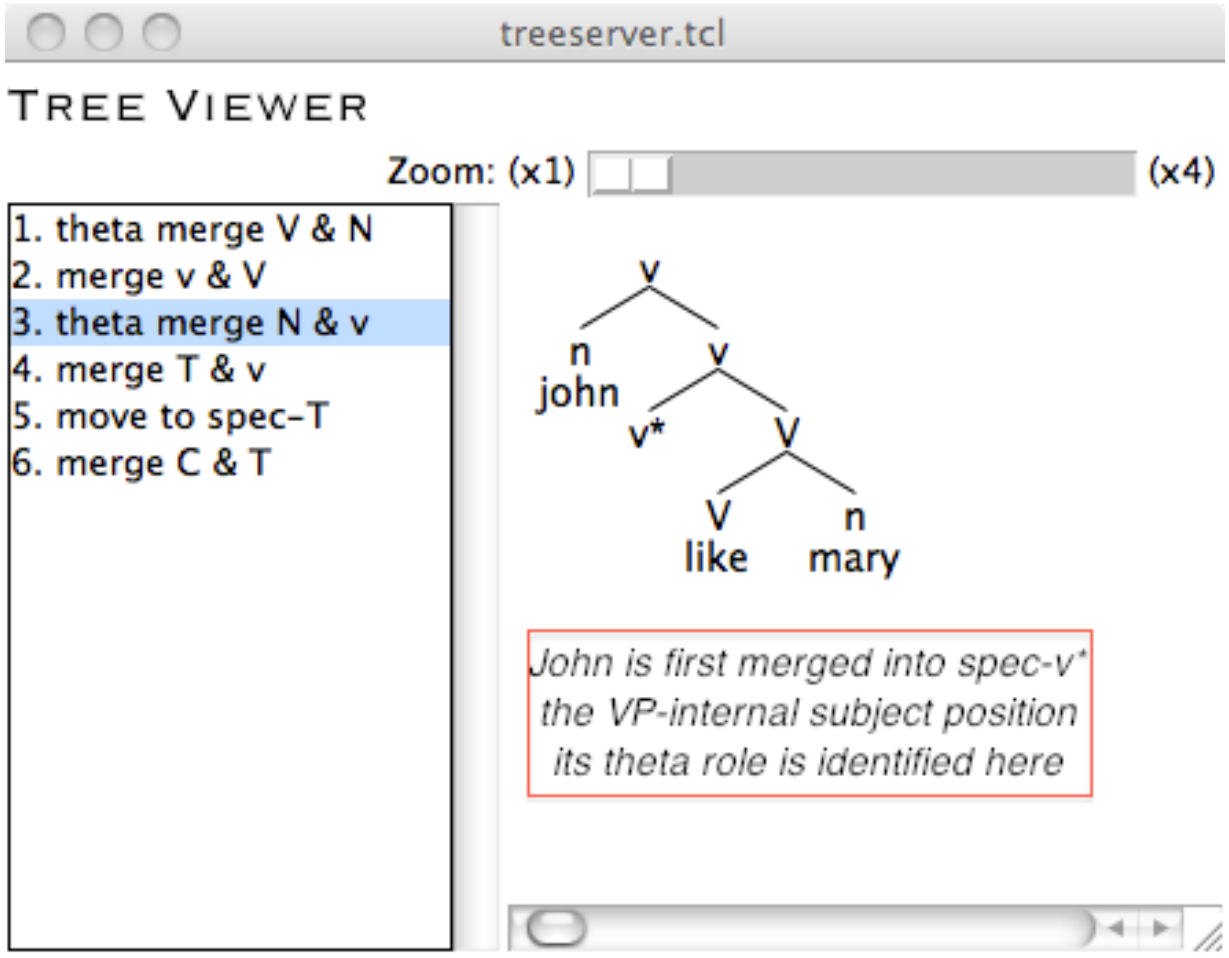

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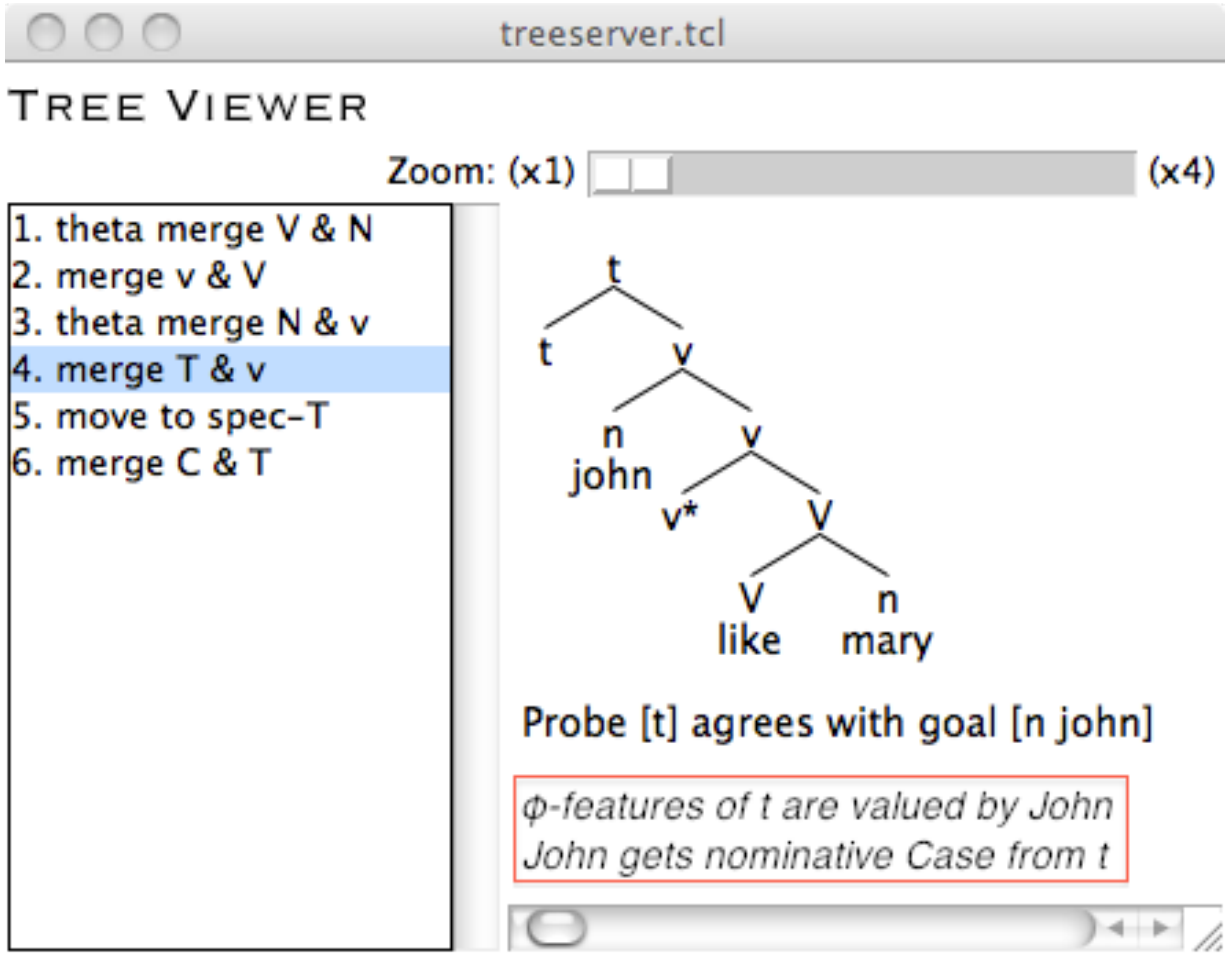
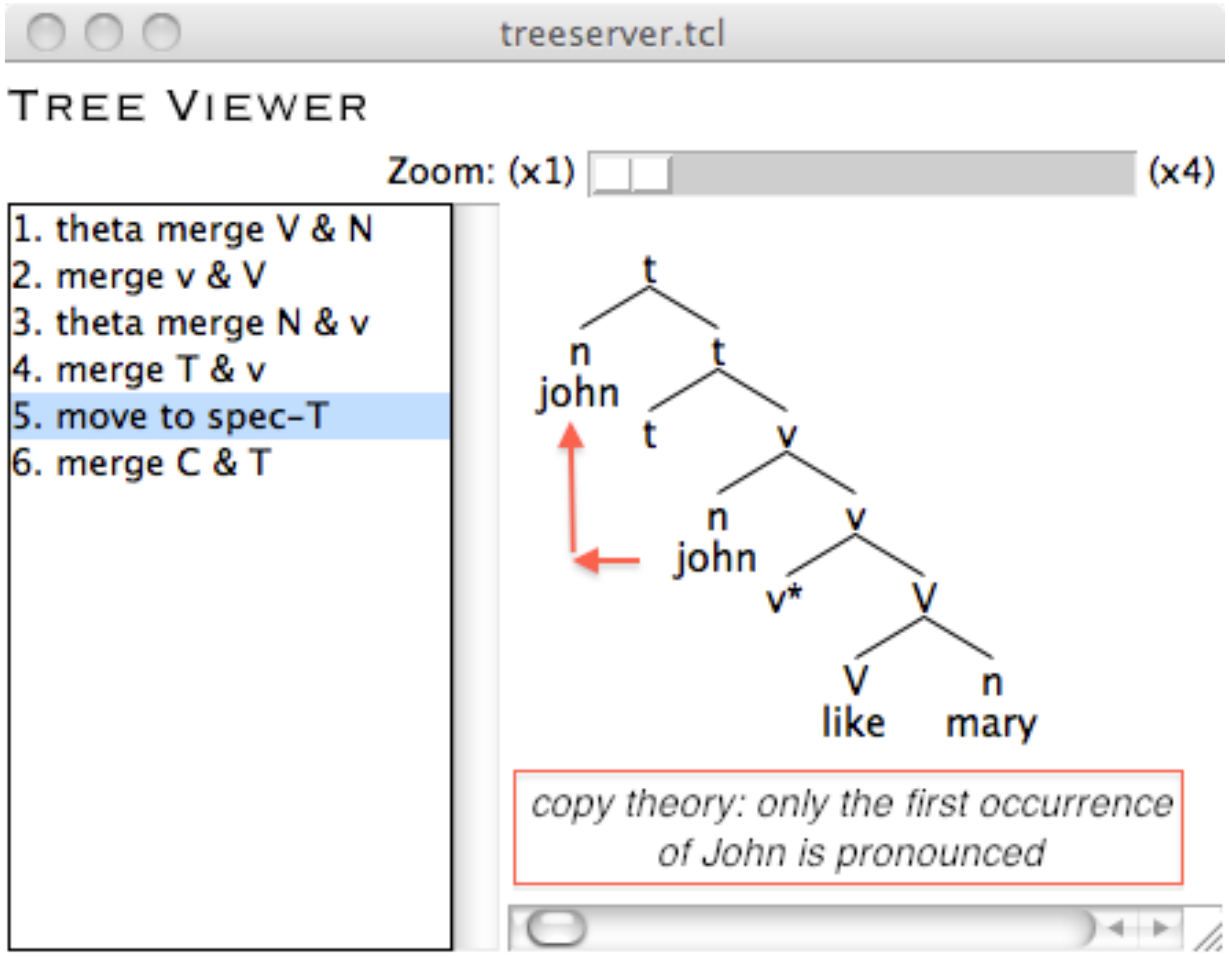
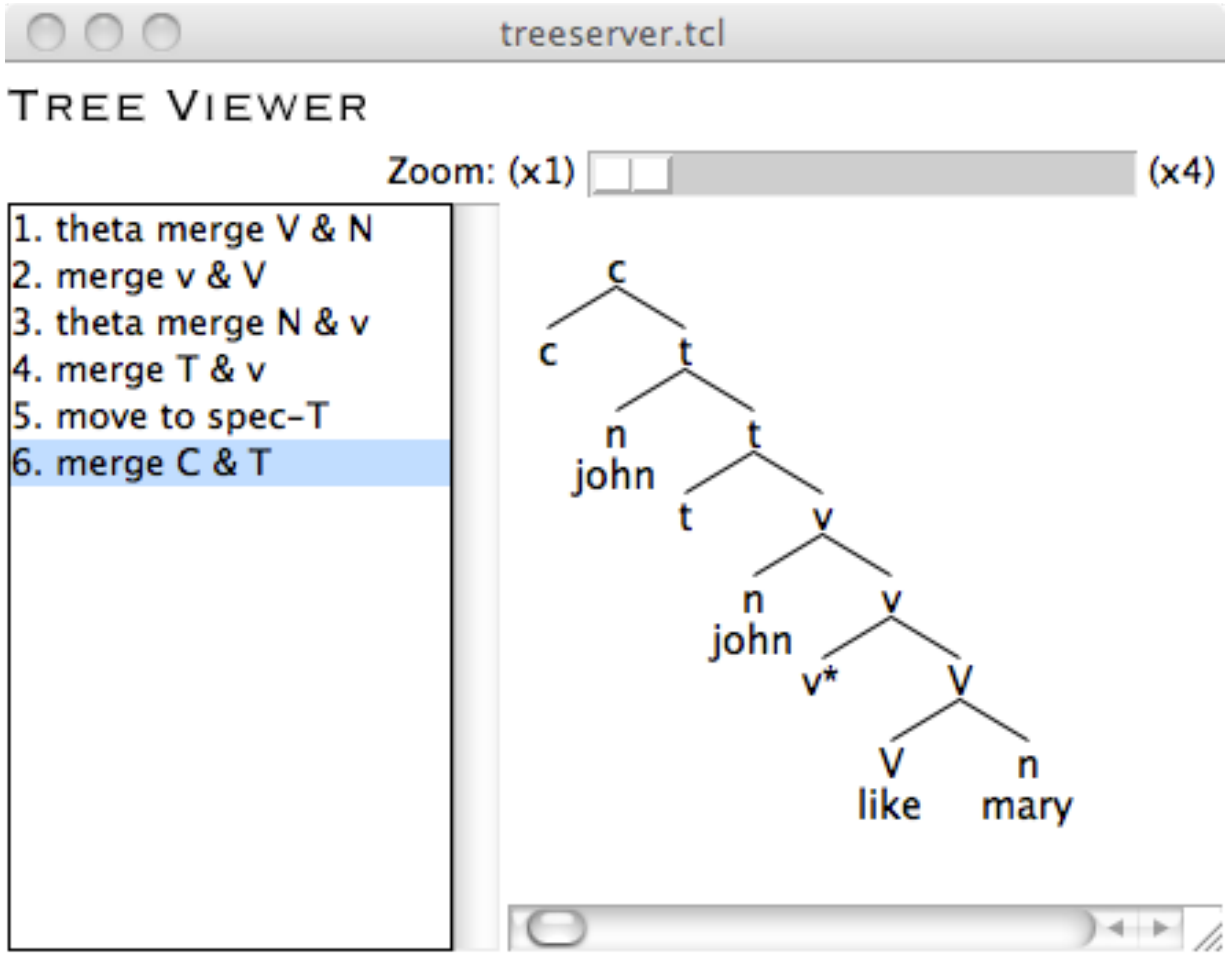


Introduction: Theory



Introduction: Theory



Introduction: Theory

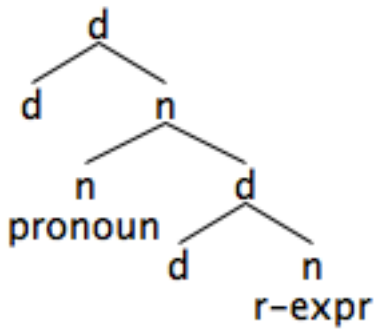
- Add Kayne's (2002) proposal
  - pronominal and r-expression
  - doubling constituent (DC): [spec head], e.g. [*John he*]
  - Stipulation: spec can move out of DC after DC moves first

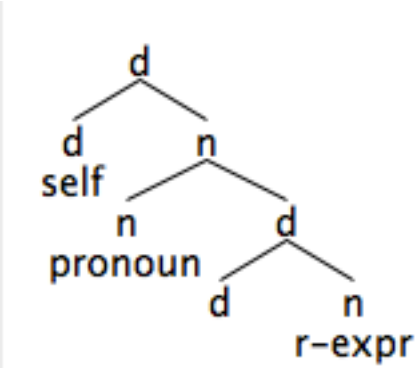
    $[_{TP}$ John thinks $[_{TP}$ [John he] is $[_{AP}$ smart [John he]]]]

Other related work:
Zwart (2002)
Heinat (2003)

- Our implementation of the DC:

1. merge D & N
2. merge N & D
3. merge D & N

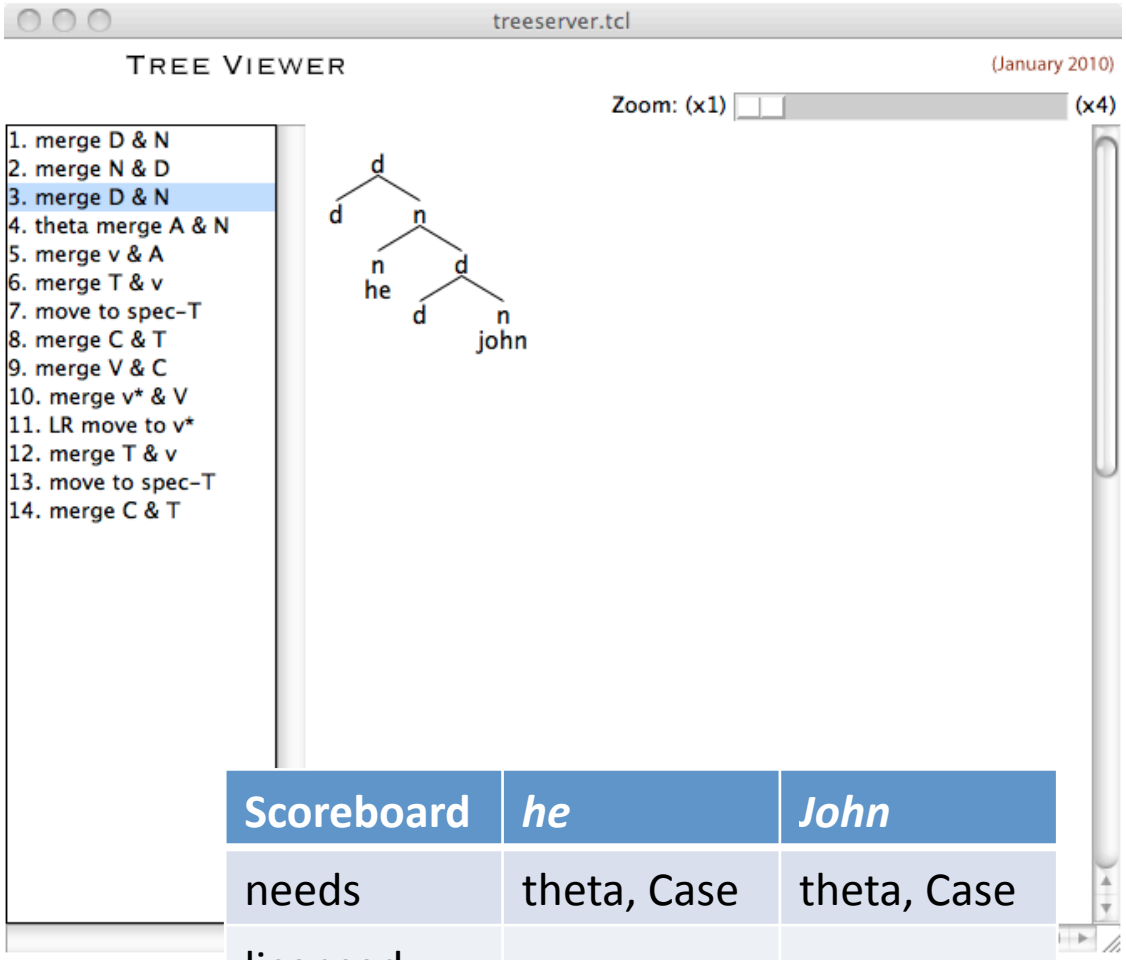




Both pronoun and r-expr
1. uninterpretable Case
2. interpretable φ-features
3. need theta-role

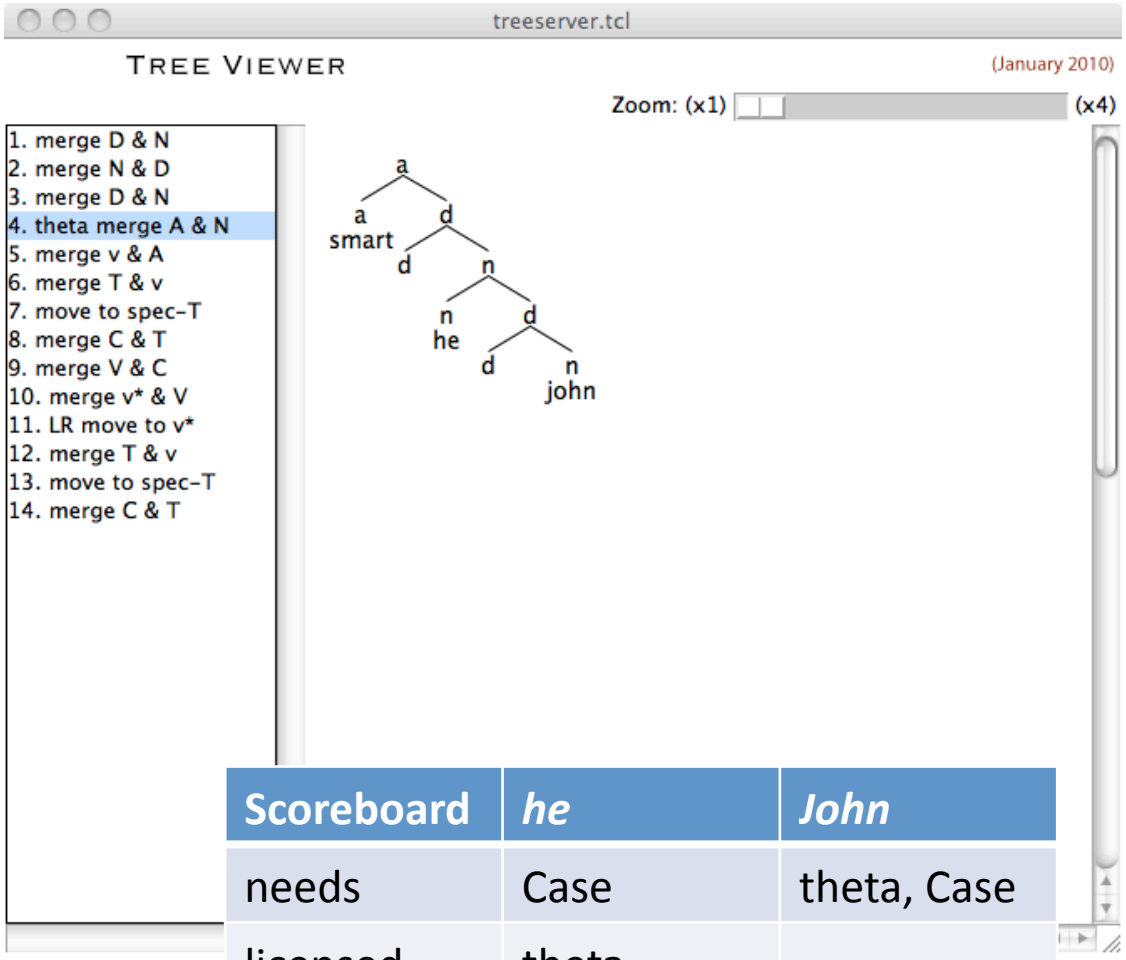
reflexive anaphor
4. phase boundary

John thinks he is smart



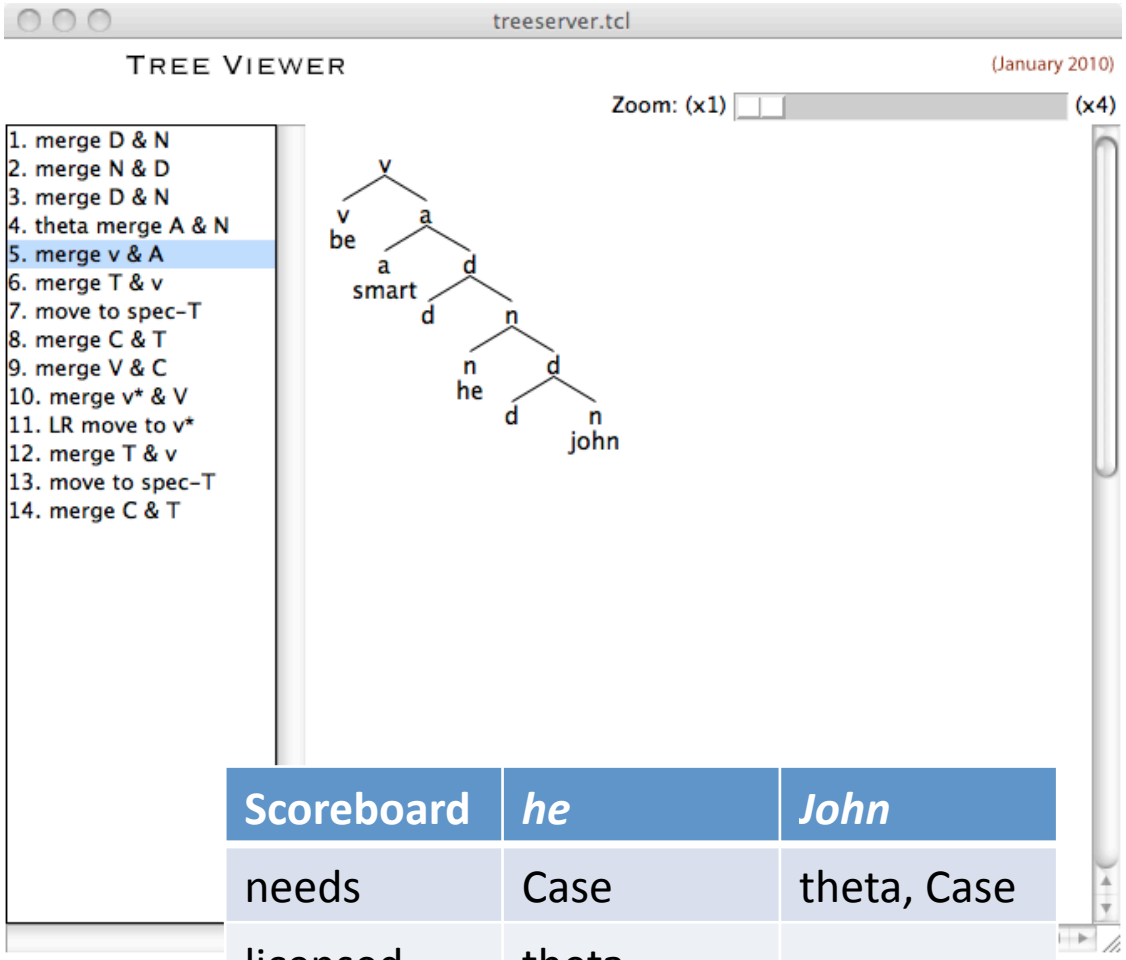
Scoreboard	*he*	*John*
needs	theta, Case	theta, Case
licensed		

John thinks he is smart



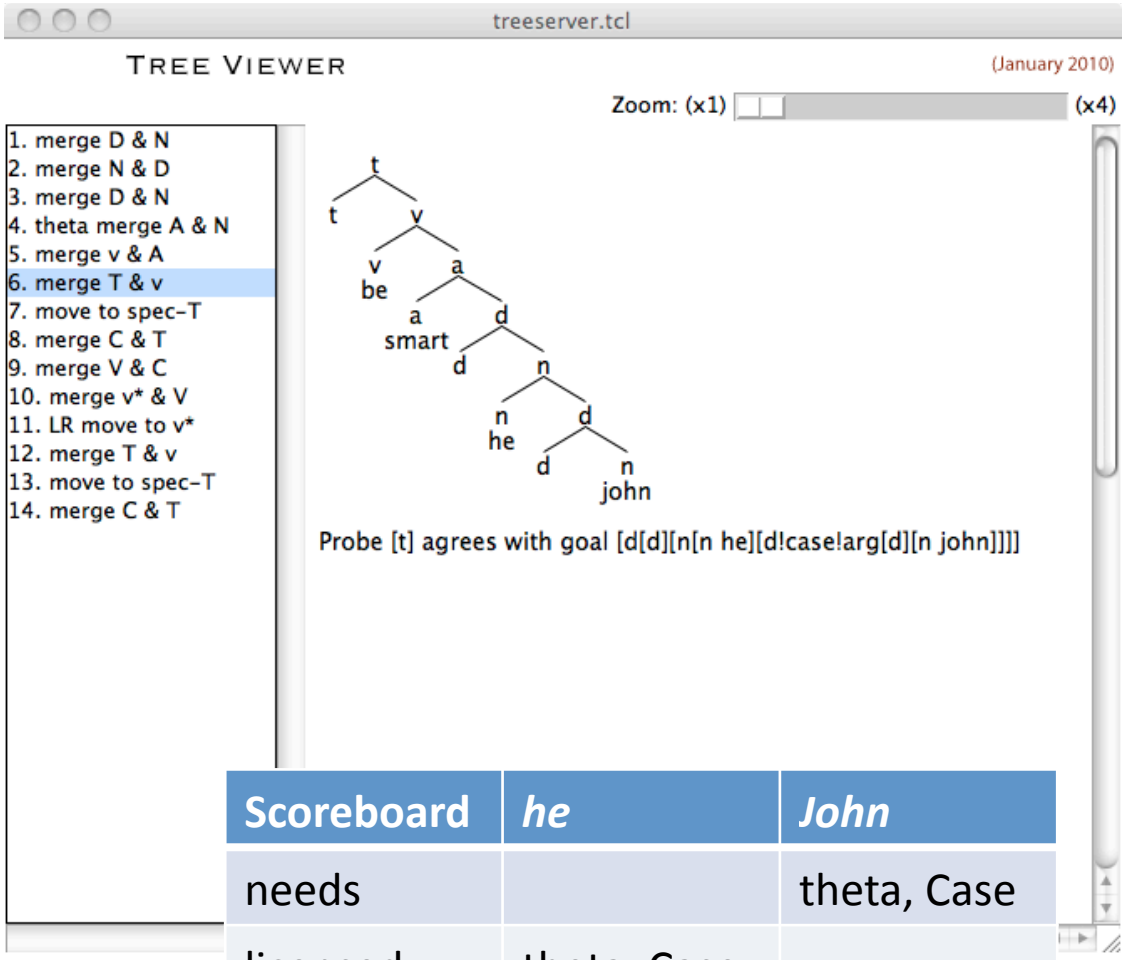
Scoreboard	*he*	*John*
needs	Case	theta, Case
licensed	theta	

John thinks he is smart



Scoreboard	*he*	*John*
needs	Case	theta, Case
licensed	theta	

John thinks he is smart



Scoreboard	*he*	*John*
needs		theta, Case
licensed	theta, Case	

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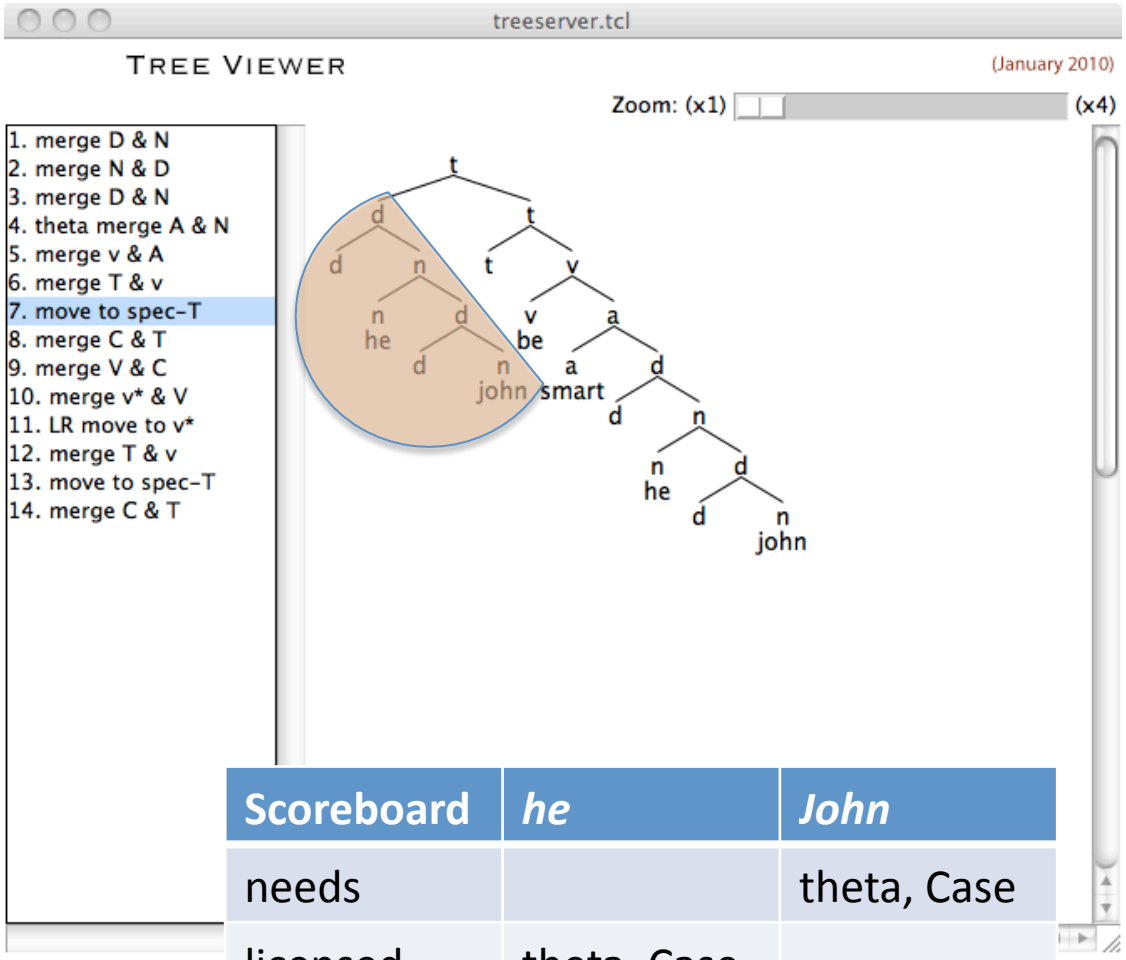

Scoreboard	*he*	*John*
needs		theta, Case
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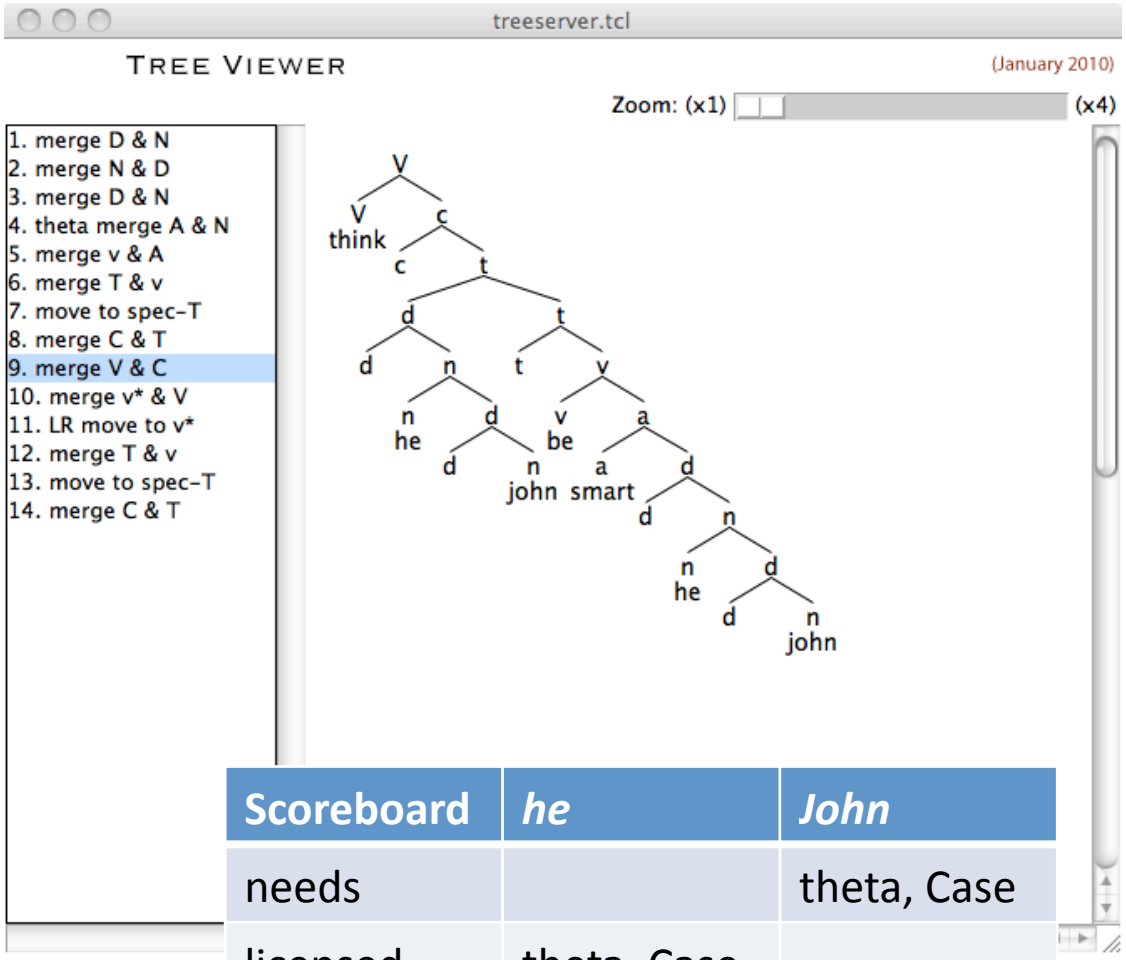
John thinks he is smart



Scoreboard	*he*	*John*
needs		theta, Case
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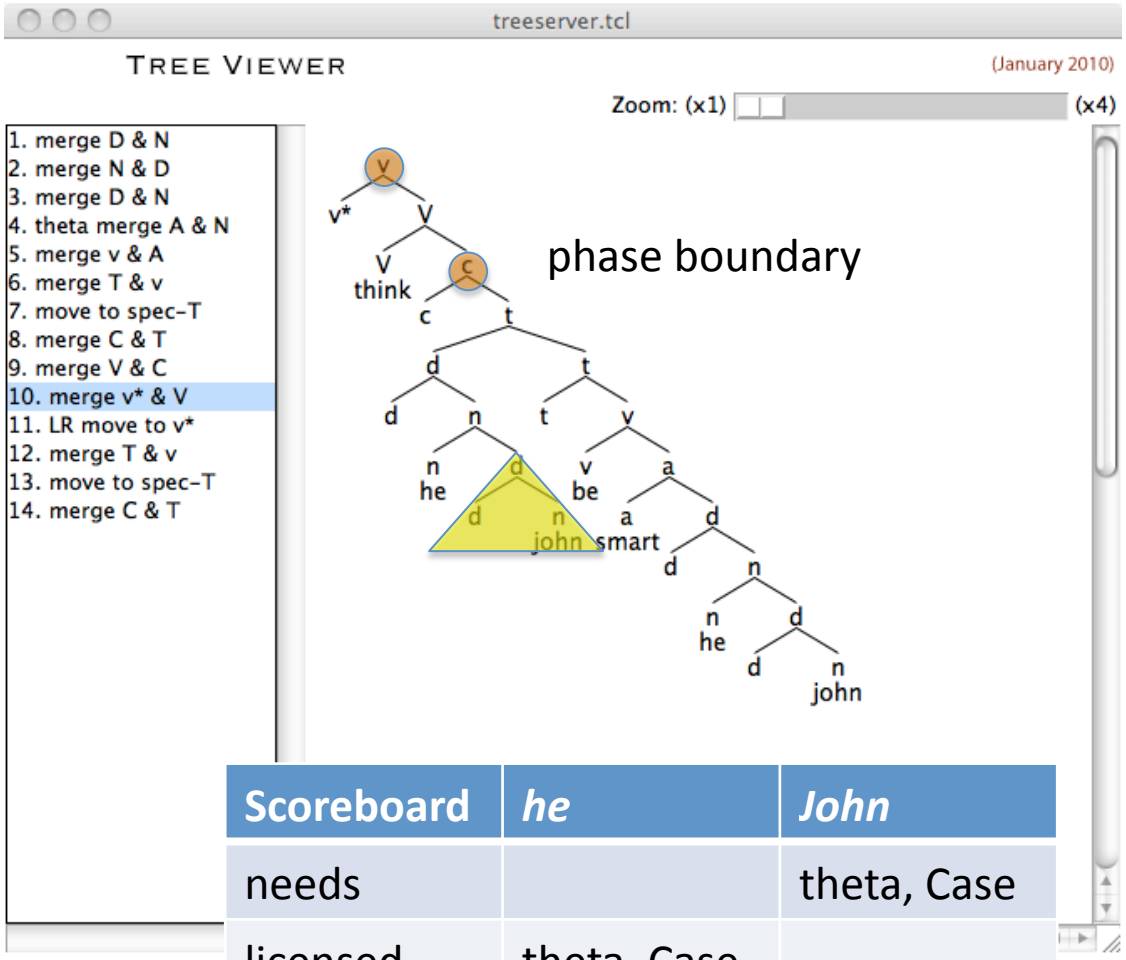
John thinks he is smart



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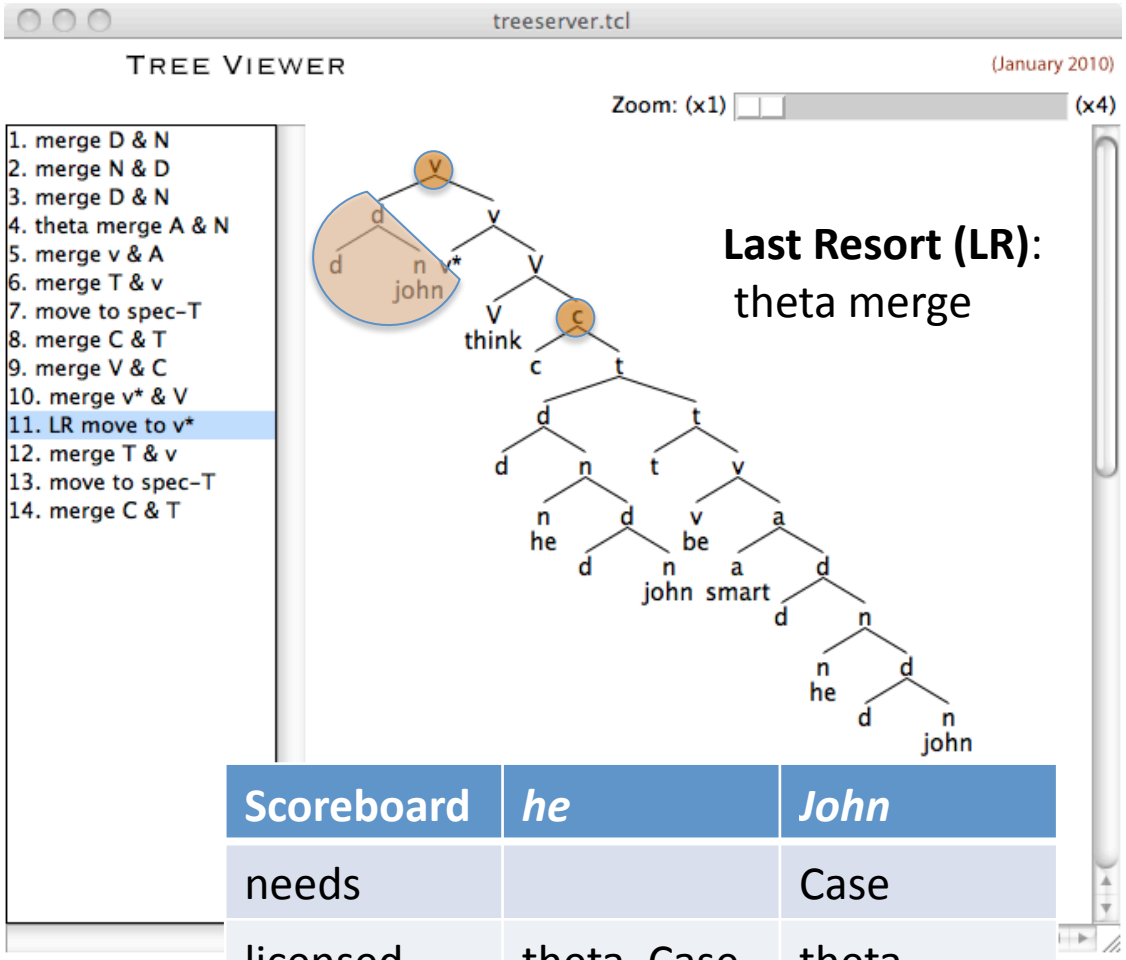
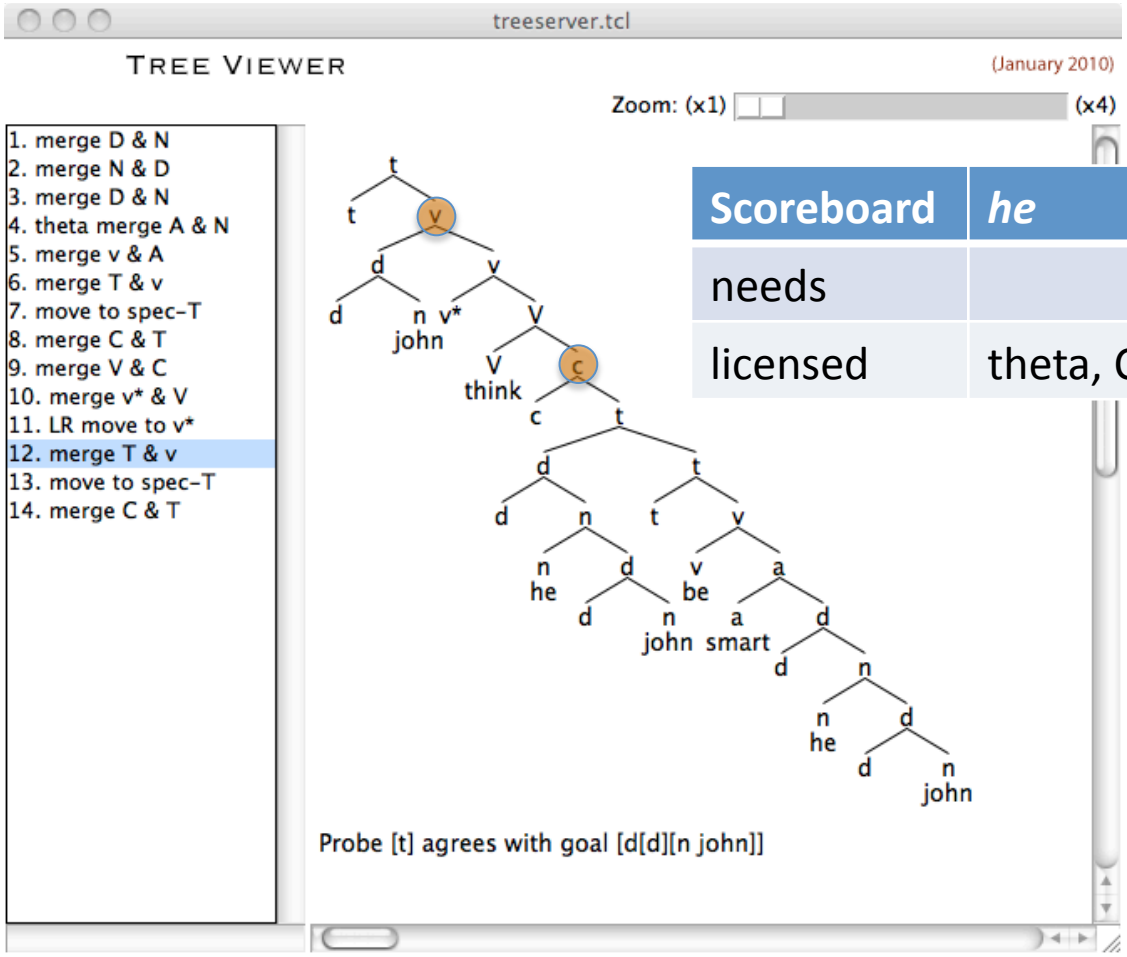
John thinks he is smart



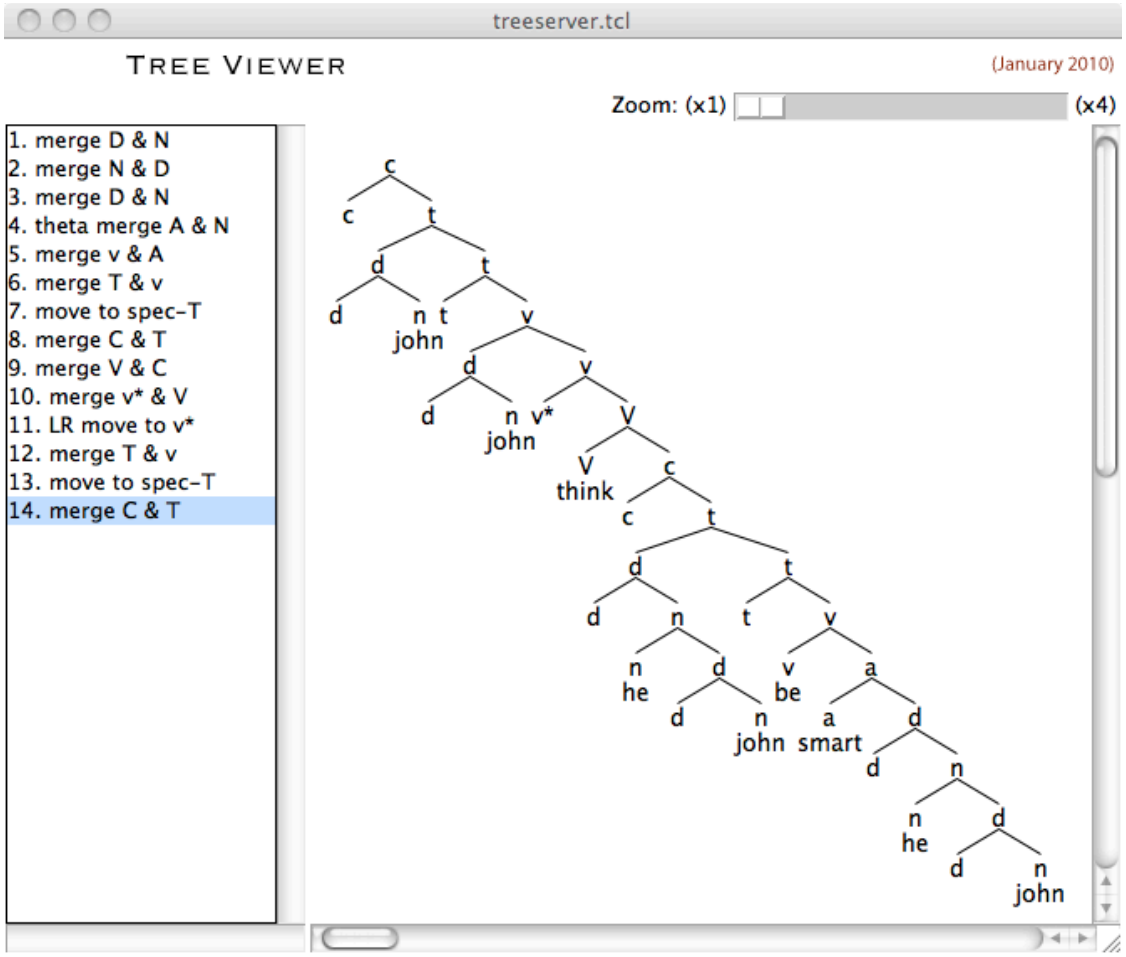
Scoreboard	*he*	*John*
needs		Case
licensed	theta, Case	theta

John thinks he is smart

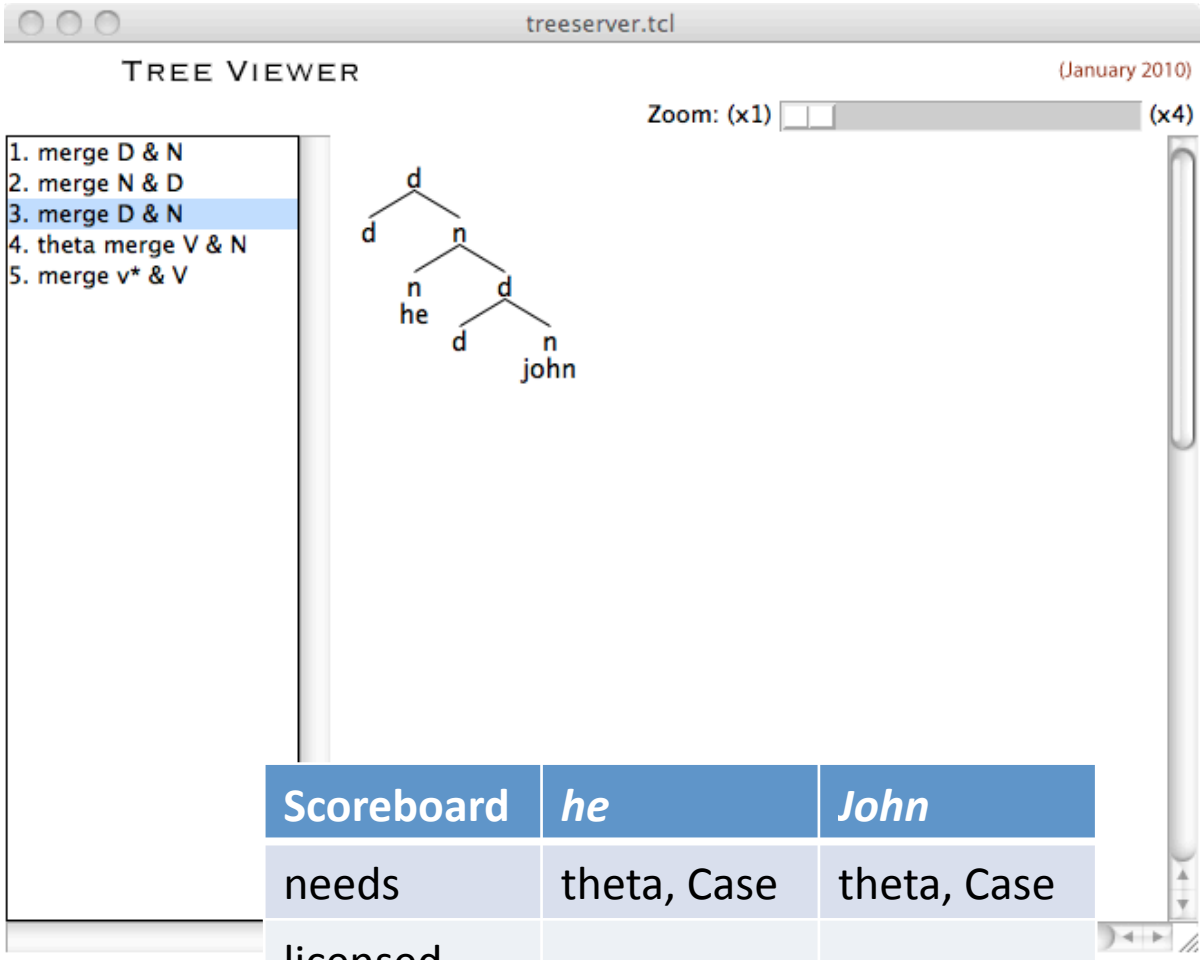


Scoreboard	*he*	*John*
needs		
licensed	theta, Case	theta, Case

John thinks he is smart



*John praises him



Scoreboard	*he*	*John*
needs	theta, Case	theta, Case
licensed		

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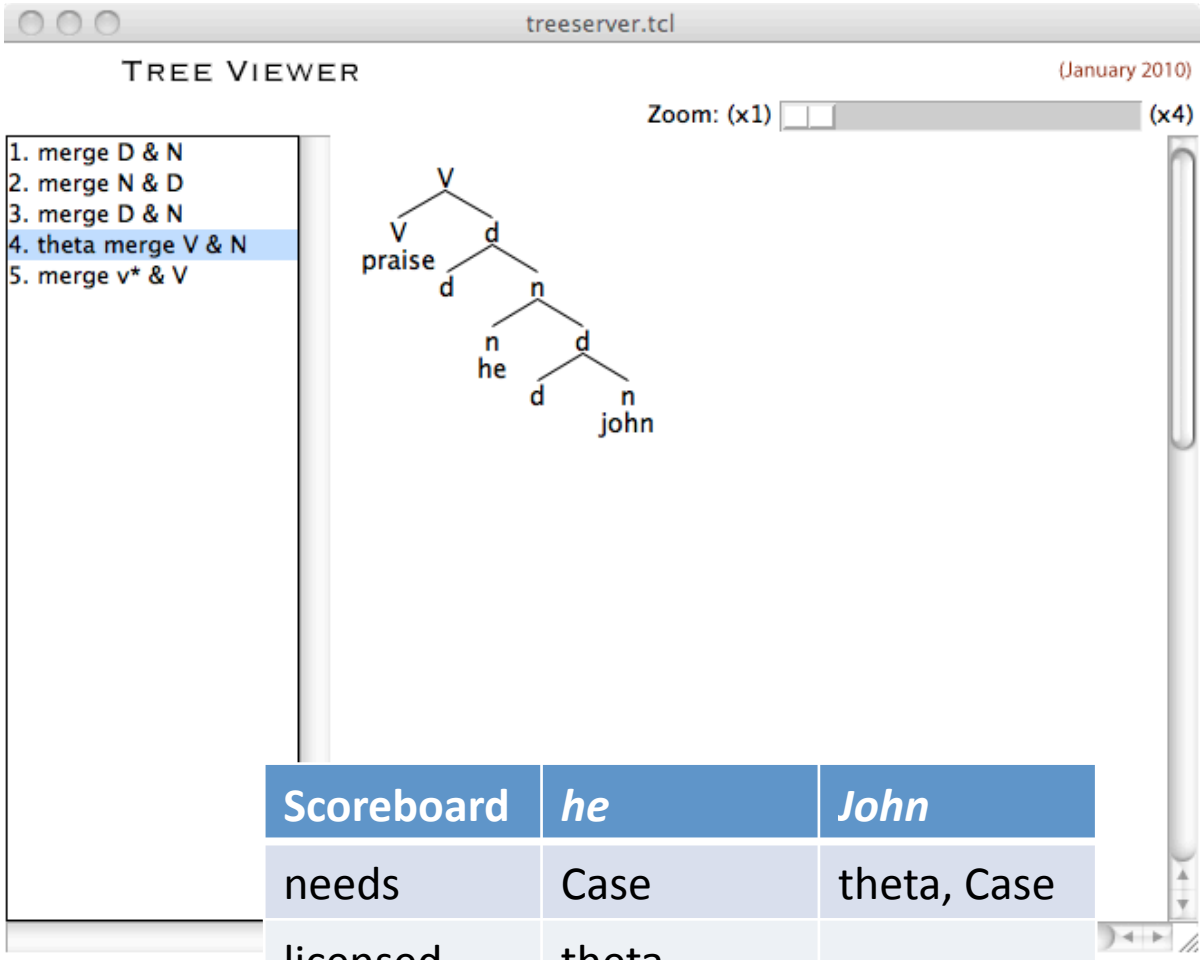
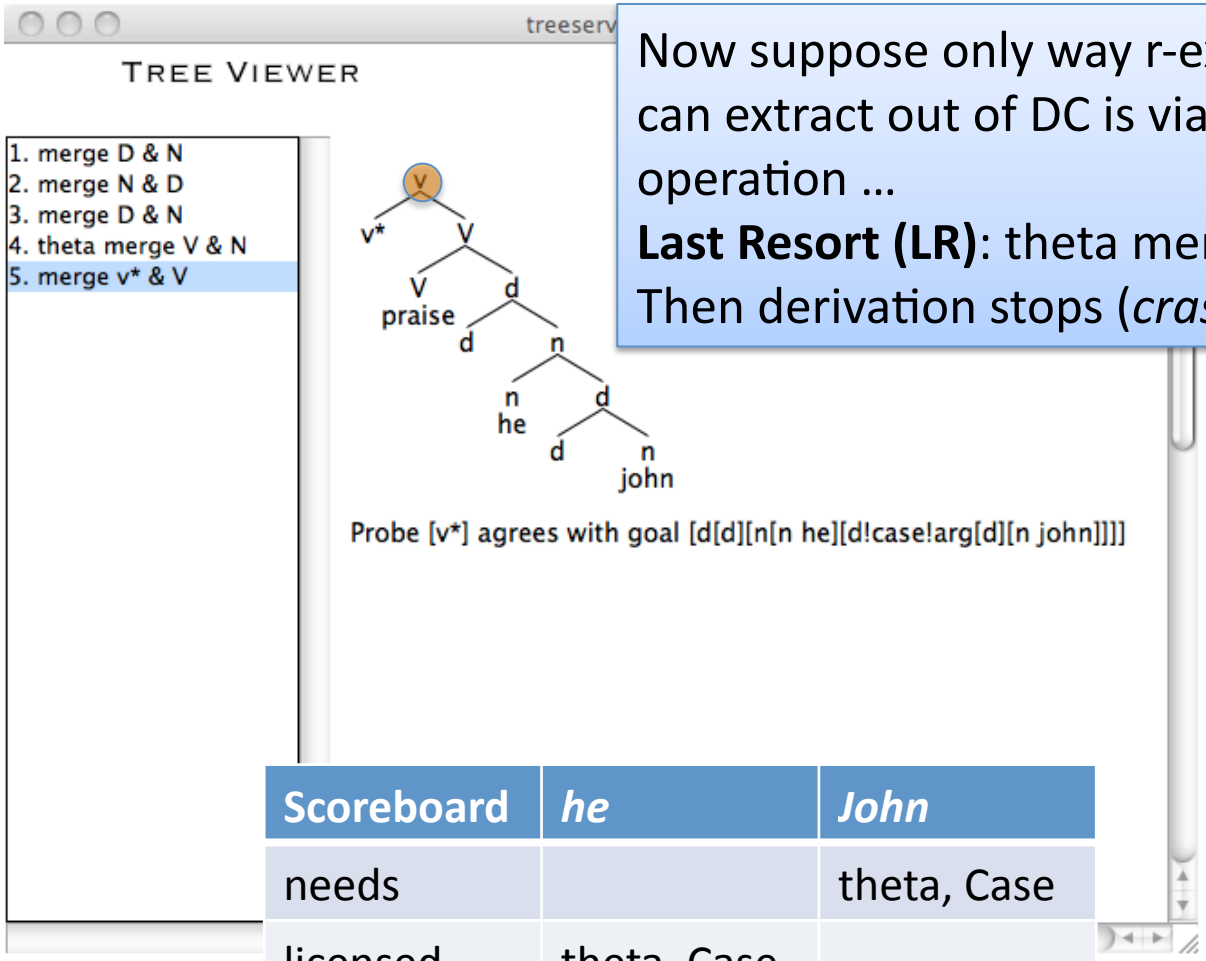


Scoreboard	*he*	*John*
needs	Case	theta, Case
licensed	theta	

*John praises him



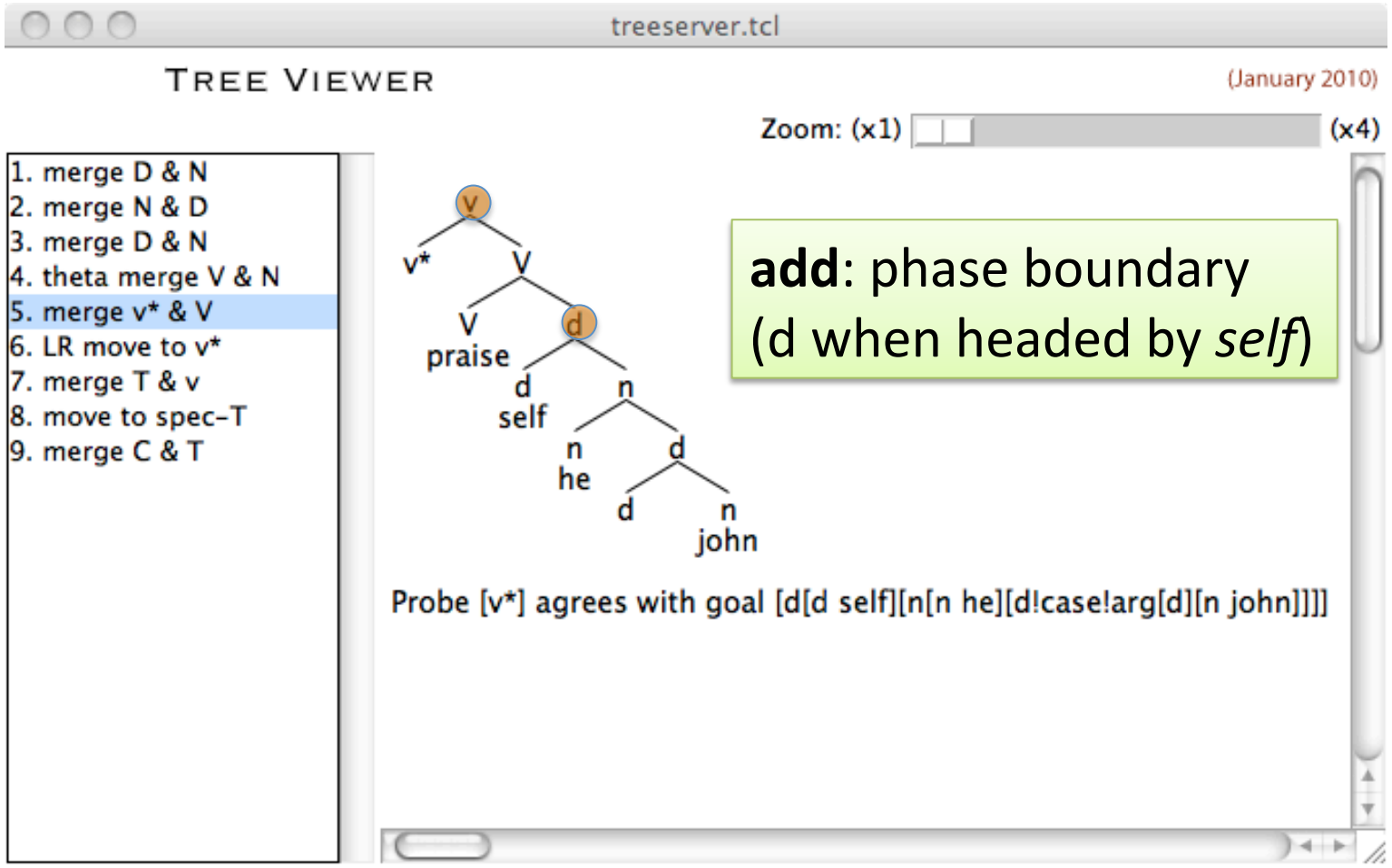
Now suppose only way r-expr *John* can extract out of DC is via that operation …

Last Resort (LR): theta merge

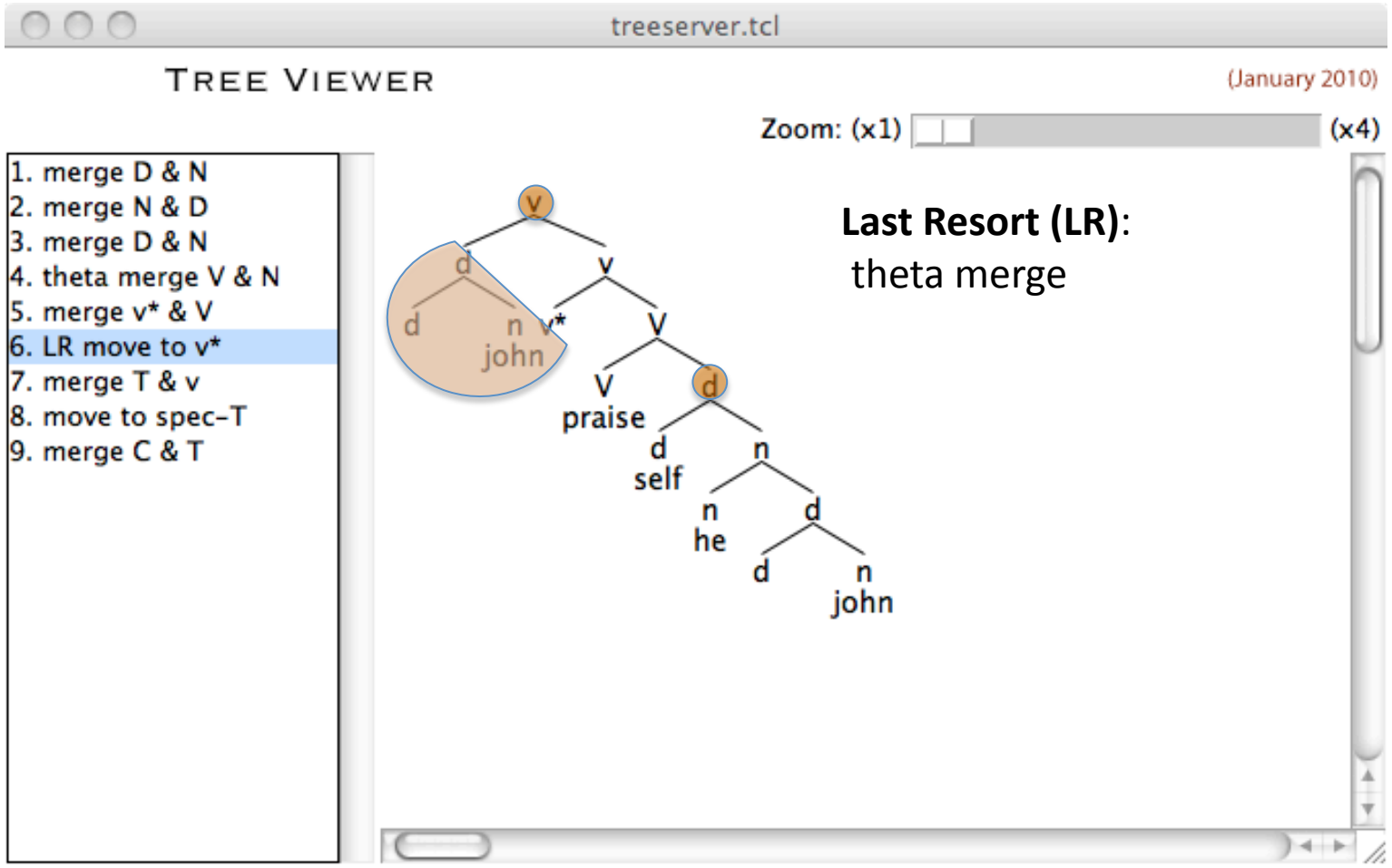
Then derivation stops (*crashes*)

Scoreboard	*he*	*John*
needs		theta, Case
licensed	theta, Case	

John praises himself



John praises himself



Introduction: Data

- Classic Binding Theory data:

  *John$_i$ praises him$_i$

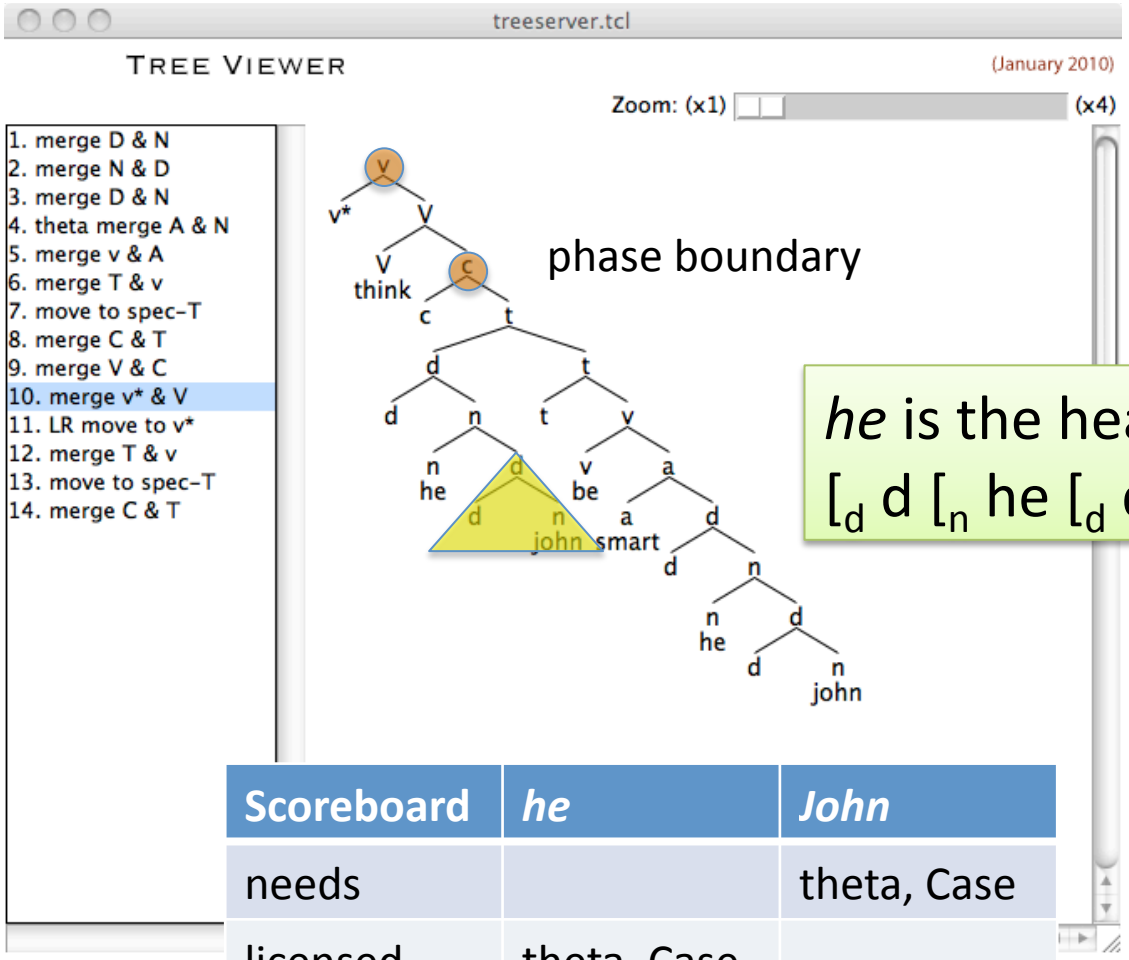
  John$_i$ praises himself$_i$

  John$_i$ thinks he$_i$ is smart

  *He$_i$ thinks John$_i$ is smart

- Kayne's (2002) proposal
  - DC: [spec head], e.g. [*John he*]
  - only the specifier may move (not the head)

*He$_i$ thinks John$_i$ is smart



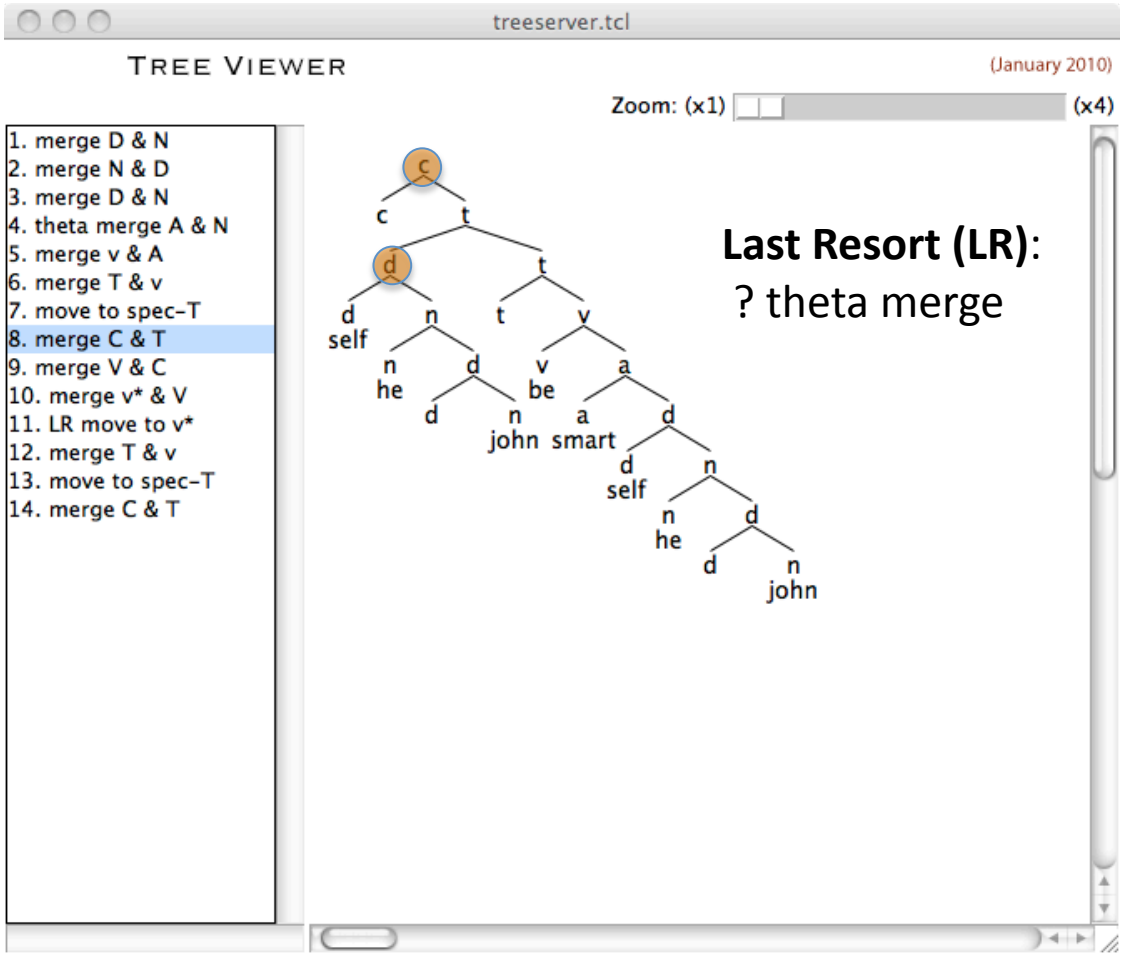
he is the head in
[$_d$ d [$_n$ he [$_d$ d [$_n$ John]]]]

Scoreboard	*he*	*John*
needs		theta, Case
licensed	theta, Case	

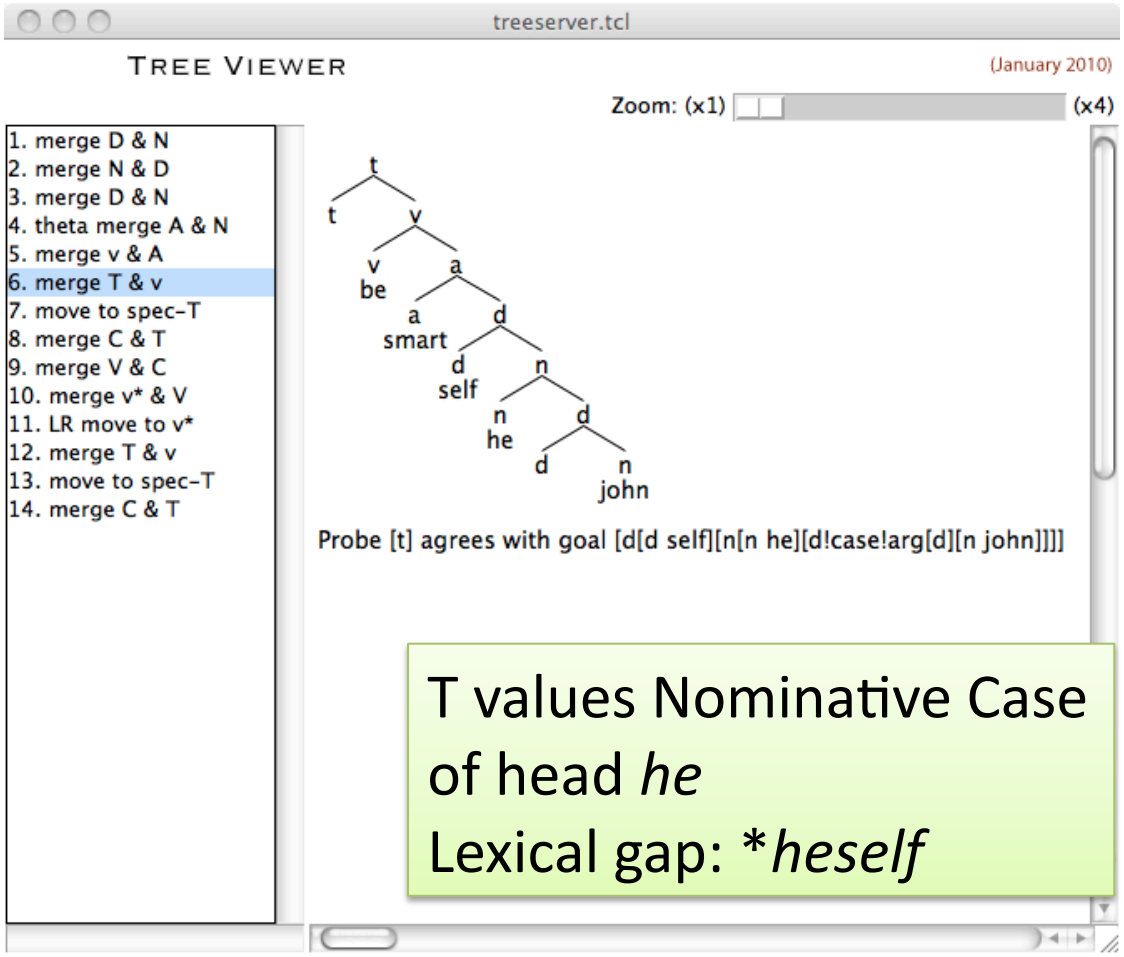
Introduction: Data

- Classic Binding Theory data:
  - *John$_i$ praises him$_i$
  - John$_i$ praises himself$_i$
  - John$_i$ thinks he$_i$ is smart
  - *He$_i$ thinks John$_i$ is smart
  - *John$_i$ thinks himself$_i$ is smart
  - *John$_i$ thinks that Mary likes himself$_i$
  - John$_i$ considers himself$_i$ to be intelligent
  - *John$_i$ considers him$_i$ to be intelligent

*John thinks himself is smart



*John thinks himself is smart



Introduction: Data

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  - *John$_i$ thinks that Mary likes himself$_i$
  - John$_i$ considers himself$_i$ to be intelligent
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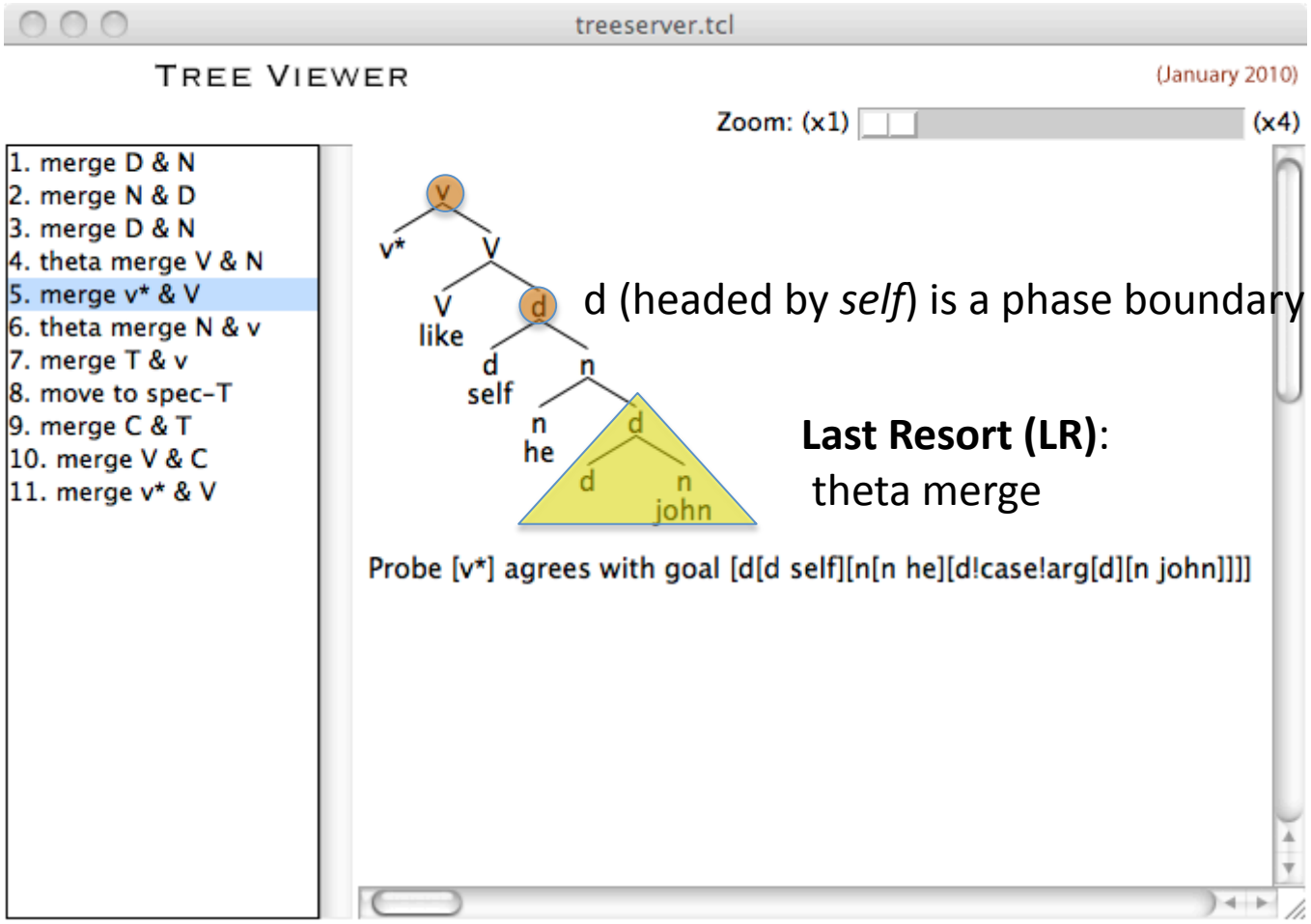
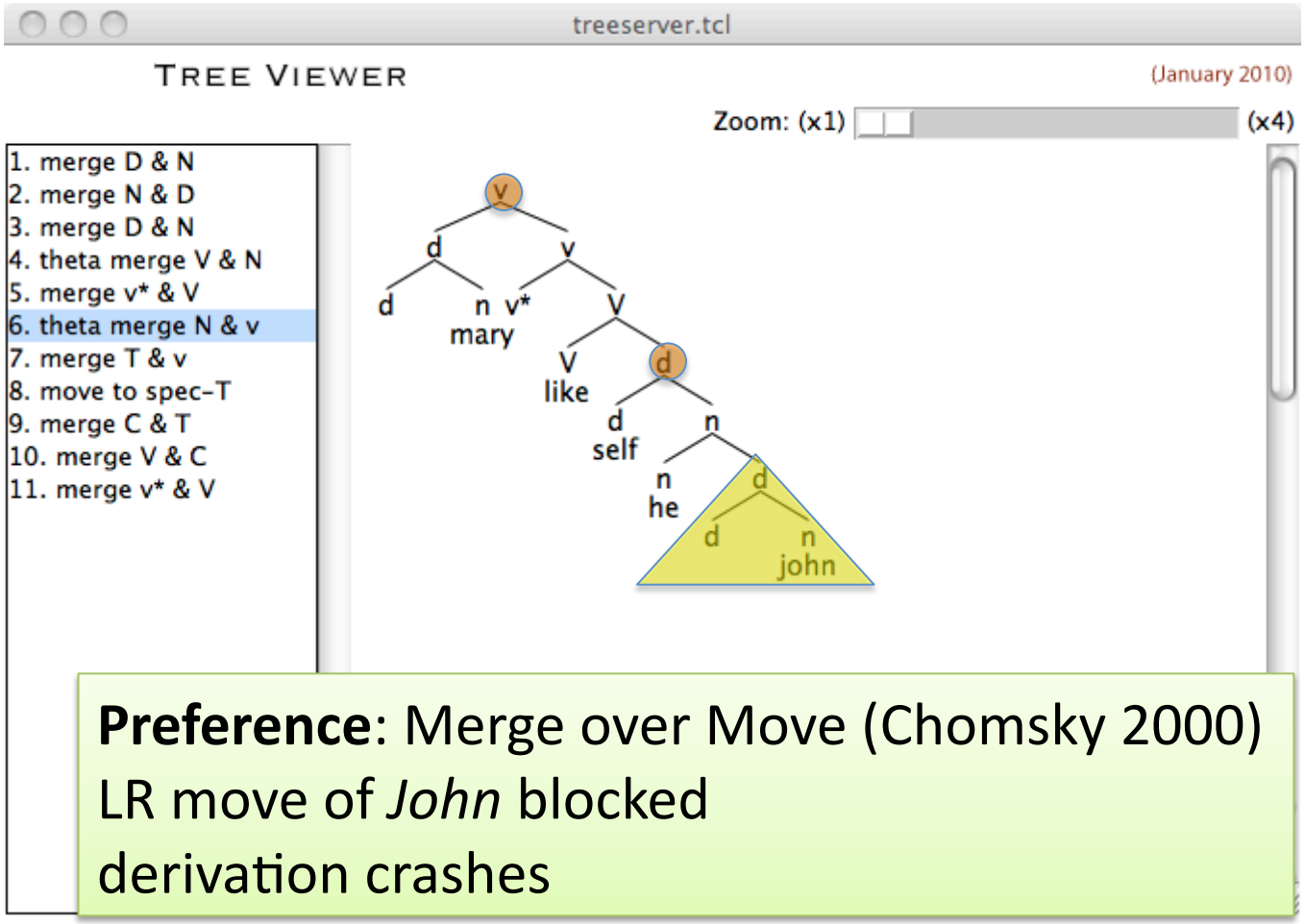
*John thinks that Mary likes himself



*John thinks that Mary likes himself



Preference: Merge over Move (Chomsky 2000)
LR move of *John* blocked
derivation crashes

Introduction: Data

- Classic Binding Theory data:
  - *John$_i$ praises him$_i$
  - John$_i$ praises himself$_i$
  - John$_i$ thinks he$_i$ is smart
  - *He$_i$ thinks John$_i$ is smart
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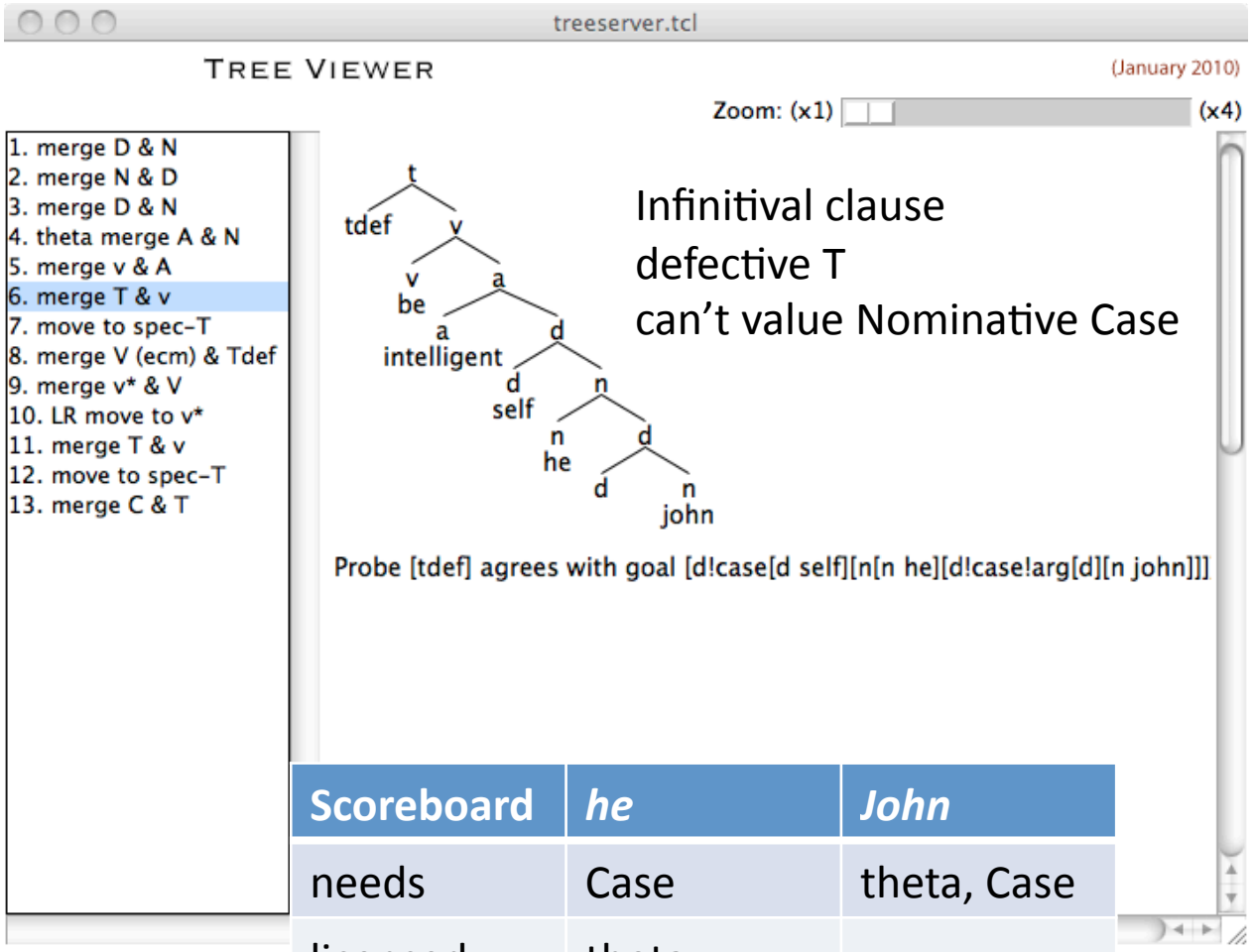
  - *John$_i$ thinks that Mary likes himself$_i$
  - John$_i$ considers himself$_i$ to be intelligent
  - *John$_i$ considers him$_i$ to be intelligent

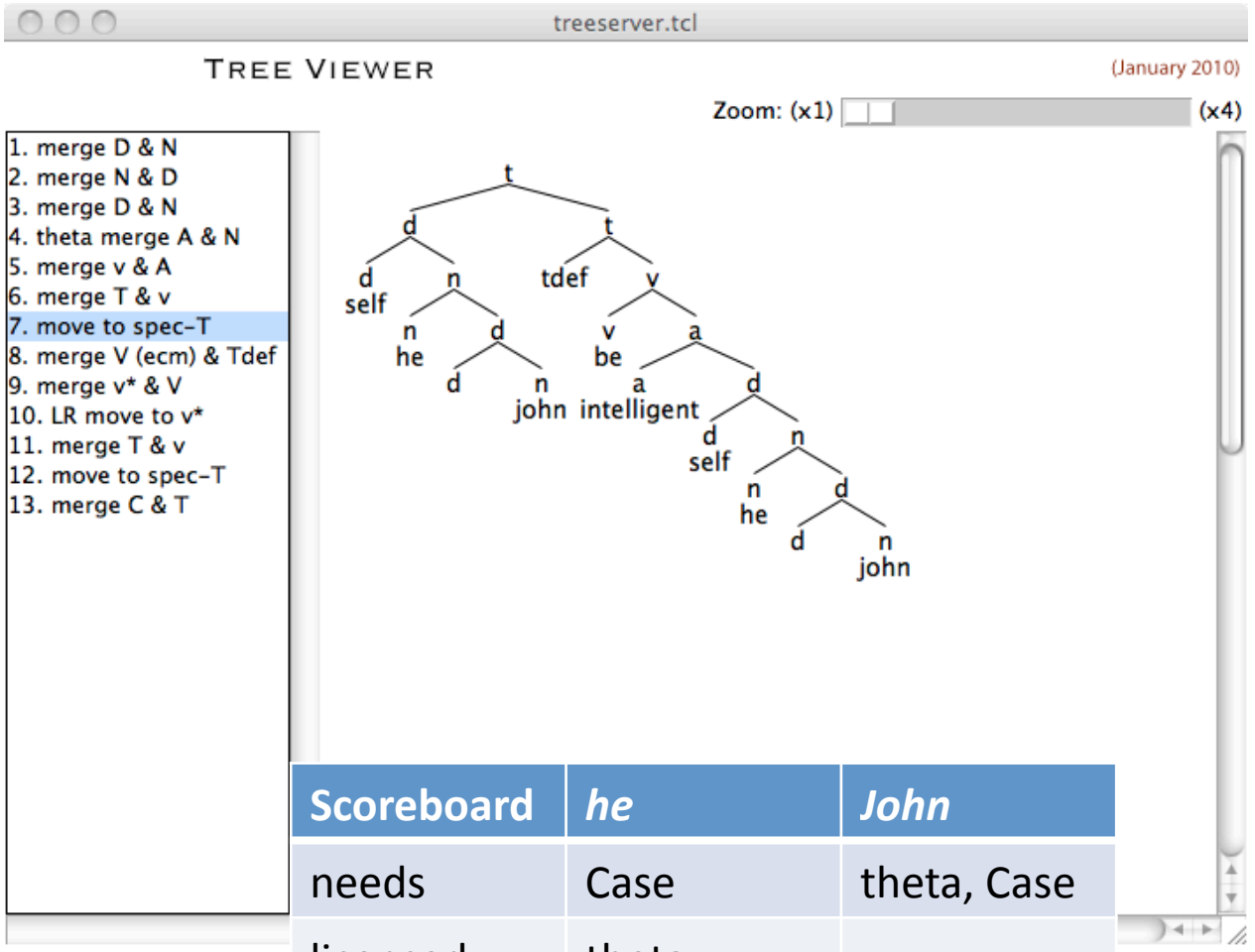
Exceptional Case Marking (ECM)

John considers himself to be intelligent



Scoreboard	*he*	*John*
needs	Case	theta, Case
licensed	theta	

John considers himself to be intelligent



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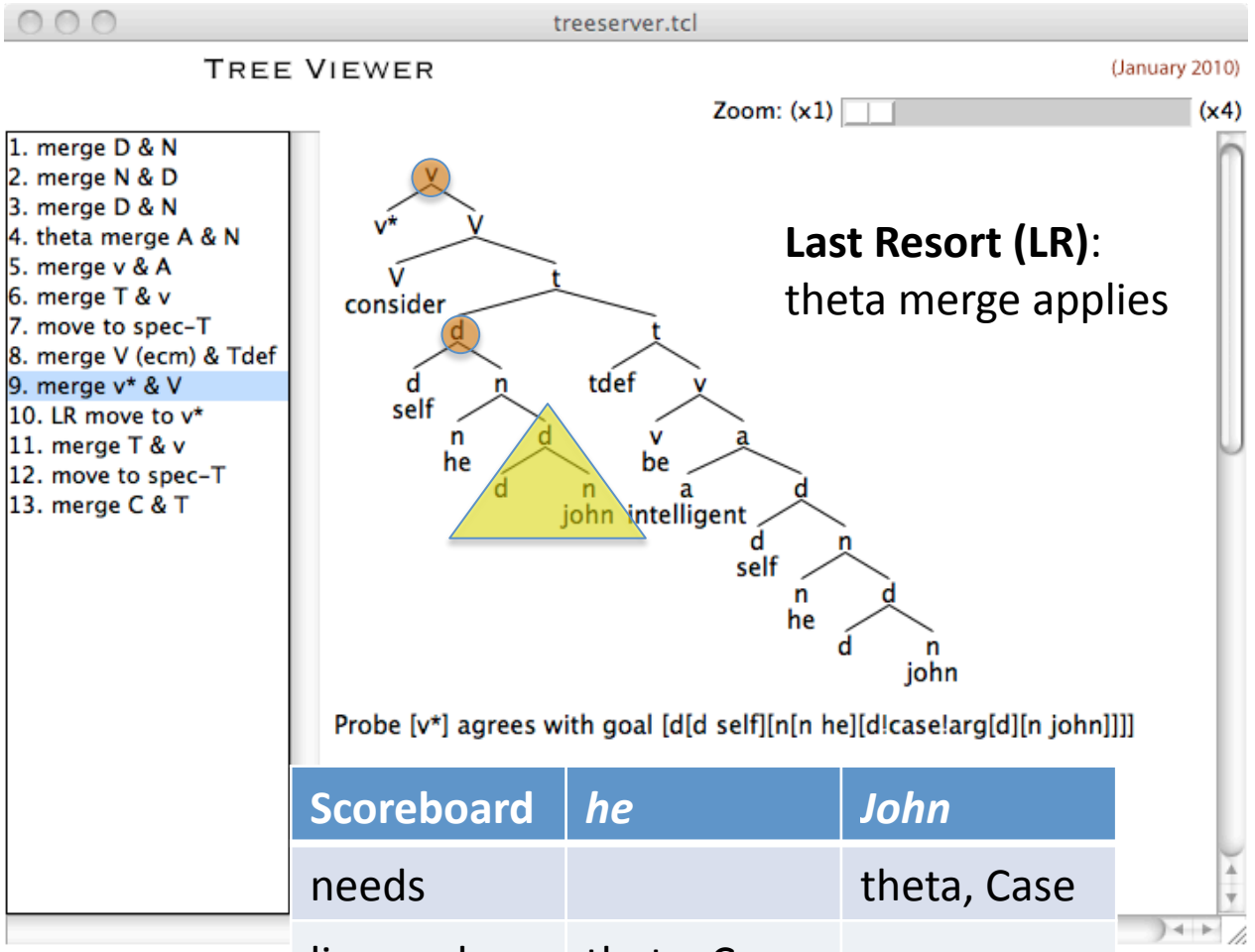
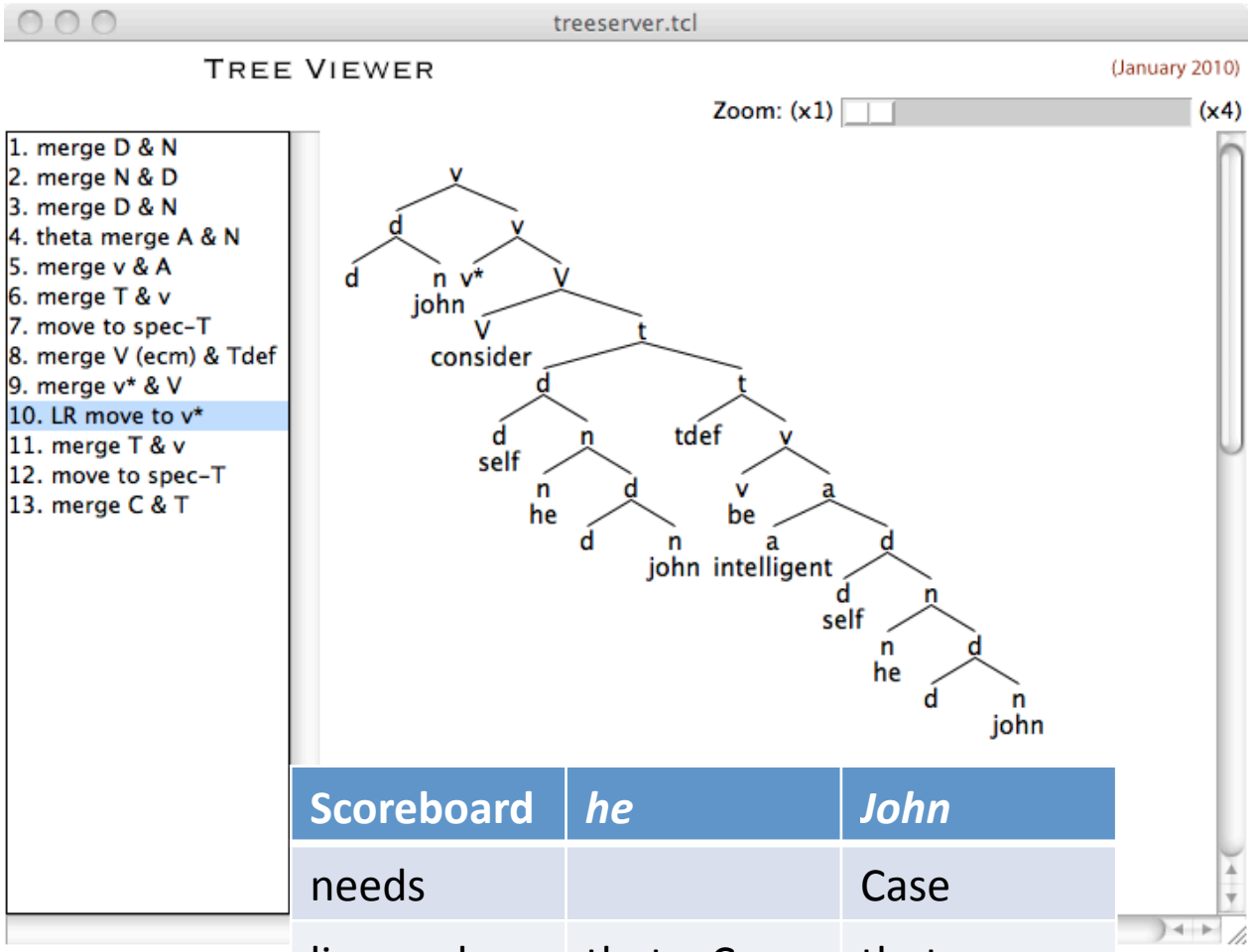


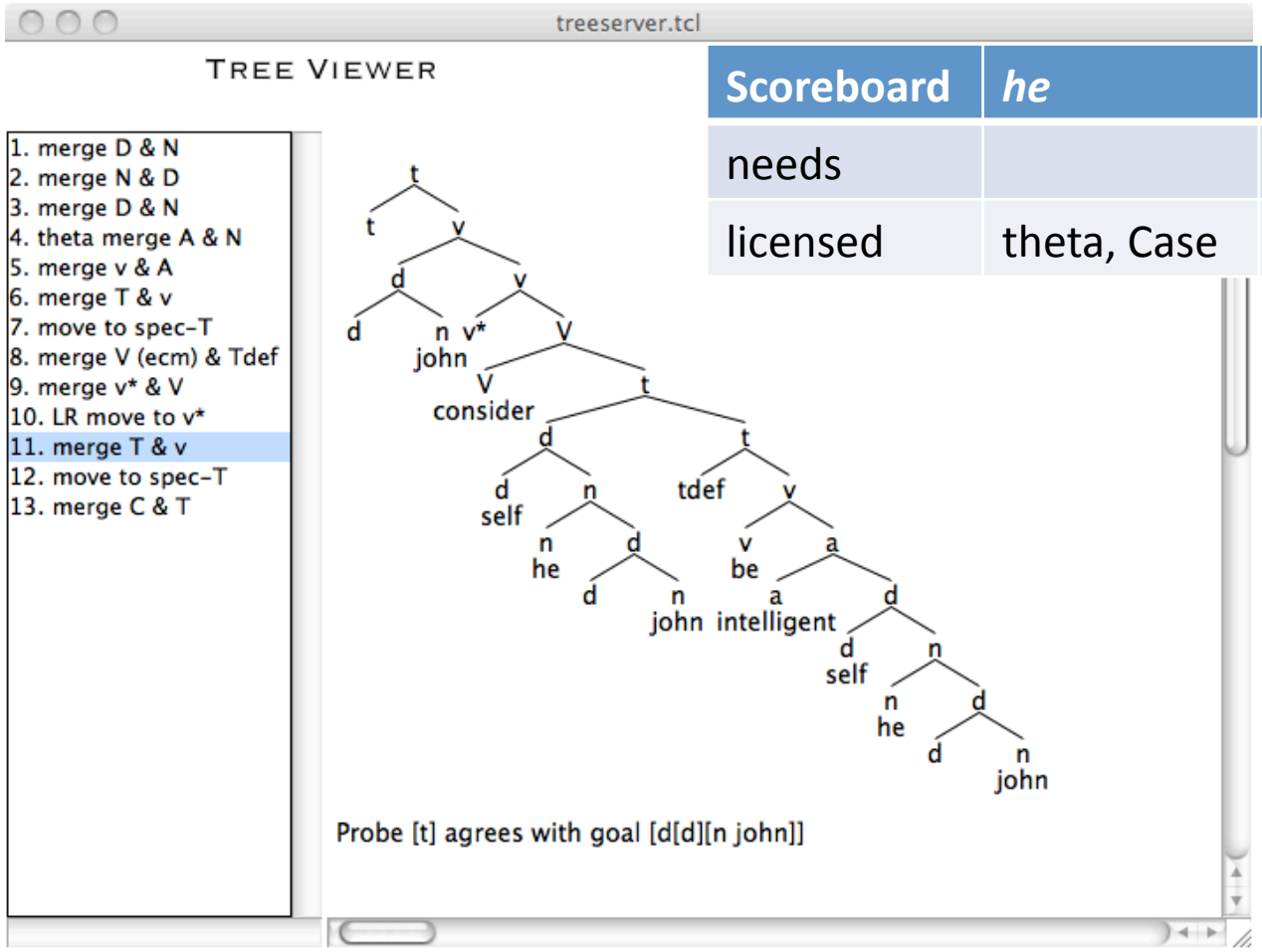
Scoreboard	*he*	*John*
needs		theta, Case
licensed	theta, Case	

John considers himself to be intelligent



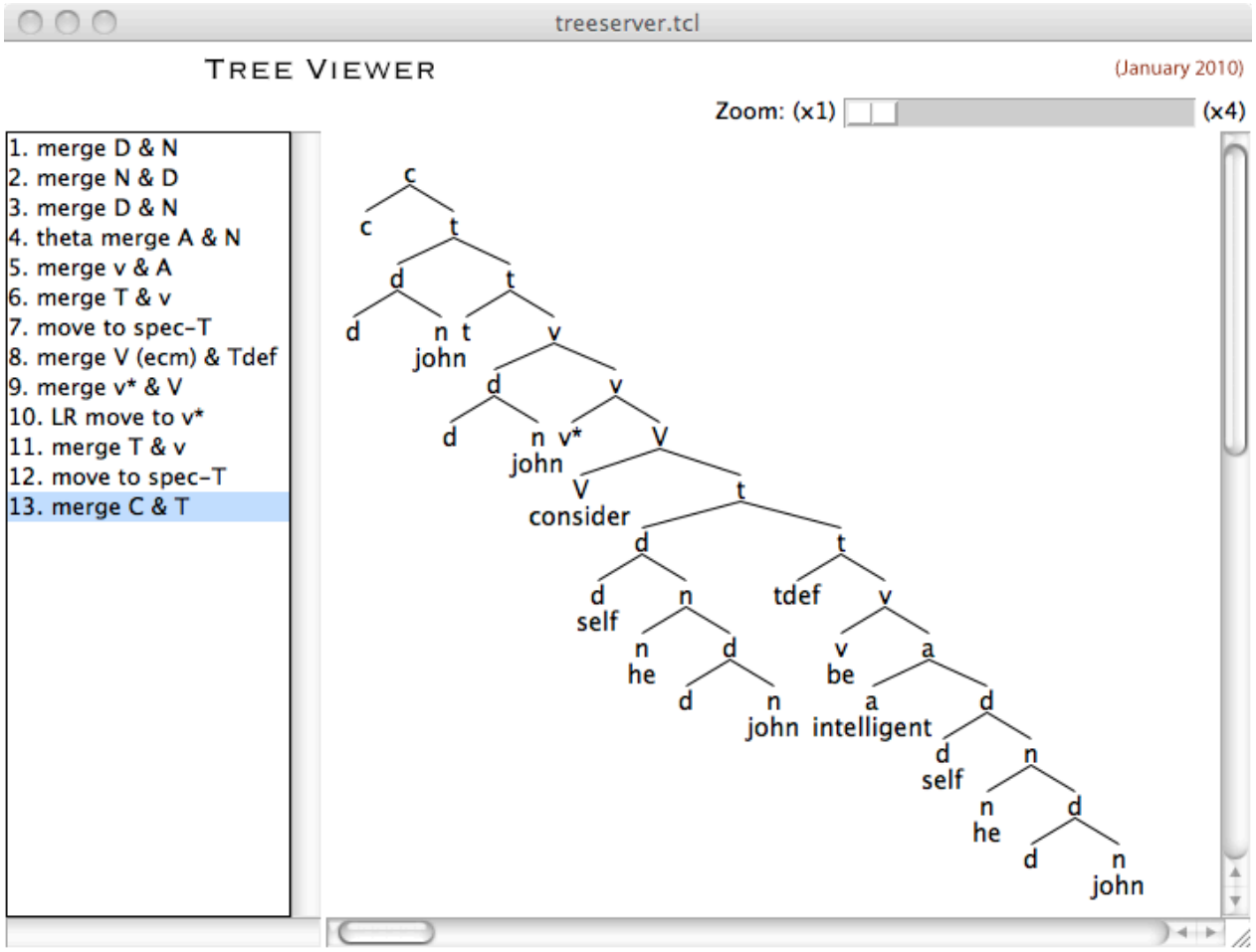
Scoreboard	*he*	*John*
needs		Case
licensed	theta, Case	theta

John considers himself to be intelligent

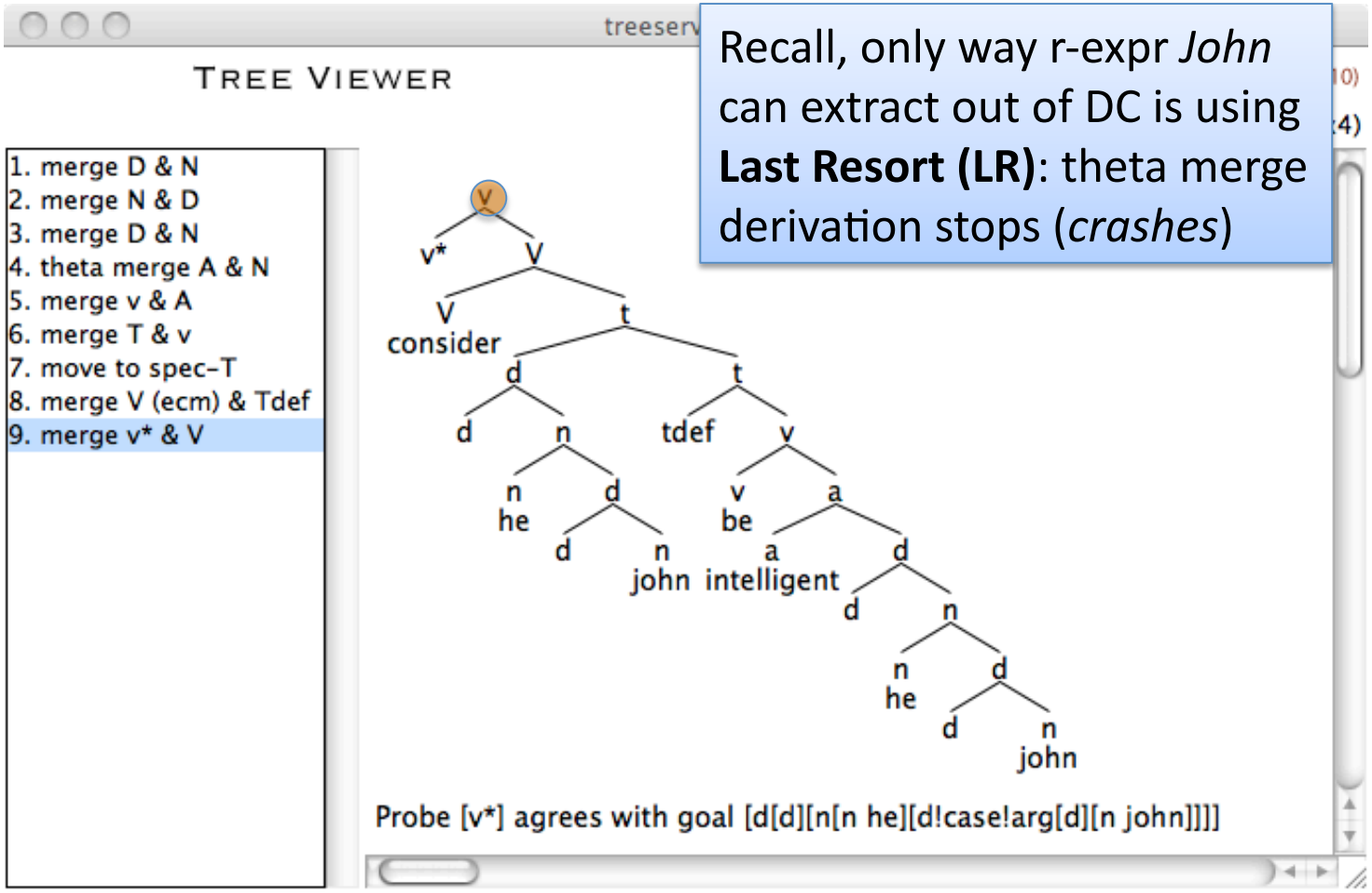


Scoreboard	*he*	*John*
needs		
licensed	theta, Case	theta, Case

John considers himself to be intelligent



*John$_i$ considers him$_i$ to be intelligent



Recall, only way r-expr *John* can extract out of DC is using **Last Resort (LR)**: theta merge derivation stops (*crashes*)

Introduction: Data

- Classic Binding Theory data:

  John$_i$ likes his$_i$ dog

  *John$_i$ likes himself$_i$'s dog

  ?*Hannah$_i$ found a picture of her$_i$

  Hannah$_i$ found a picture of herself$_i$

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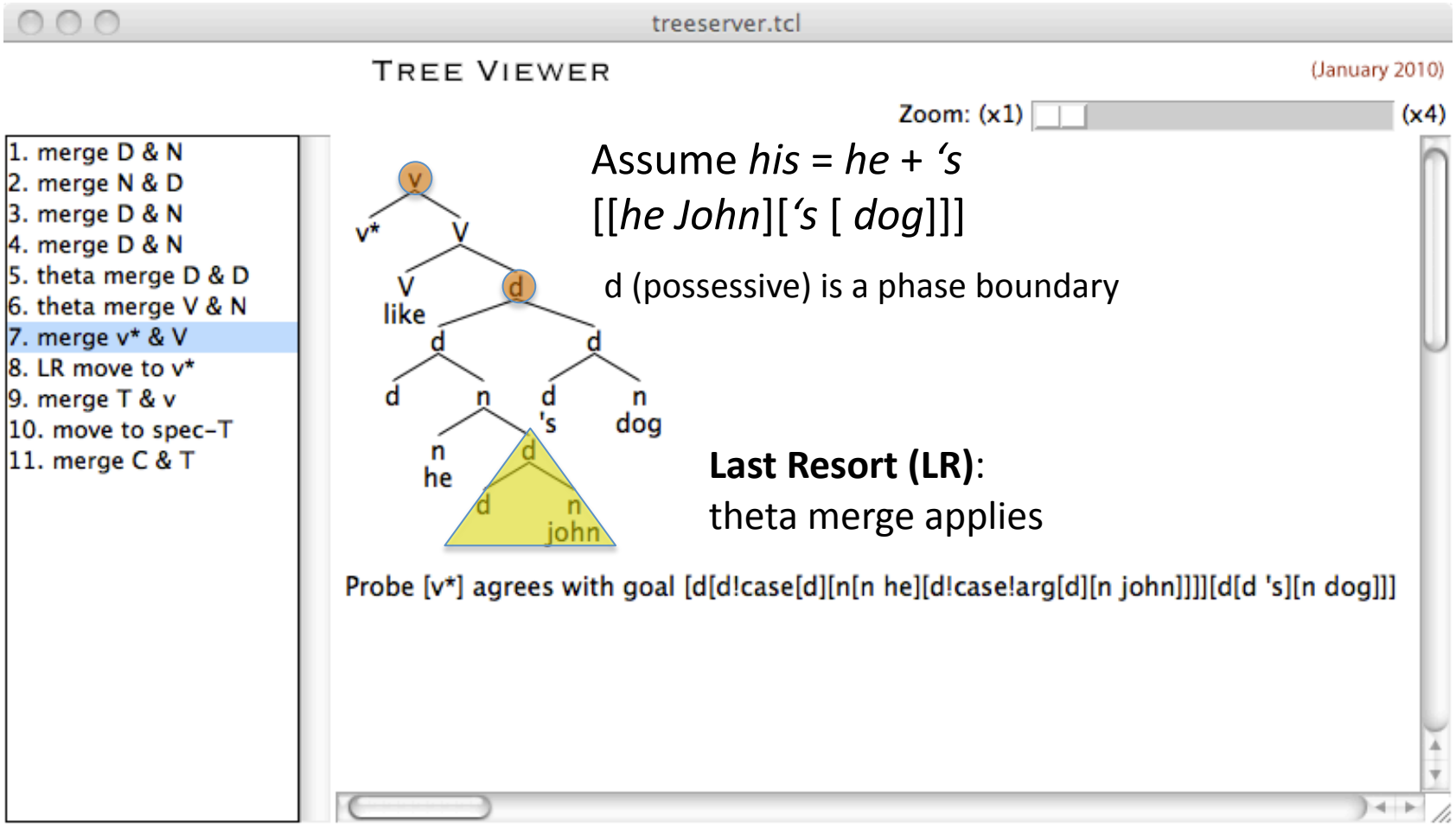
  Hannah found Peter$_i$'s picture of himself$_i$

  Hannah$_i$ found Peter's picture of her$_i$

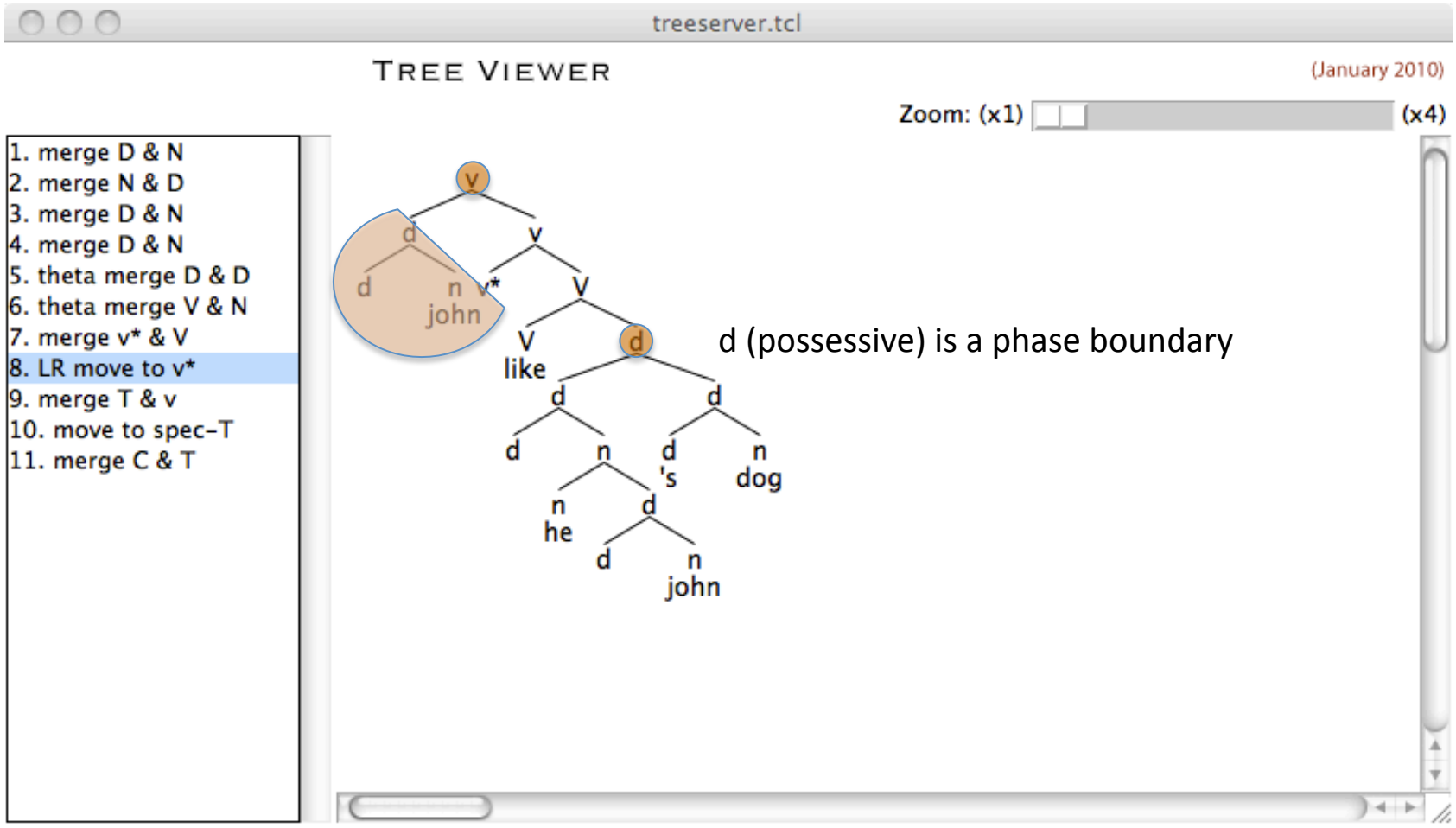
  Hannah$_i$ found Peter's picture of herself$_i$

Note: *picture*-DP judgments from Keller & Asudeh's (2001) study

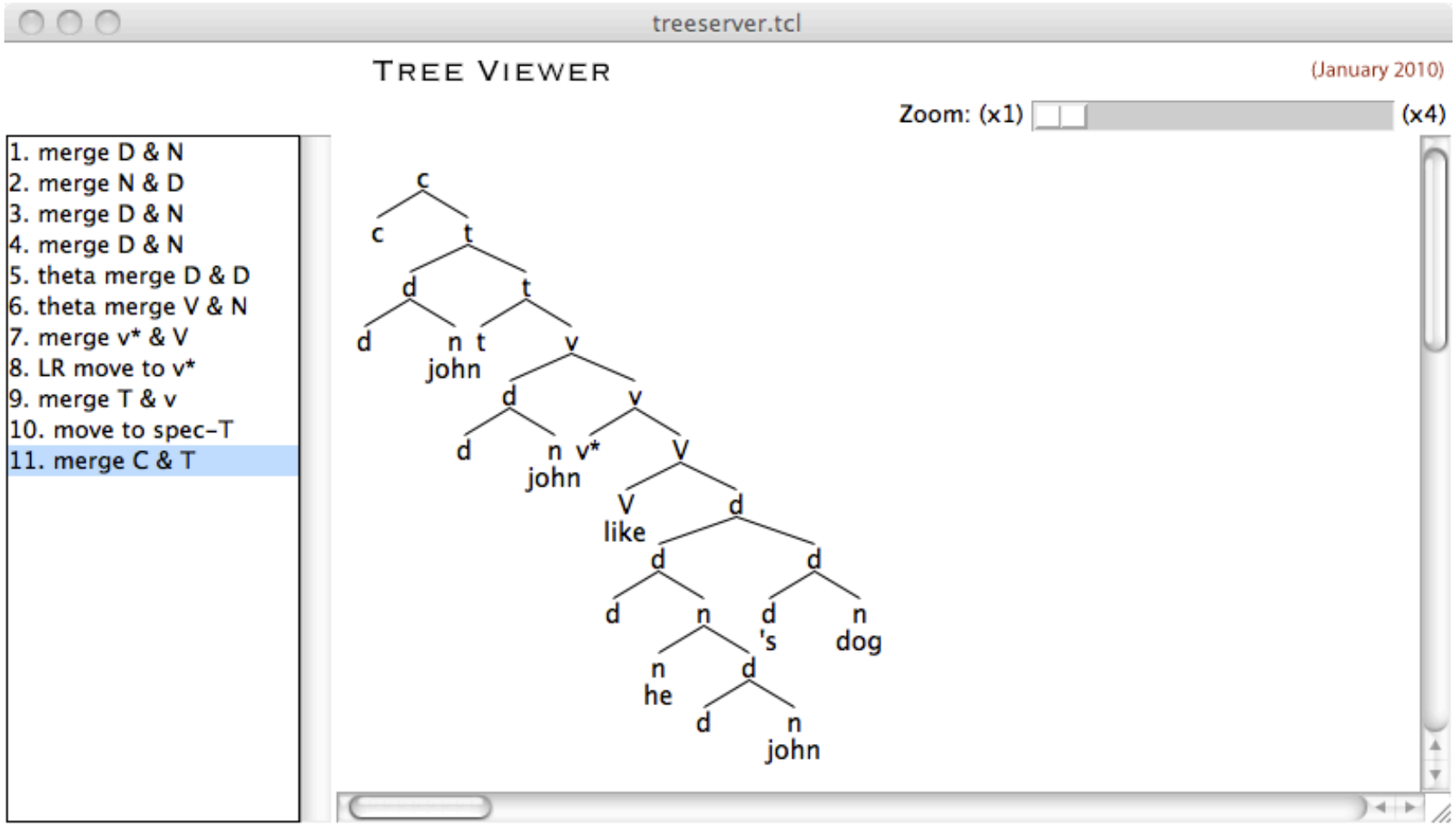
John$_i$ likes his$_i$ dog



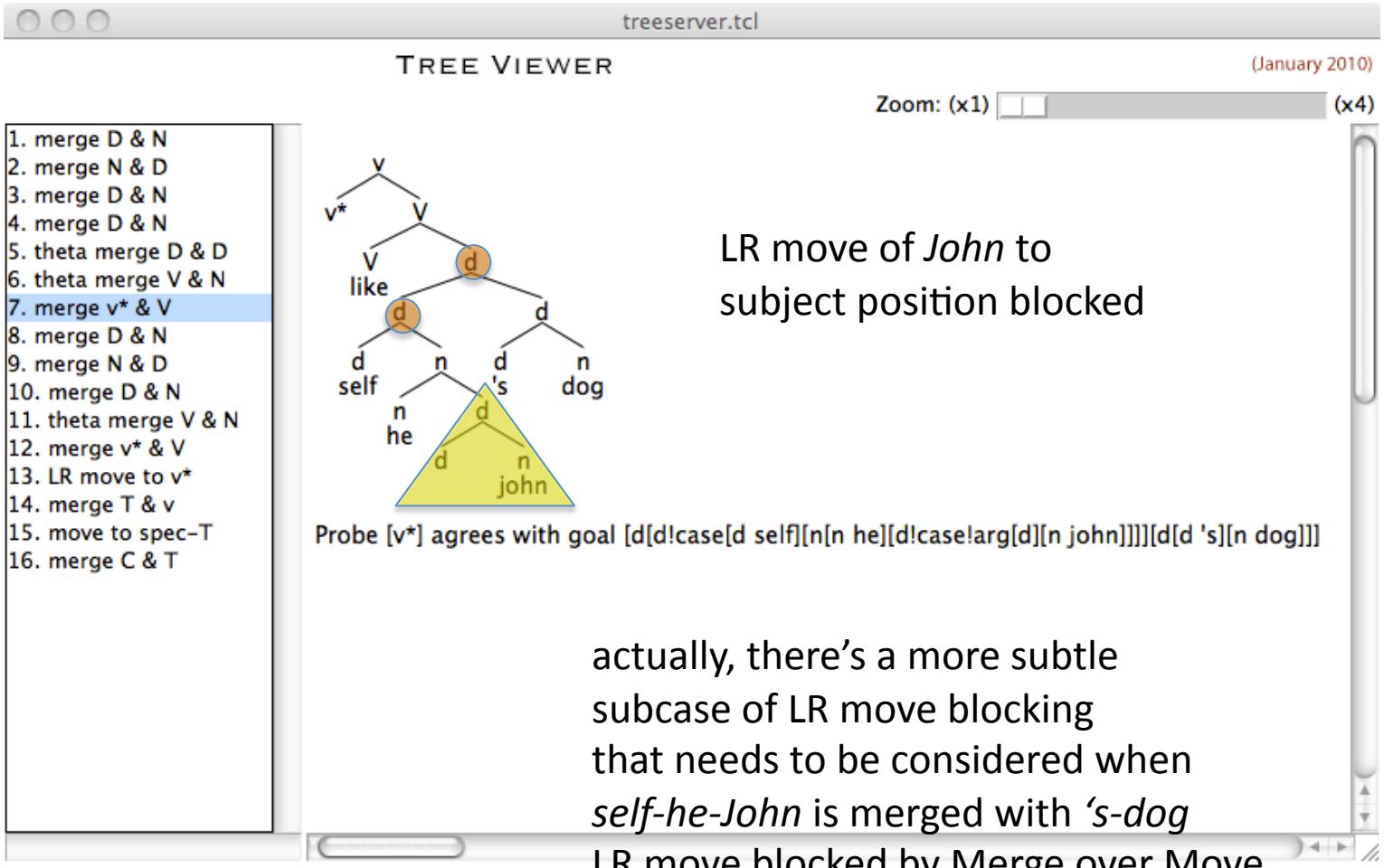
John$_i$ likes his$_i$ dog



John$_i$ likes his$_i$ dog



*John likes himself's dog



LR move of *John* to subject position blocked

actually, there's a more subtle subcase of LR move blocking that needs to be considered when *self-he-John* is merged with *'s-dog*

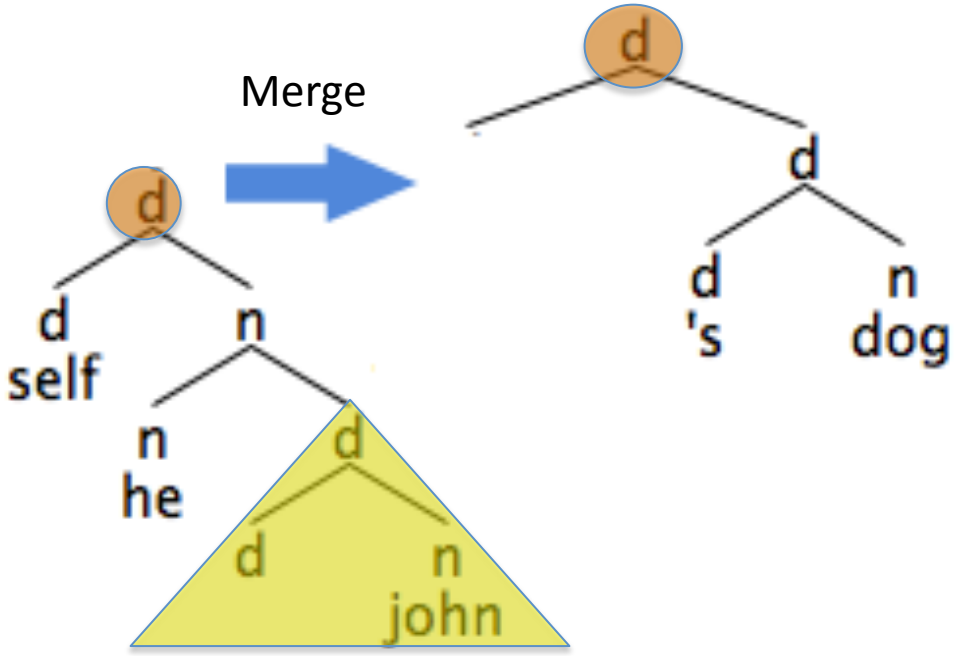
LR move blocked by Merge over Move

*John likes himself's dog

Why didn't *John* get a chance to move earlier?

Two ways to think about it

1. LR move to spec-D blocked by Merge over Move
2. Internal merge (move) can only apply to already merged syntactic objects.
   LR move is (still) an instance of internal merge
   Once *self-he-John* merges with *'s-dog*, it's too late



Introduction: Data

- Classic Binding Theory data:

  John$_i$ likes his$_i$ dog

  *John$_i$ likes himself$_i$'s dog

  ?*Hannah$_i$ found a picture of her$_i$

  Hannah$_i$ found a picture of herself$_i$

  ?*Hannah found Peter$_i$'s picture of him$_i$

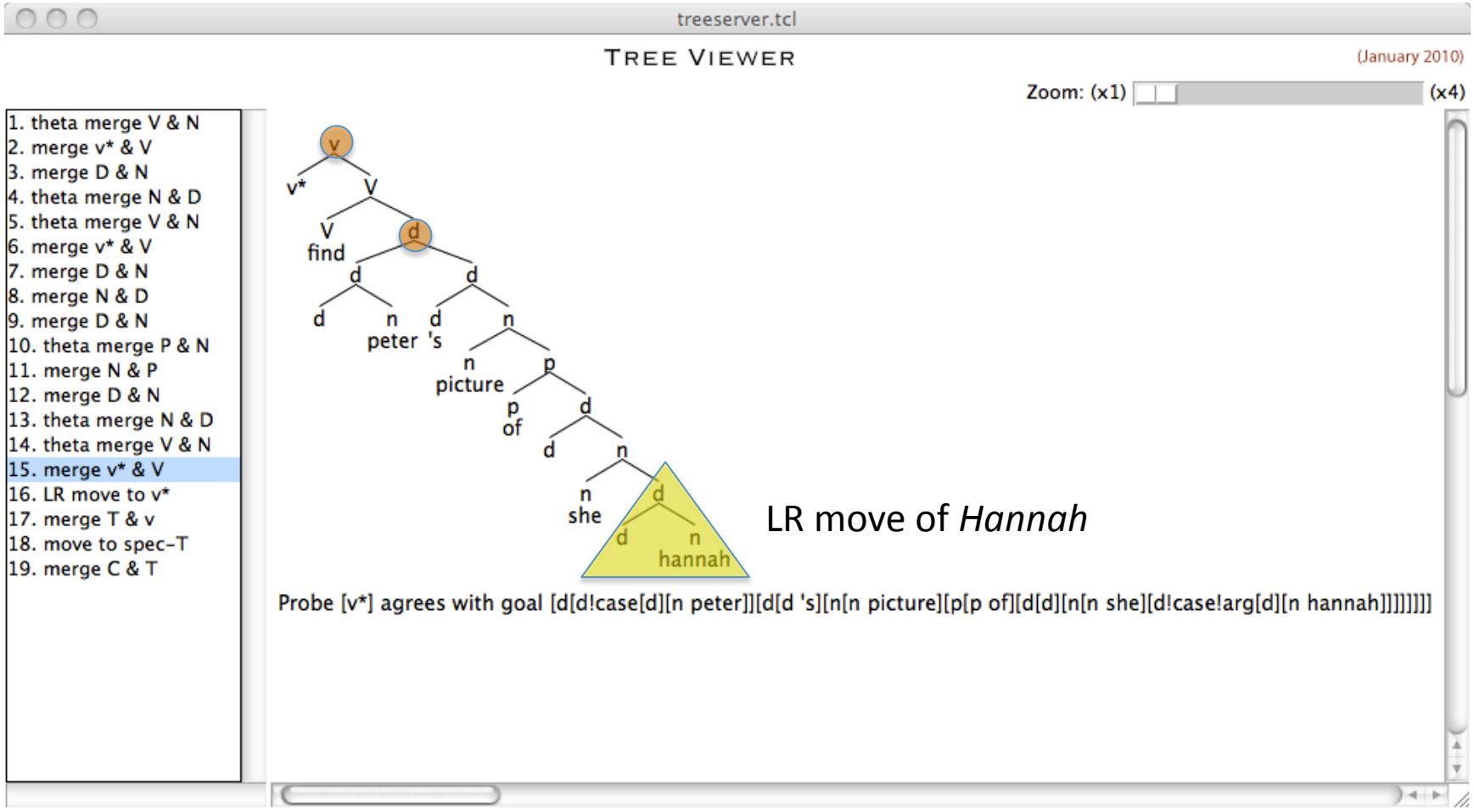
  Hannah found Peter$_i$'s picture of himself$_i$

  Hannah$_i$ found Peter's picture of her$_i$

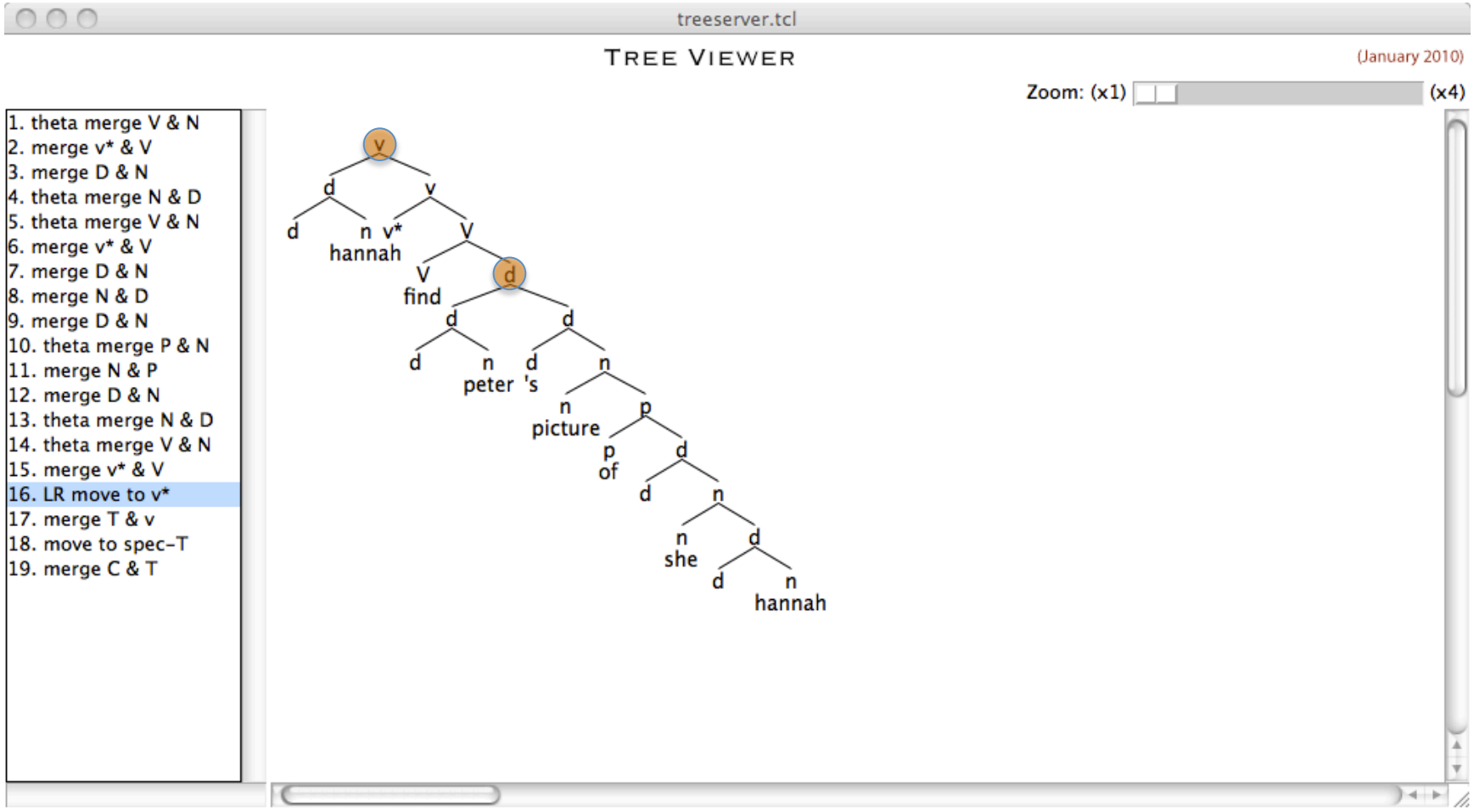
  Hannah$_i$ found Peter's picture of herself$_i$

Note: *picture*-DP judgments from Keller & Asudeh's (2001) study

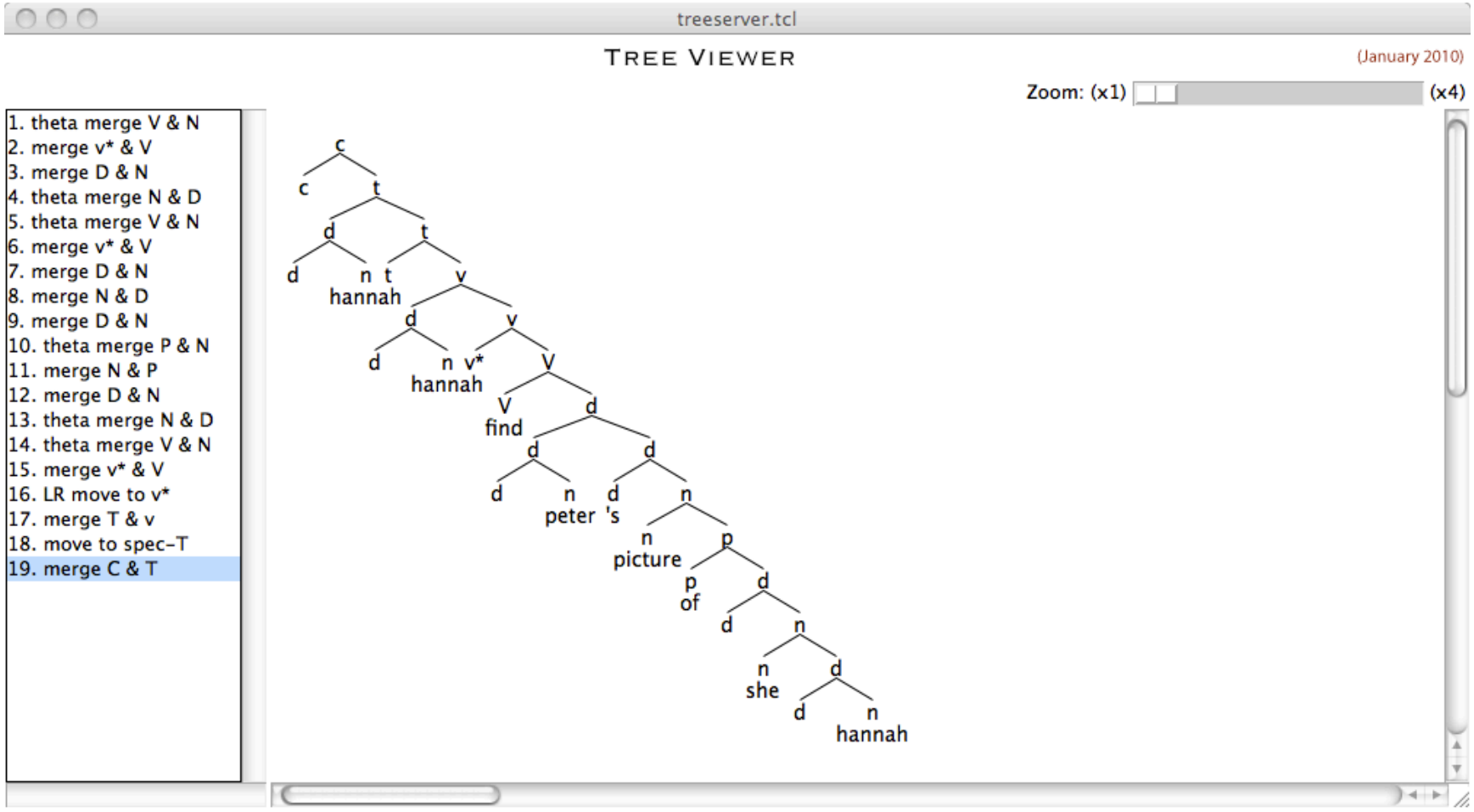
Hannah found Peter's picture of her



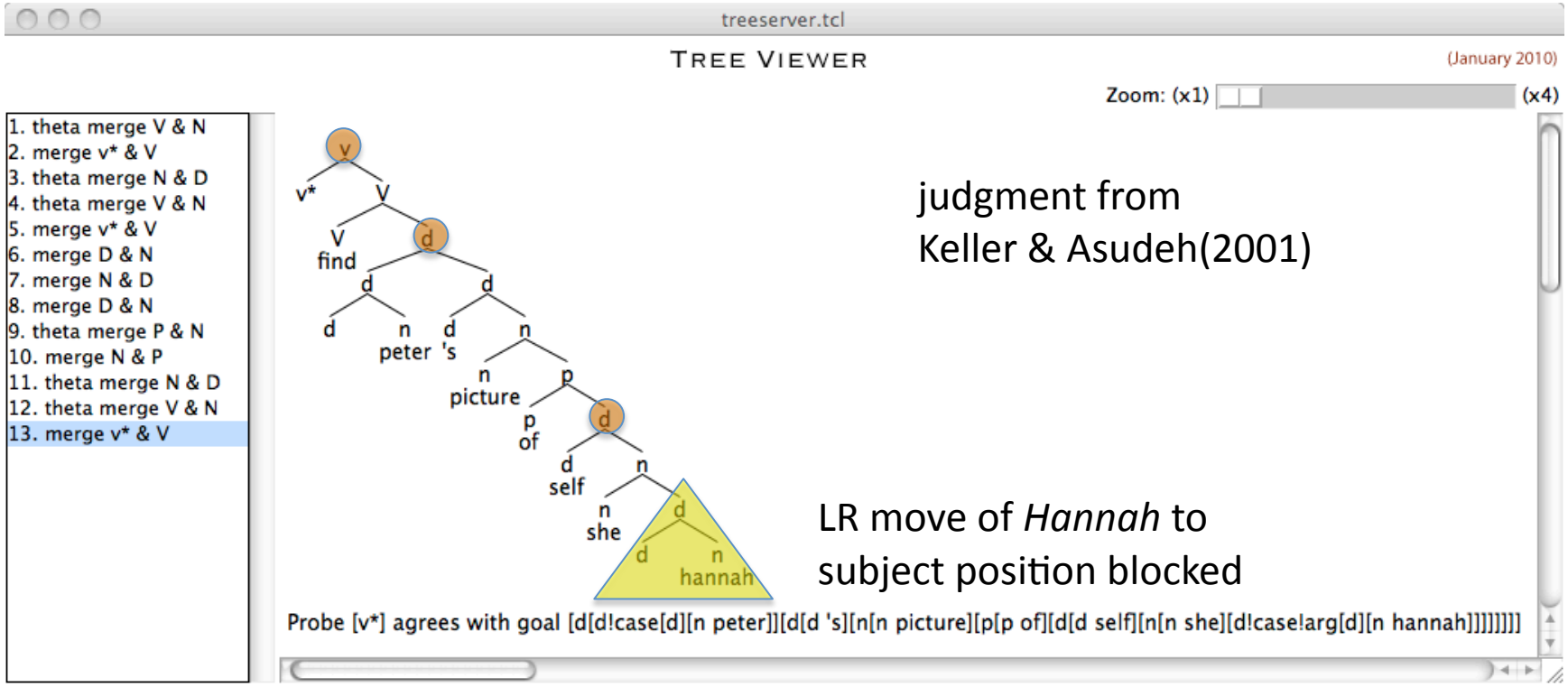
Hannah found Peter's picture of her



Hannah found Peter's picture of her



Hannah found Peter's picture of herself



Other data

To-do list …

- **transitivity of coreference**
  - $John_i$ says he_i thinks he_i's smart (Kayne 2002:157)
- **circularity**
  - $[His_i$ wife$]_j$ just saw $[her_j$ husband$]_l$ (Kayne 2002:156)
- ***wh*-constructions**
  - Which book that $John_i$ wrote does he_i like best (Zwart 2002)
  - Who that $John_i$ knows does he_i admire? (Chomsky & Lasnik 1995:106)
  - Which stories about $Diana_i$ did she_i most object to? (Zwart 2002)
  - *How many stories about $Diana_i$ does she_i want us to invent.((Heycock 1995:558f), per Zwart 2002)
- **anaphors and pronouns in non-complementary distribution**
  - Lucie counted five tourists in the room apart from $herself_i$/her_i (Reinhart & Reuland 1993:661)
  - Lucie saw a picture of $herself_i$/her_i (Reinhart & Reuland 1993:661)
  - Max likes jokes about $himself_i$/him_i (Reinhart & Reuland 1993:661)

Summary

- computational implementation *theory verification*
- accounts for bunch of classic Binding Theory facts *sans* Conditions A, B and C
- theory:

  basic MP (Chomsky 2000)

  + doubling constituent (Kayne 2002) *also* Chomsky (2006), Svenonious (2004), Hiraiwa (2005)

  + some DPs are phases

  + LR move

extra mechanism… yes
But doesn't impact efficient computation
e.g. creates no extra choice points
LR theta merge: competes with external Merge