Logical Transductions for the Typology of Ditransitive Prosody

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The Talk in One Slide

- Phonological processes can refer to domains larger than words
- These domains form hierarchical layers (prosodic constituents)
- But: Prosodic constituency cannot be read directly from syntactic constituency
- Also: Little existing work on the computation of phrase-level phonology (Yu 2021)

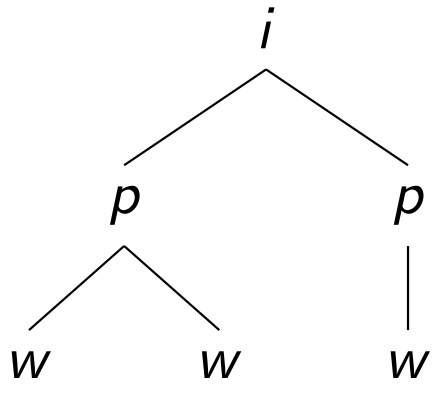
In This Talk

Computational requirements for the syntactic/prosody mapping?

- Using logical tree transductions
- A case study: Ditransitives in SVO languages

Prosodic Constituency

- Prosodic domains form hierarchical layers
- Consider the internal arguments of a ditransitive verb...



I gave Mary books

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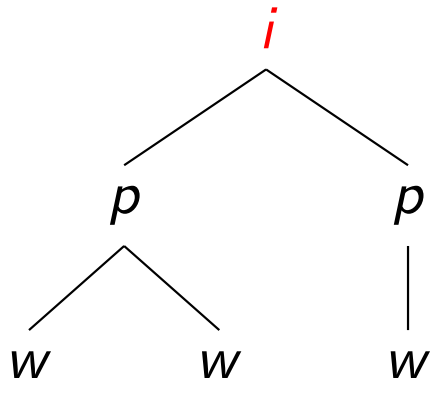

Intonational Phrase

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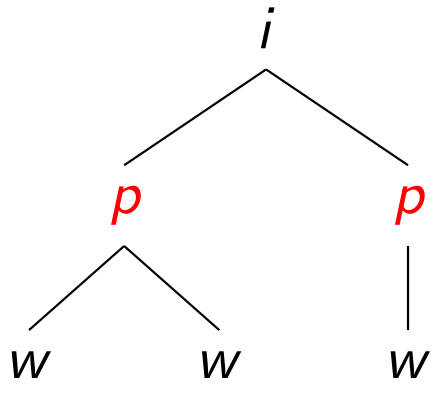

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Intonational Phrase

Phonological Phrase

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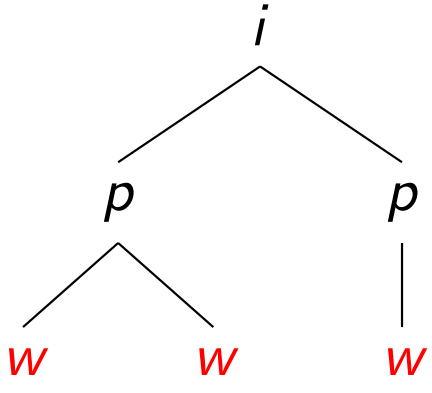

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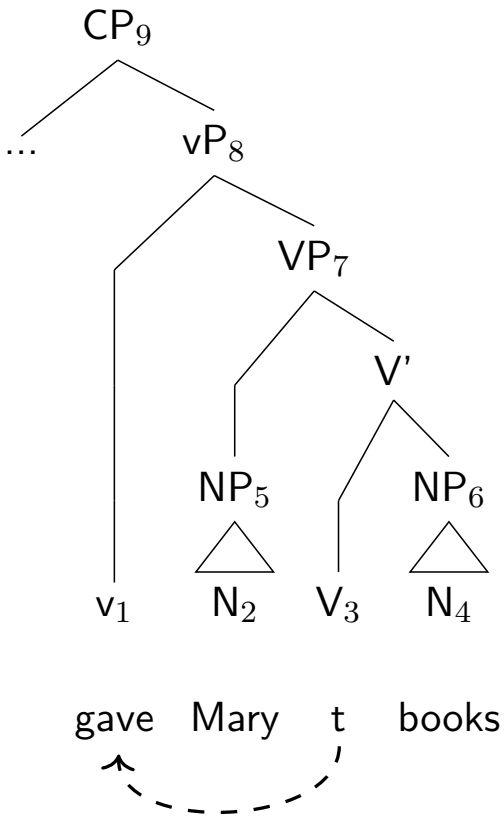
Intonational Phrase

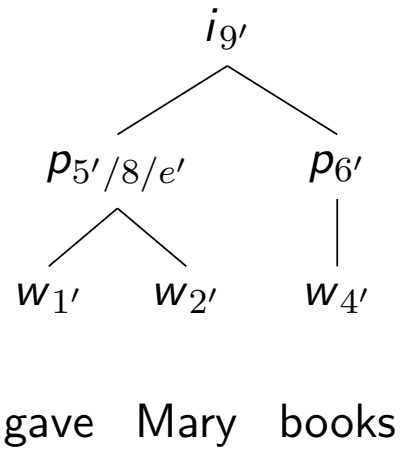
Phonological Phrase

Prosodic Word

Syntax to Prosody?

- How does the syntactic parse map to the prosodic parse?





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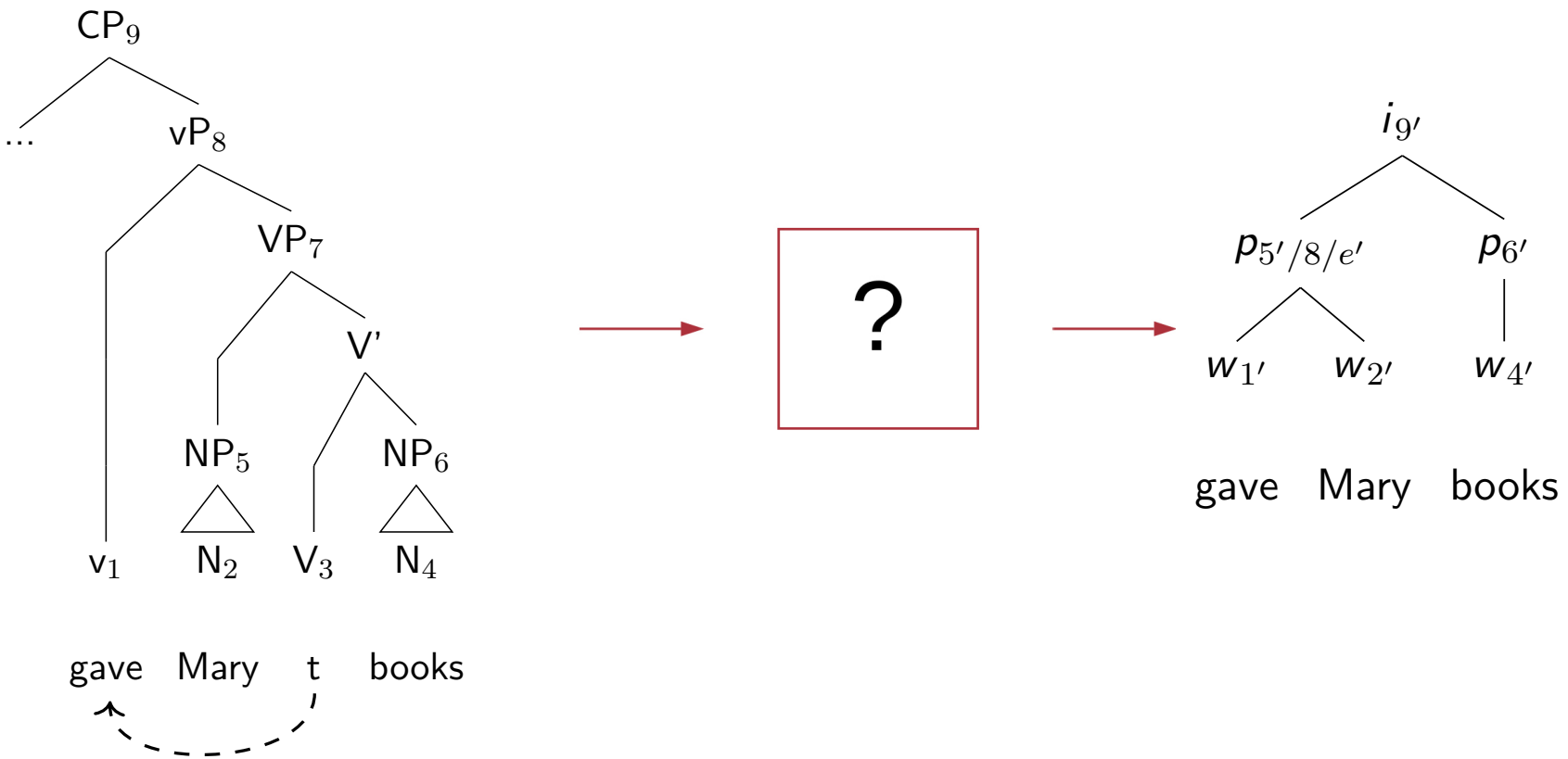

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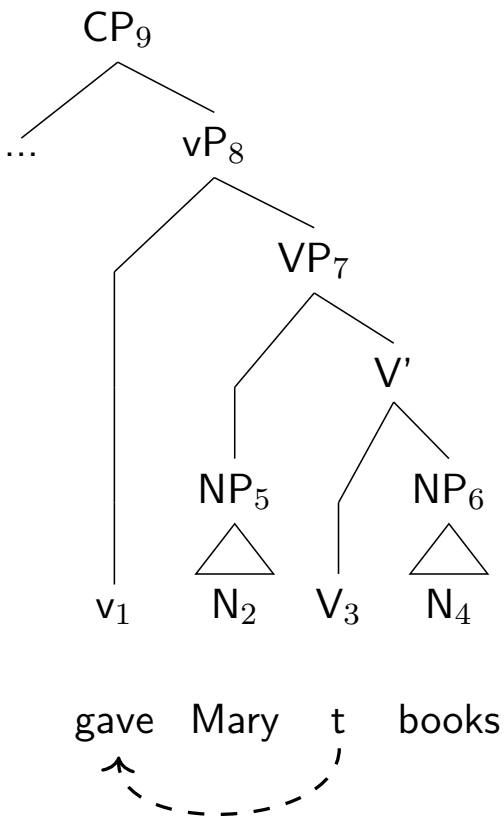
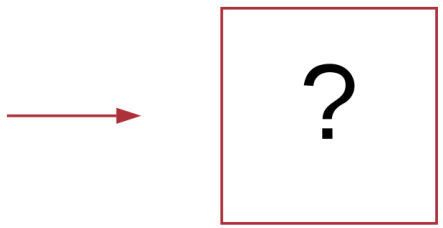
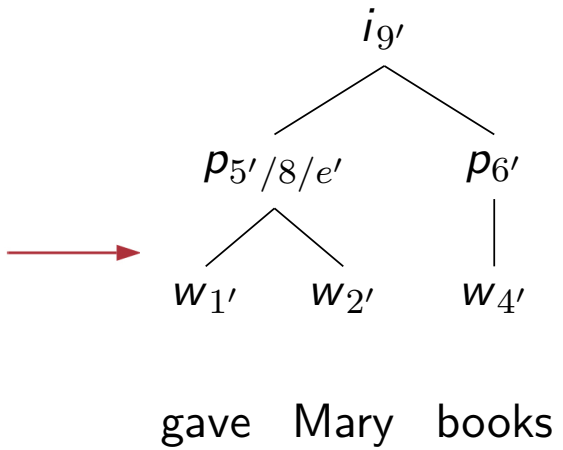




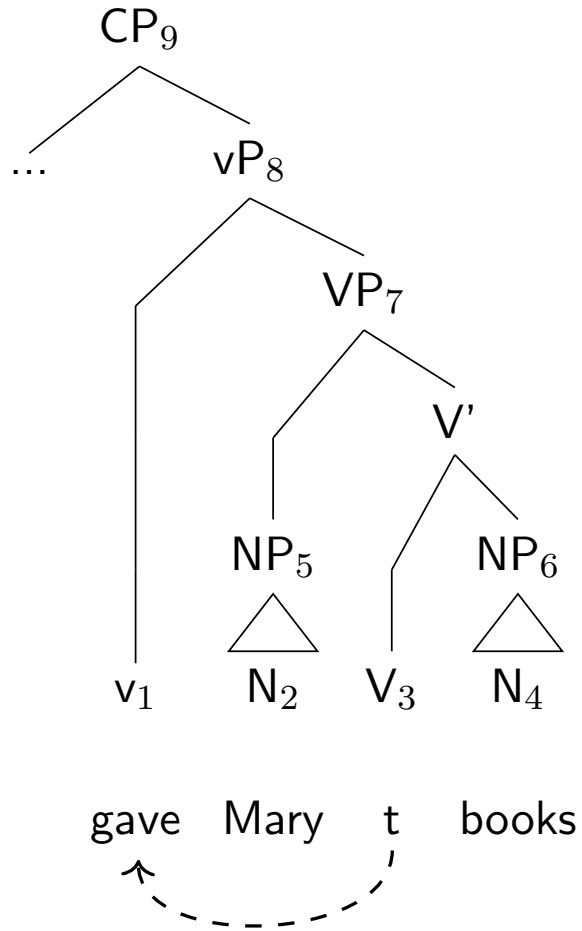


- Mismatches in the size of an XP and its prosodic phrase
- Ambiguity wrt input-output correspondences

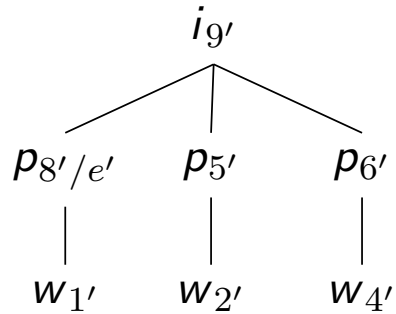
Syntax/Prosody Mappings: Ewe

- SVO ditransitive phrases: four types of prosodic parses (Kalivoda 2018)

Input Syntax
[V [N N]]



Separated
(V)(N)(N)



Syntax/Prosody Mappings: Chimwiini

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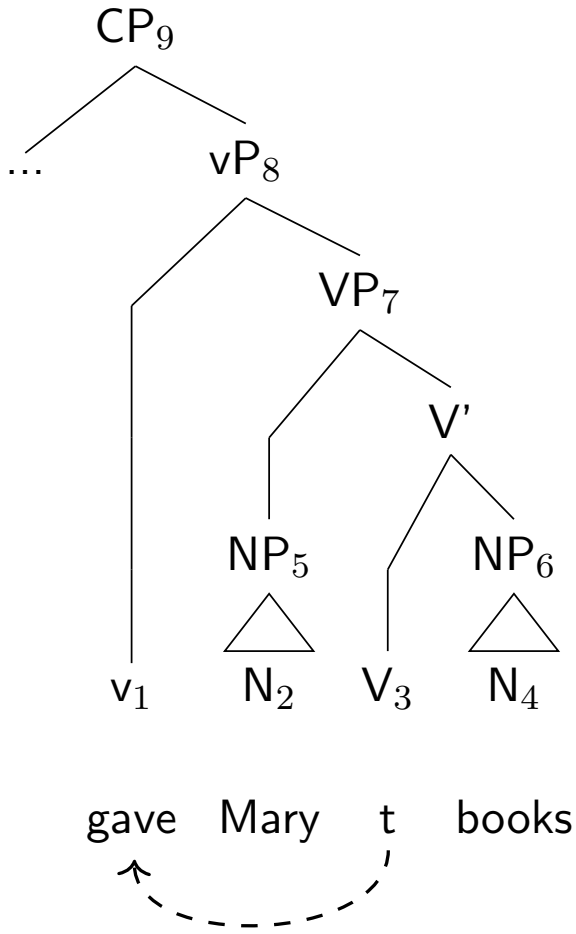
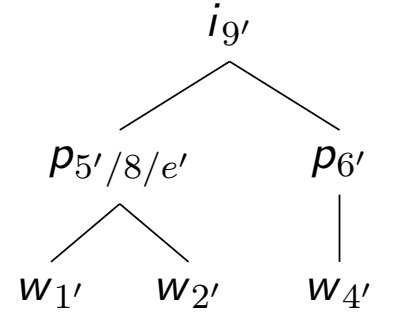


Closest-merged
(VN)(N)



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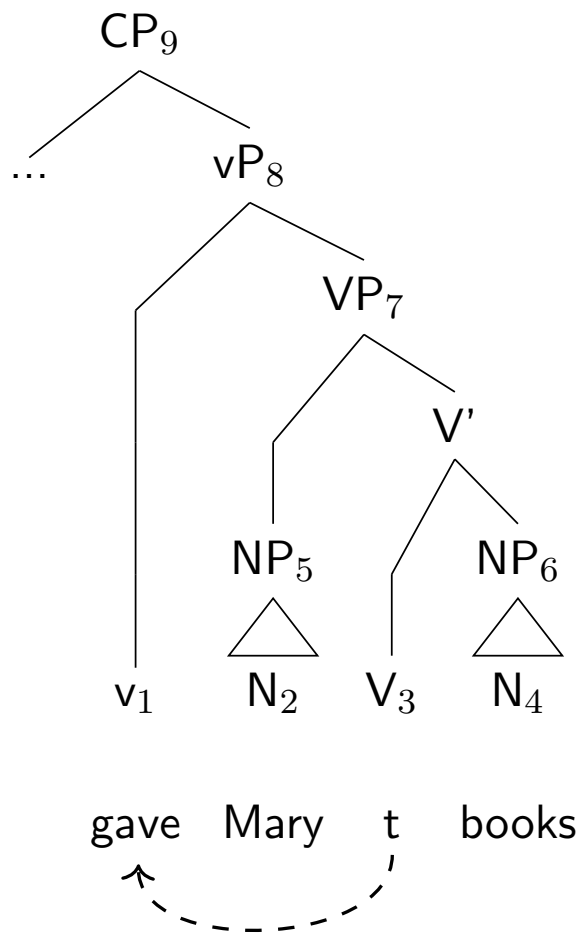
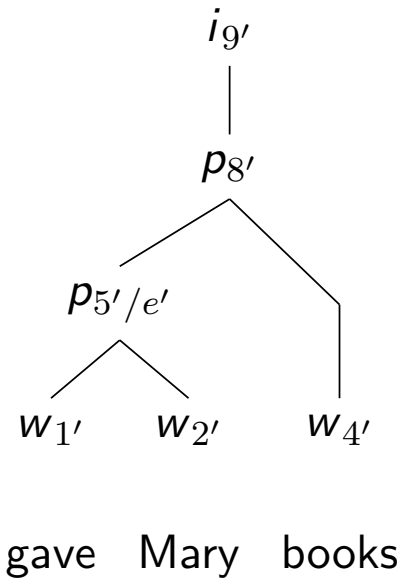


Recursive
((VN)(N))



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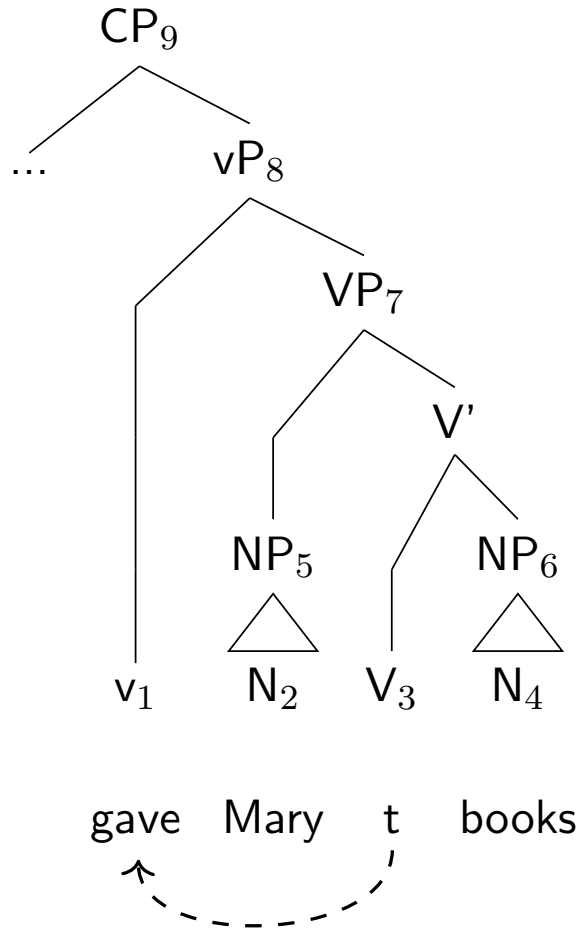

All-merged
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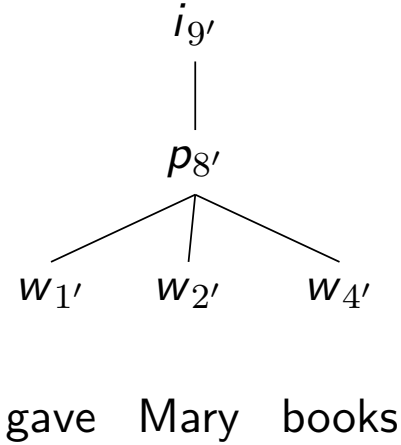

A Typological Overview (Kalivoda 2018)

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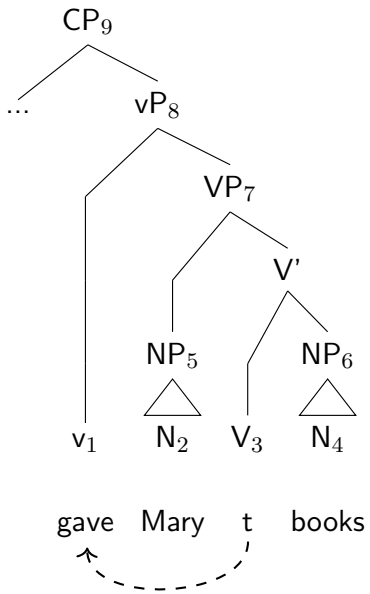

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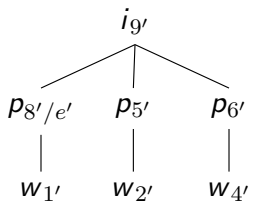

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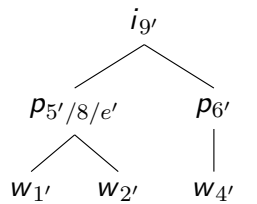

Recursive
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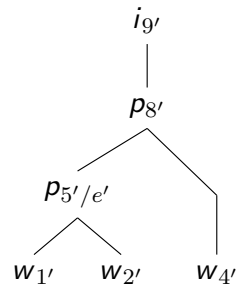

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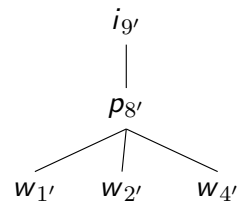

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- What is the complexity of these mappings?
- What syntactic information is relevant?

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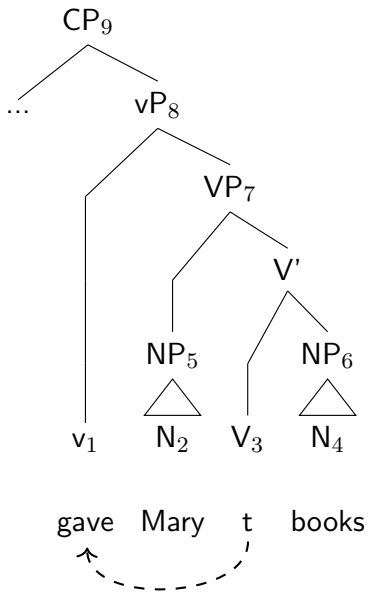

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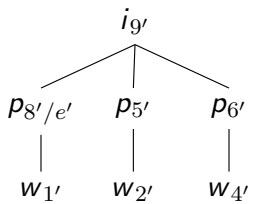

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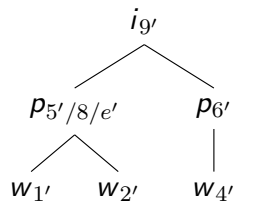

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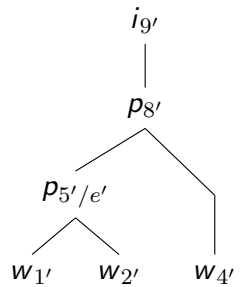

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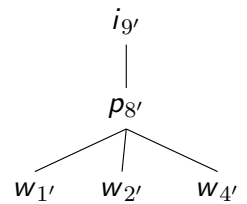

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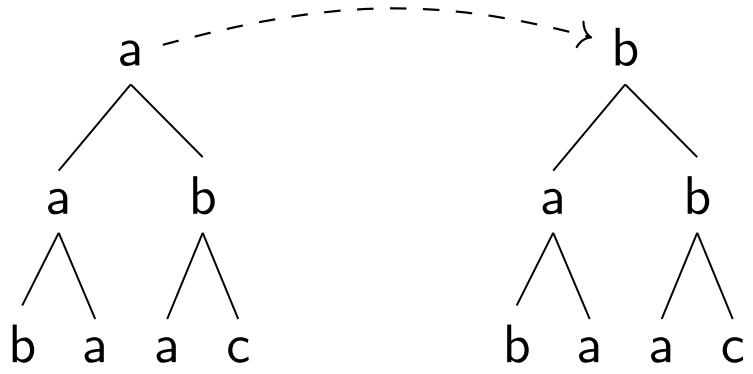
Logical Tree Transductions

- Take a mapping that changes root labels from a to b



- With logical transductions, the input tree model is defined in terms of a signature $\langle D, R \rangle$

Tree Model

Domain $D = \{\varepsilon, 0, 1, 00, 01, 10, 11\}$

Unary relations $L \subset R$:

- $\mathsf{a}(x) = \{\varepsilon, 0, 01, 12\}$
- $\mathsf{b}(x) = \{1, 00\}$
- $\mathsf{c}(x) = \{11\}$

Binary relations in R:

- $\lhd(x, y) = \{\langle \epsilon, 0\rangle, \langle \epsilon, 1\rangle, \langle 0, 00\rangle, \langle 0, 01\rangle, \langle 1, 10\rangle, \langle 1, 11\rangle\}$
- $\prec(x, y) = \{\langle 0, 1\rangle, \langle 00, 01\rangle, \langle 10, 11\rangle\}$

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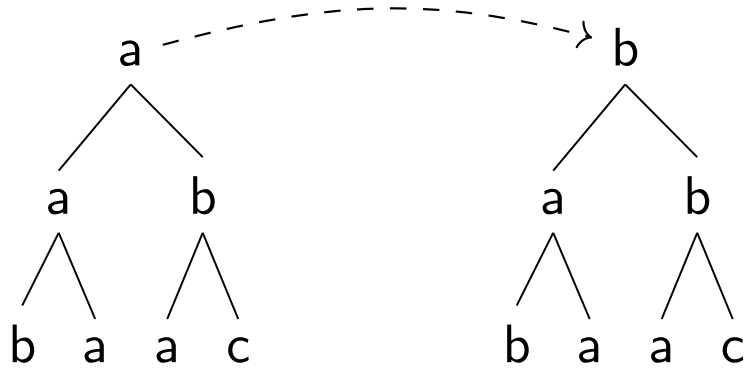

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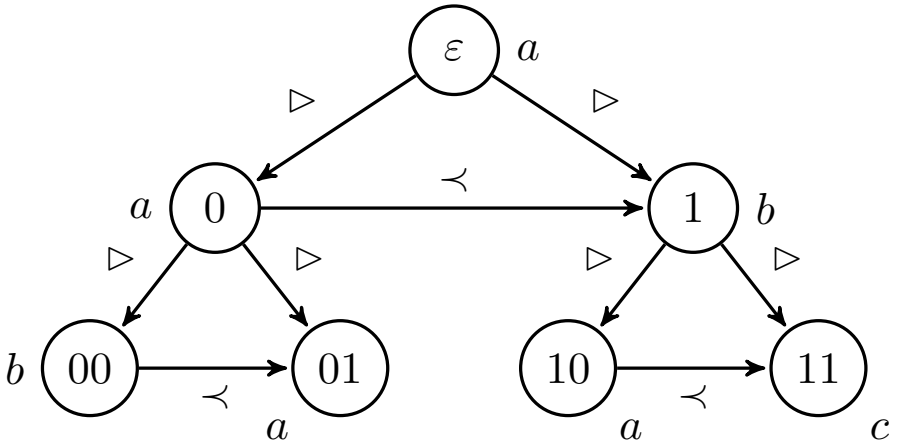

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Logical Tree Transductions [cont.]

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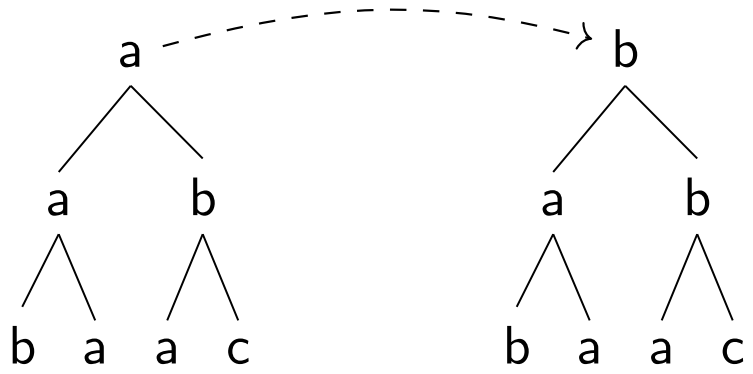
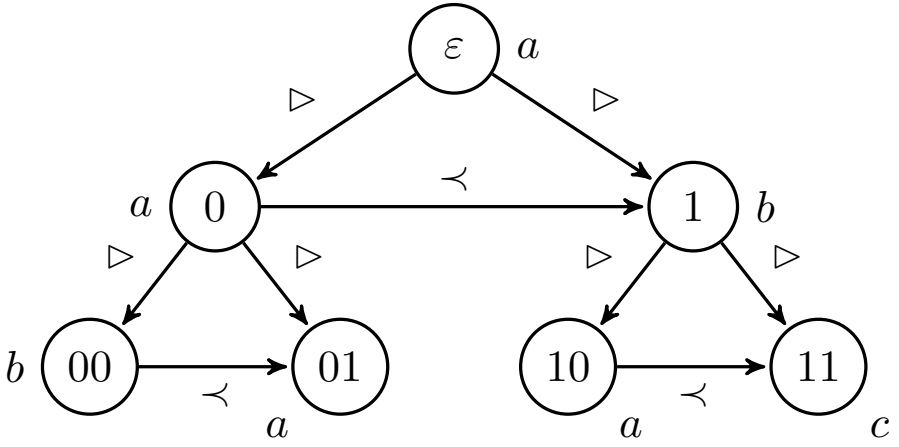


- Predicated define properties of the input segments
- Output functions define output segments wrt input segments



Tree transduction

$$\mathbf{root\_a}(x) \stackrel{\text{def}}{=} \mathsf{a} \wedge \neg\exists y[\lhd(y,x)]$$

$$\lhd(x',y') \stackrel{\text{def}}{=} \lhd(x,y)$$

$$\phi_{\mathsf{a}}(x') \stackrel{\text{def}}{=} \mathsf{a}(x) \wedge \neg\mathbf{root\_a}(x)$$

$$\phi_{\mathsf{b}}(x') \stackrel{\text{def}}{=} \mathsf{b}(x) \vee \mathbf{root\_a}(x)$$

$$\phi_{\mathsf{c}}(x') \stackrel{\text{def}}{=} \mathsf{c}(x)$$

Formalizing Syntax/Prosody Mappings

What Information Matters?

- Pronounced vs unpronounced nodes
  ⇒ prosody works over overt or pronounced terminal items
- Headedness
  ⇒ can be reconstructed from local geometry of the tree
- Tree geometry
  ⇒ sensitivity to sisterhood and c-command
- Argument structure
  ⇒ two configurations: with and without head-movement
- Linearity
  ⇒ the verb is phrased with its *closest* argument
- Category labels
  ⇒ syntax/prosody mappings generally blind to category labels

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Summing Up

Broad Result

First-order Tree Transductions derive the alignment mismatches between syntactic and prosodic constituents!

General Takeaways

- Usually unspecified mapping details matter!
  - Head-movement and locality
  - Predictions from category Blindness
  - Complexity of the mappings
- Tree transductions to refine long-standing theoretical questions
- Inspect theoretical assumptions about linguistic representations across sub-domains

Summing Up

Broad Result

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Thank you!