Minimalist Grammar Induction over Morphemes

THE UNIVERSITY OF CHICAGO

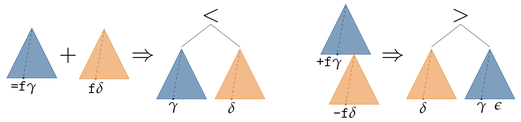
Marina Ermolaeva
mermolaeva@uchicago.edu

Introduction

- Is it possible to **compare competing analyses** of syntax phenomena based on some robust quantitative metric?
- Assume a sufficiently rich formalism compatible with the Minimalist framework (Chomsky 1995)
- Frame the question as a **learning problem** (Gold 1967)

Minimalist Grammars

- Introduced by Stabler (1997)
- **Lexical items**: pairs consisting of a phonological exponent and a sequence of syntactic features
- Two structure-building operations: **Merge** and **Move**



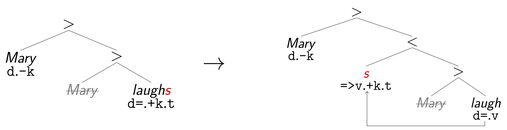
Right Merge Move

Lexical item decomposition

- Lexical items can be learned from dependency stuctures over segmented words (Kobele et al. 2002)
- **Our goal:** relax the segmentation requirement and learn morphological structure within complex words

Mary : : d.−k
laughs : : d=.+k.t

Mary : : d.−k
laugh : : d=.v
s : : =>v.+k.t



- Kobele (2018): an operation that **splits a lexical item** in two, creating a new syntactic category

$$w :: \alpha\beta x\gamma \quad \rightarrow \quad \begin{array}{l} u :: \alpha y \\ v :: {=}y\beta x\gamma \\ w = u \oplus v \end{array}$$

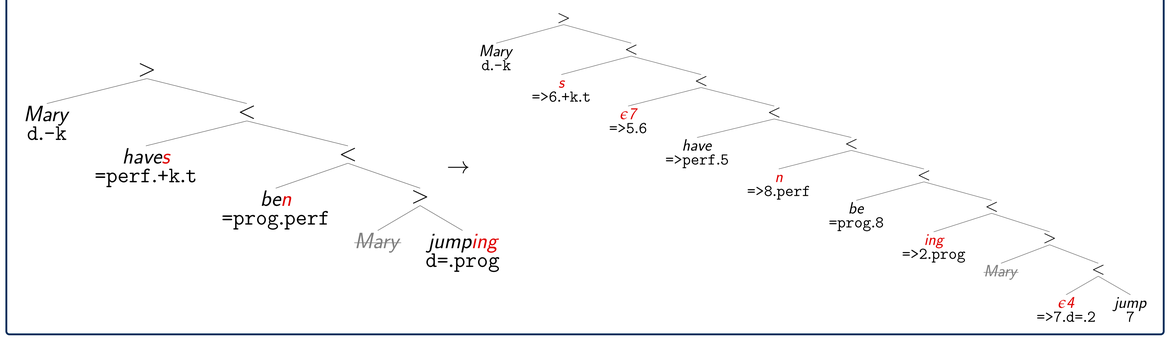
- New lexical items form a complex head via **Head Movement**
- A morphological rule constructs the original phonological exponent from the root and affix

Work in progress

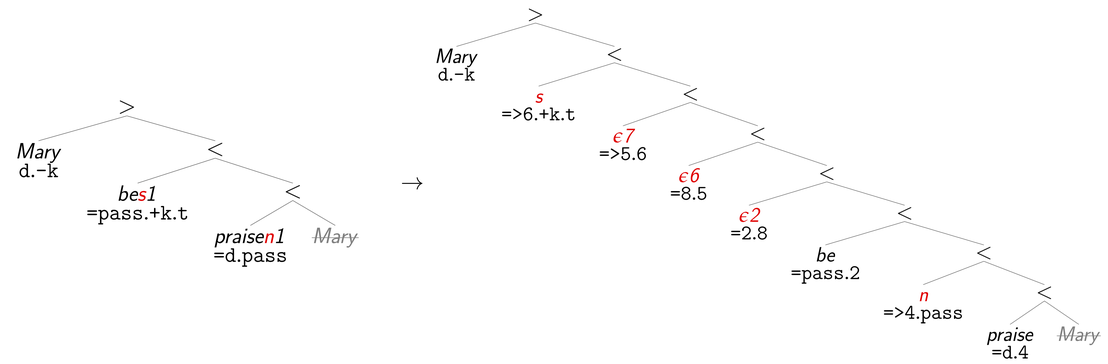
- Factor out **linguistic generalizations** and express them as new lexical items
- Derive **empty functional heads** if necessary
- Multiple lexical items sharing syntactic and/or phonological features can be decomposed as a batch
- Use **Minimum Description Length** (Rissanen 1978) to quantify differences between grammars
- **Case study:** simplified English with fully regular morphology

Preliminary results

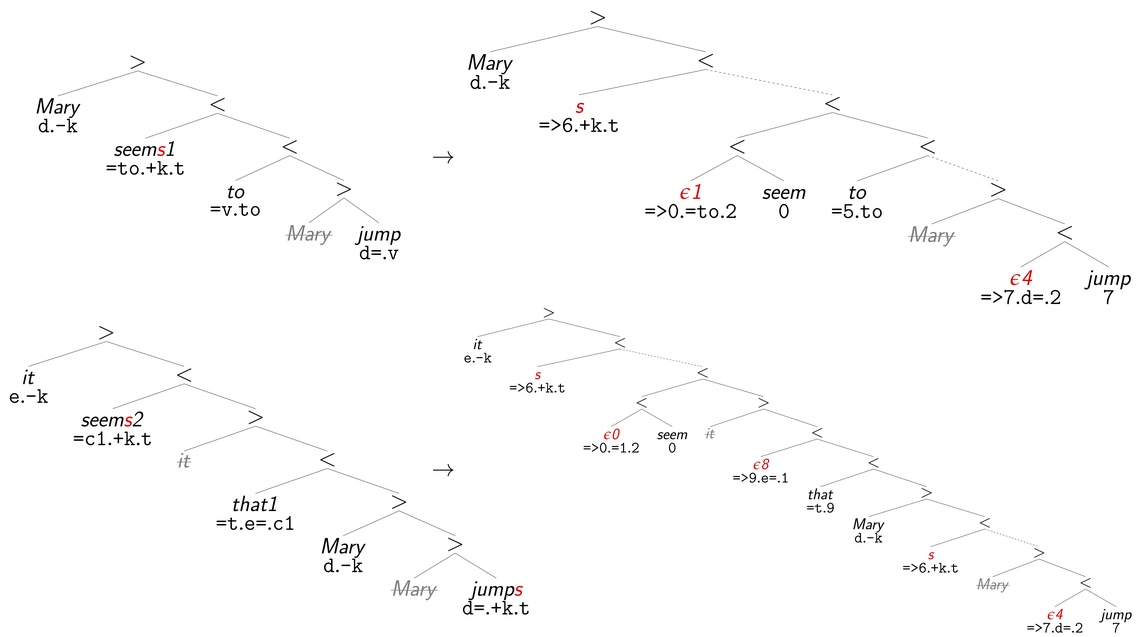
Auxiliaries



Passives



Raising



Transforming a lexicon

Original lexicon

Mary : : d.−k	*laughs* : : d=.+k.t	*jumps* : : d=.+k.t
bes : : =g.+k.t	*laughing* : : d=.g	*jumping* : : d=.g
wills : : =v.+k.t	*laugh* : : d=.v	*jump* : : d=.v
be : : =g.v		

Final lexicon

Mary : : d.−k	*s* : : =x.+k.t	*will* : : =v.x
laugh : : d=.V	*ϵ* : : =v.x	*be* : : =g.v
jump : : d=.V	*ϵ* : : =V.v	*ing* : : =V.g

References: Chomsky, N. 1995. The Minimalist Program. ▪ Gold, E. M. 1967. Language identification in the limit. ▪ Kobele, G. M. 2018. Lexical decomposition. ▪ Kobele, G. M., Collier, T., Taylor, C., and Stabler, E. P. 2002. Learning Mirror Theory. ▪ Rissanen, J. 1978. Modeling by shortest data description. ▪ Stabler, E. P. 1997. Derivational minimalism.