May 3, 2004

Lexical rules in action,

MRS, open Q&A

Overview

- How the LKB applies lexical rules
- MRS: representations
- MRS: composition
- Time for Q&A

How the LKB applies lexical rules (1/3)

- When we write them, we think in terms of building an inflected word from a stem.
- When we write the lexicon, we provide stem forms.
- When we go to parse something, we hand the LKB fully inflected forms.
- How to reconcile this?

How the LKB applies lexical rules (2/3)

- Tokenize sentence into words
- Attempt to apply each spelling change rule to each word REGARDLESS OF MORPHOSYNTAX to produce stem froms.
  - Use spelling-change subrules to create stems.
  - Look up stems in lexicon.
  - If successful, record which rule was used.
- Enter stem forms (as complete feature structures) in the chart.

- Attempt to build further edges using lexical rules with stem forms as daughters.
- If the rules used for stemming aren’t used in building the form back up, produce an error.

How the LKB applies lexical rules (3/3)

- What happens if the stem isn’t in the lexicon?
- What happens if the spelling change rule isn’t written right?
- What happens if there is a feature path error or a non-existent type used in the lexical rule instance?
- What happens if the stem’s feature structure doesn’t unify with the DTR of the lexical rule?

Semantics: Scope

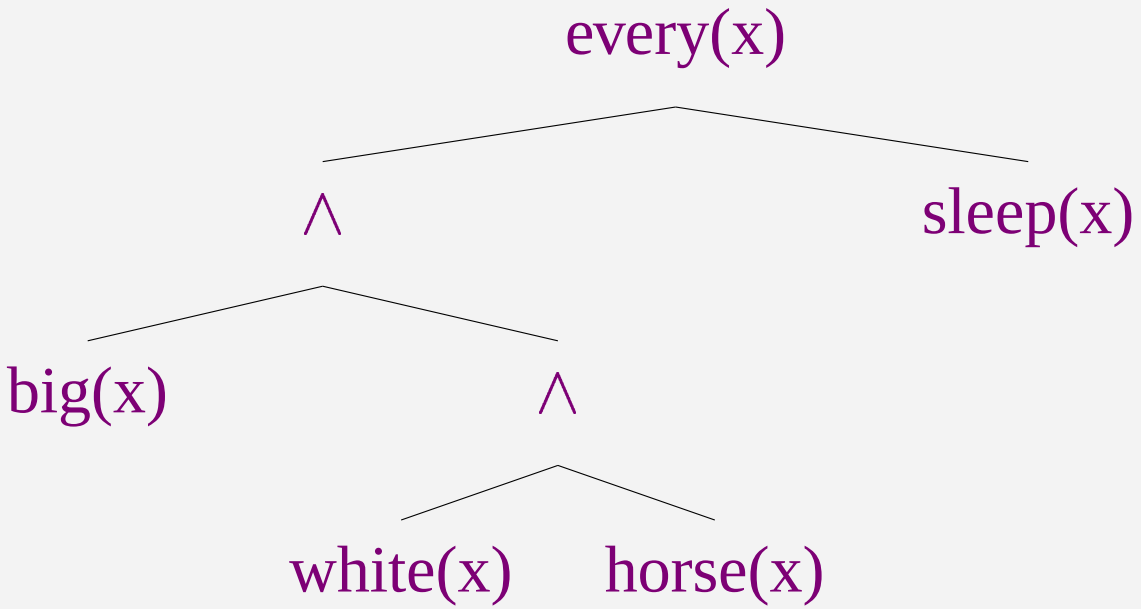
- Quantifiers (predicate logic or natural language) take three arguments:
  - A variable to bind
  - A restriction
  - A body
- Every dog sleeps: $\forall x\, dog(x) sleep(x)$
- When one quantifier appears within the restriction or body of another, we say the first has wider scope.

MRS: Goals

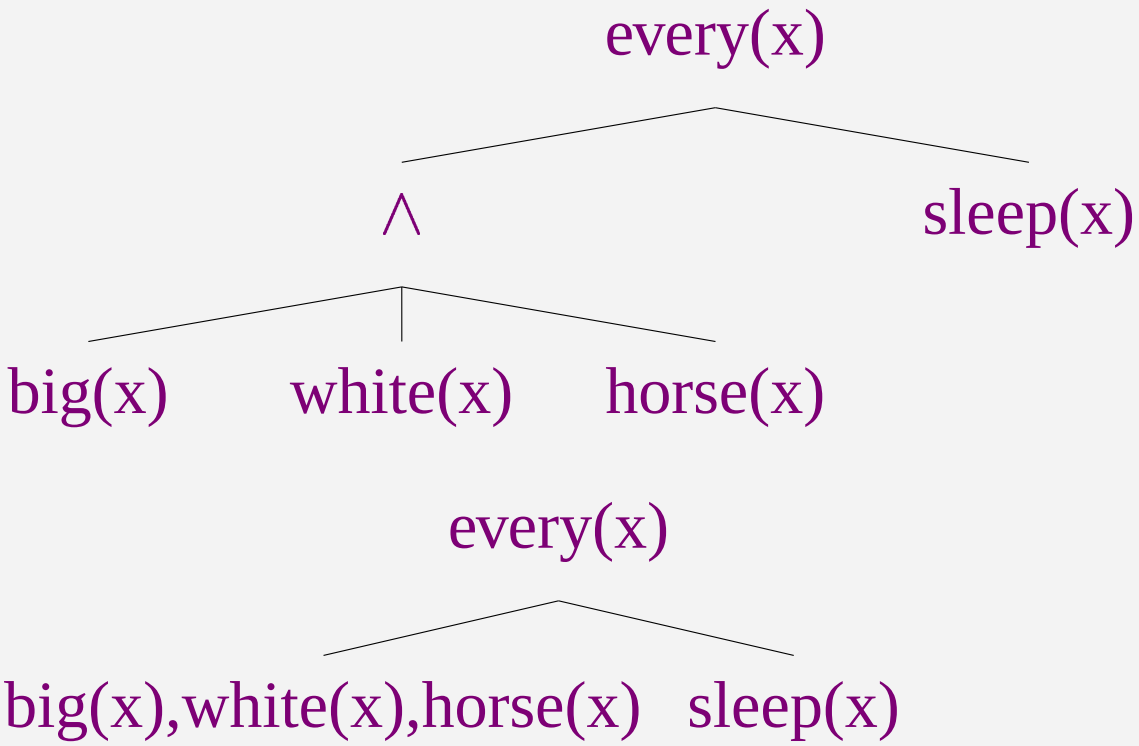
- Adequate representation of natural language semantics
- Grammatical compability
- Computaitonal tractability
- Underspecifiability
- $\rightarrow$ For our purposes today: represent scopal relations in a flat structure.

Working towards MRS (1/4)

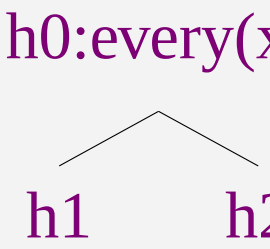
- Every big white horse sleeps.
- every (x, $\wedge$(big(x), $\wedge$(white(x),horse(x))), sleep(x))



Working towards MRS (2/4)



Working towards MRS (3/4)



h1:big(x), h1:white(x), h1:horse(x) h2:sleep(x)

- And finally:

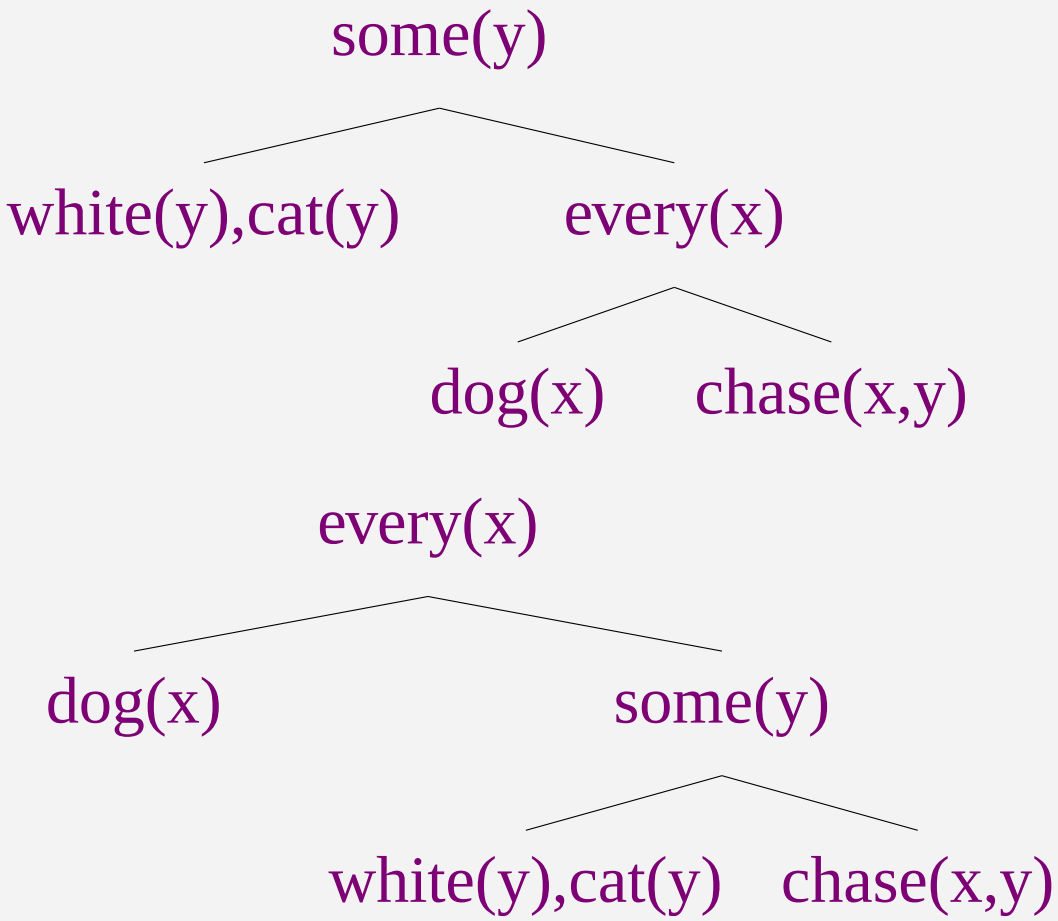
  $h0$:every(x, $h1$, $h2$), $h1$:big(x), $h1$:white(x),
  $h1$:horse(x), $h2$:sleep(x)

Working towards MRS (4/4)

- This is a flat representation, which is a good start.
- Next we need to underspecify quantifier scope, and it's easier to see why with multiple quantifiers.
- At the same time, we want to be able to partially specify it, since this is required for adequate representations of NL semantics.

Underspecified quantifier scope (1/2)

- Every dog chases some white cat.



Underspecified quantifier scope (2/2)

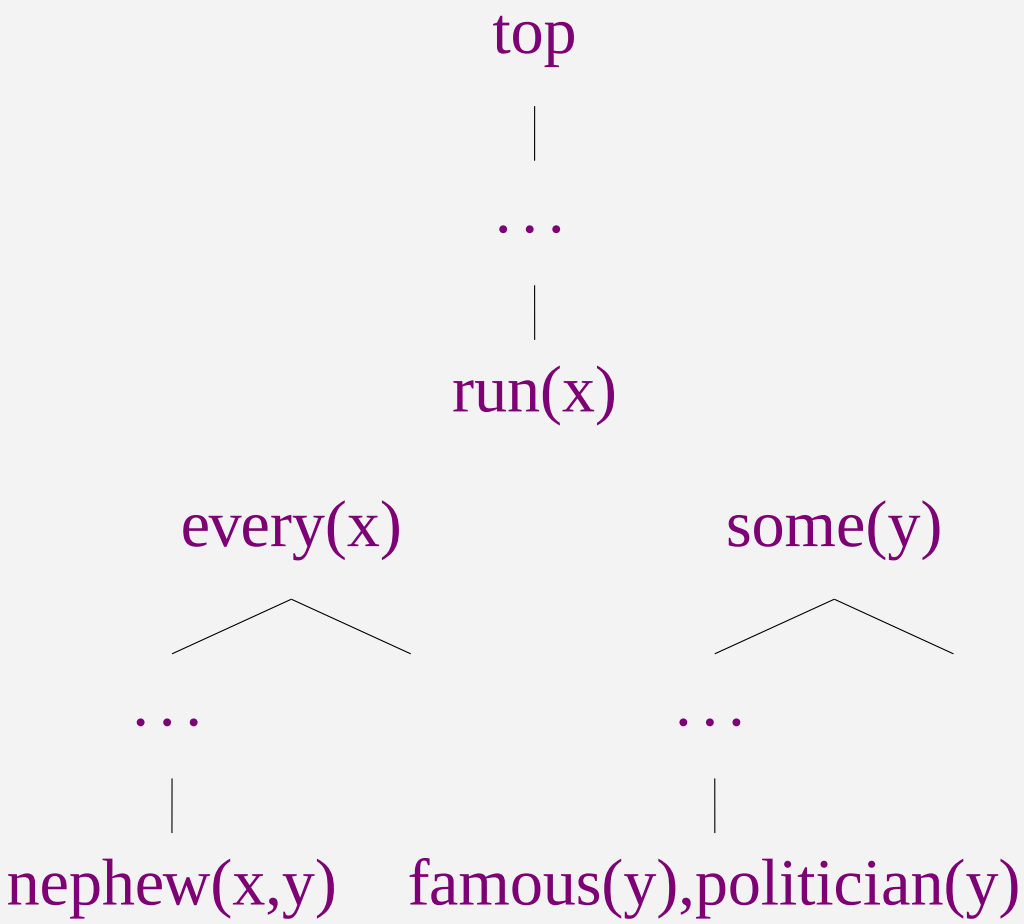
- $h1$:every(x,$h3$,$h4$), $h3$:dog(x), $h7$:white(y), $h7$:cat(y), $h5$:some(y,$h7$,$h1$), $h4$:chase(x,y)
- $h1$:every(x,$h3$,$h5$), $h3$:dog(x), $h7$:white(y), $h7$:cat(y), $h5$:some(y,$h7$,$h4$), $h4$:chase(x,y)
- $h1$:every(x,$h3$,hA), $h3$:dog(x), $h7$:white(y), $h7$:cat(y), $h5$:some(y,$h7$,hB), $h4$:chase(x,y)

Partially constrained quantifier scope (1/4)

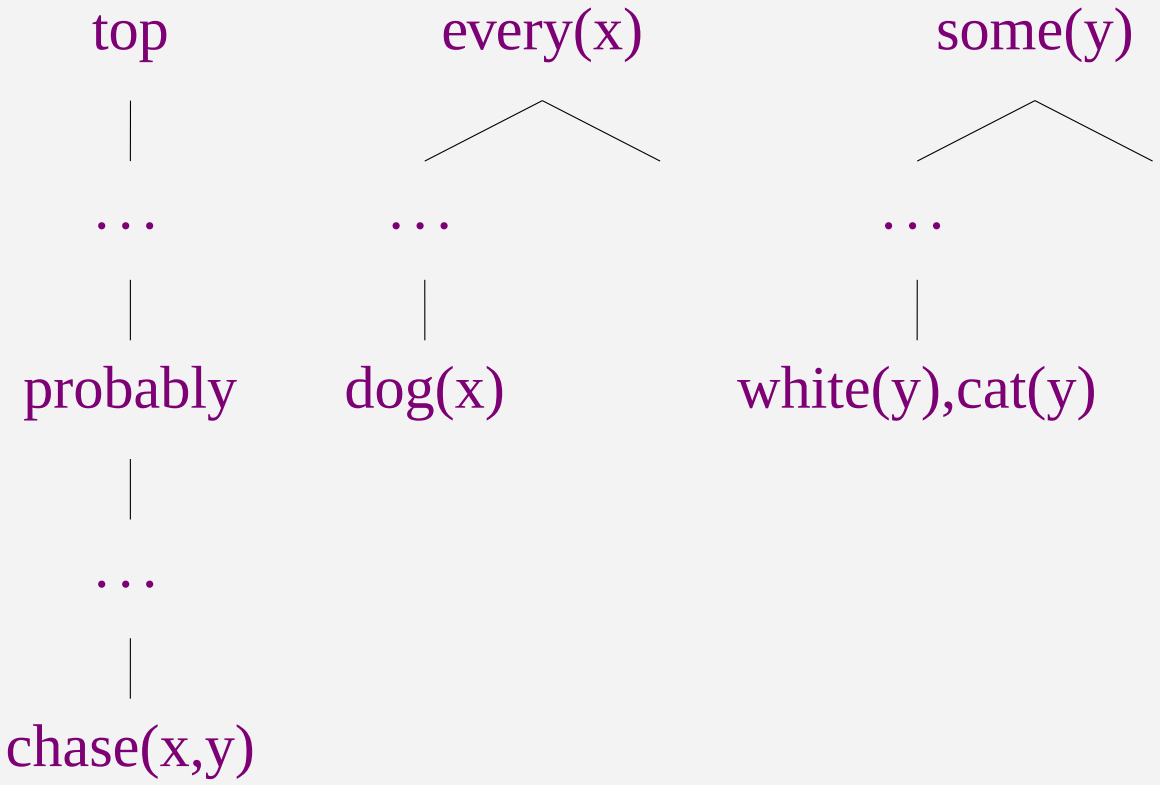
- For the BODY of quantifiers, we have no particular constraints to add.
- In turns out that the RESTRICTION needs to have partially underconstrained scope:
  - Every nephew of some famous politican runs.
  - every(x,some(y,famous(y) $\wedge$ politican(y), nephew(x,y)) run(x))
  - some(y,famous(y) $\wedge$ politican(y), every(x, newphew(x,y),run(x)))
  - But not:

- every(x,run(x),some(y,famous(y) $\wedge$ polician(y), nephew(x,y)))
- ‘Everyone who runs is a newphew of a famous politician.’

Partially constrained quantifier scope (2/4)



Partially constrained quantifier scope (3/4)



Partially constrained quantifier scope (4/4)

- $\langle h0, \{h2 : \text{every}(x, h3, h4), h5 : \text{nephew}(x, y), h6 : \text{some}(y, h7, h8), h9 : \text{politician}(y), h9 : \text{famous}(y), h10 : \text{run}(x)\}, \{h1 =_q h10, h7 =_q h9, h3 =_q h5\}\rangle$
- $\langle h0, \{h1 : \text{every}(x, h2, h3), h4 : \text{dog}(x), h5 : \text{probably}(h6), h7 : \text{chase}(x, y), h8 : \text{some}(y, h9, h10), h11 : \text{white}(y), h11 : \text{cat}(y)\}, \{h0 =_q h5, hw =_q h4, h6 =_q h7, h9 =_q h11\}\rangle$

MRS in feature structures

- HOOK, HCONS, RELS
- ARGn

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