Further Evidence for the Net-Hypothesis

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Background

- Various scope underspecification formalisms have been proposed to model scope ambiguities:
  - Minimal Recursion Semantics (MRS, Copestake & al. 1999)
  - Dominance constraints (Egg & al. 2001)
- Although these formalisms are based on the same ideas, they are not equivalent in general.
  - Underspecified descriptions are interpreted differently
- “Nets” are a sub-class of underspecified descriptions for which MRS and dominance constraints are essentially equivalent (Niehren & Thater, 2003).

Net-Hypothesis

- Hypothesis: all linguistically relevant constrains computed by modern grammars are nets.
  - Theoretically interesting
    (How much expressivity is needed?)
  - Sharing resources between different formalisms
    (e.g., efficient dominance constraint solvers for MRS)
  - Grammar checking: automatic detection of inconsistencies

Previous Work

- Question: are all linguistically “relevant” underspecified descriptions nets?
- Fuchss & al., 2004:
  - 82 % of the sentences of the Redwoods treebank are mapped to an MRS-net.
  - Conjecture: the remaining MRS expressions are systematically “incomplete.”
  - Non-nets have approx. 8 times more solutions on average than nets have.

Fuchss &al.: Limitations

- Only one parse (randomly chosen) was considered.
- The annotation in the treebank (the “right” MRS) was ignored.
- The syntactic derivation tree was not considered.

This Talk

- This talk presents the results of a recent evaluation that considers Fuchss &al's limitations, and
- which supports a "look into" the grammar
  - Problematic syntactic rules

Overview

- Scope ambiguities and underspecification
- Minimal Recursion Semantics
- Dominance constraints
- What are nets?
- Are all underspecified descriptions nets?
- Conclusion

Scope Ambiguities

- "Every student reads a book."
  - (every student x) (some book y) (x reads y)
  - (some book y) (every student x) (x reads y)

- Further examples:
  - "Every student did not pay attention."
  - "Mary wants to marry a millionaire."
  - […]

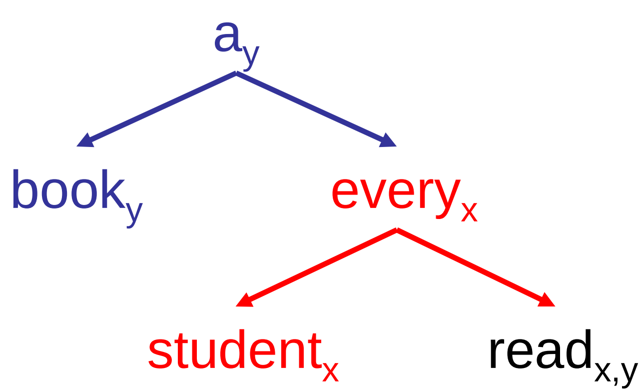
Scope Ambiguities: Problems

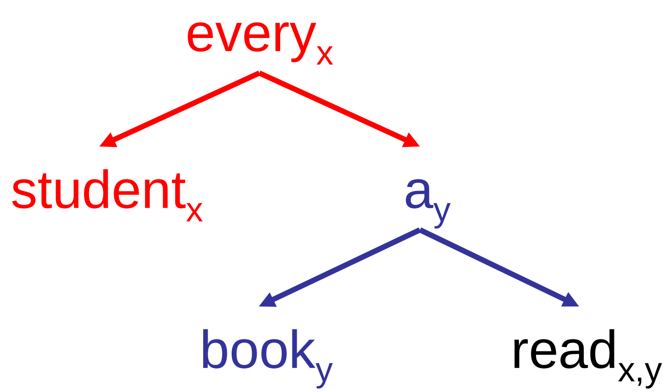
- Problem #1: formulation of a compositional syntax-semantics interface.

- Problem #2: combinatorial explosion of readings
  - "And once down in the saddle between the two Bjørndalstindane summits, we decided to put the rope back into the rucksack." (6160 Readings)

Readings as Trees

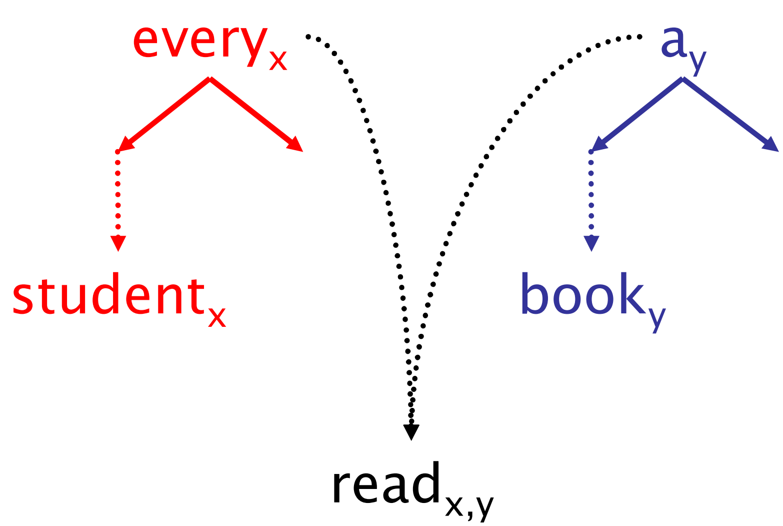
- "Every student reads a book."
  - $every_x(student(x), a_y(book(y), read(x,y)))$
  - $a_y(book(y), every_x(student(x), read(x,y)))$





Minimal Recursion Semantics

- "Every student reads a book."
  - $every_x(student(x), a_y(book(y), read(x,y)))$
  - $a_y(book(y), every_x(student(x), read(x,y)))$

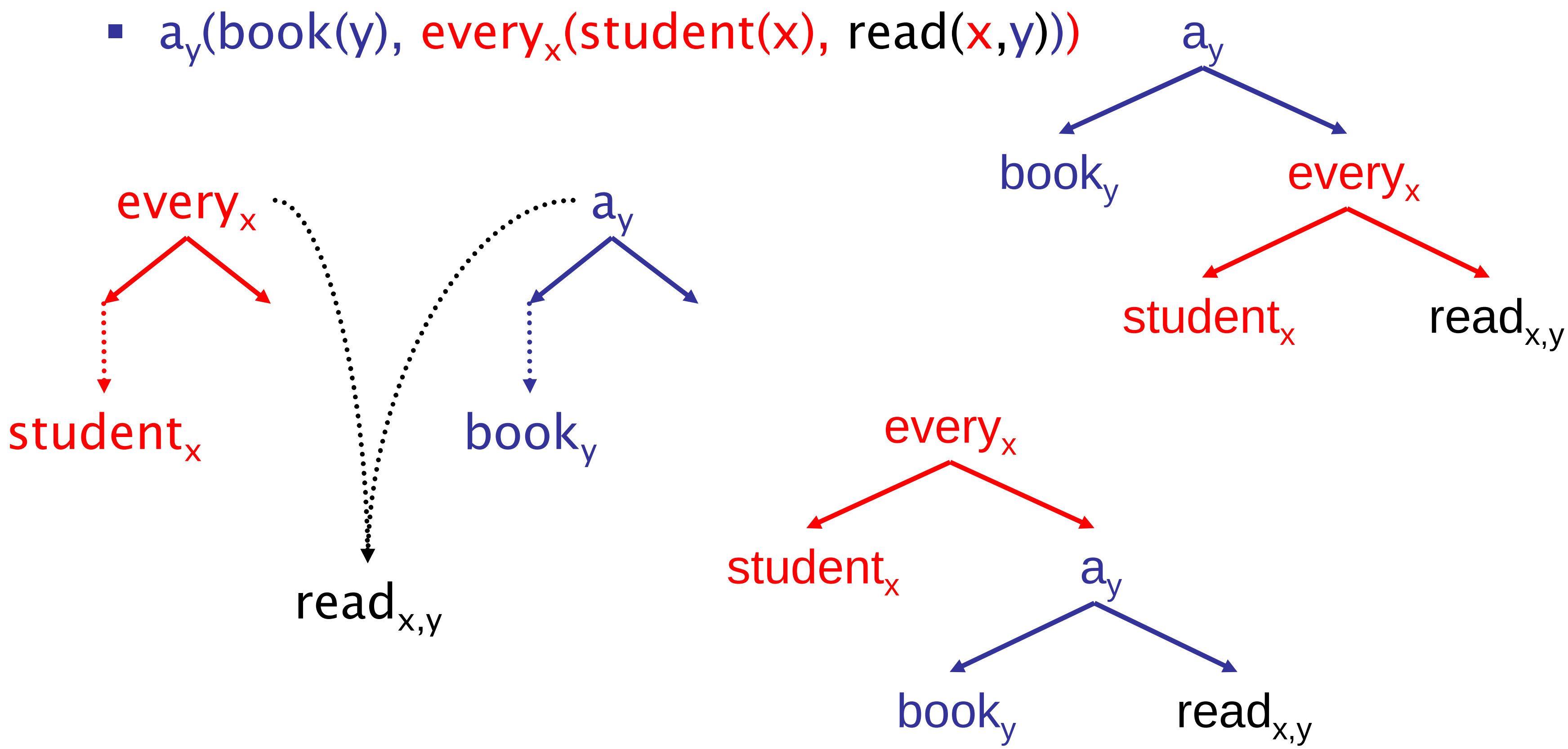


Interpretation (Informal)

- MRS descriptions are interpreted in terms of “scope resolved” MRS structures, or configurations.
- A configuration of an MRS description is a tree obtained by “plugging” tree fragments into each other.
  - A configuration must respect all dominance wishes.
  - All “holes” must be “plugged” at least once.

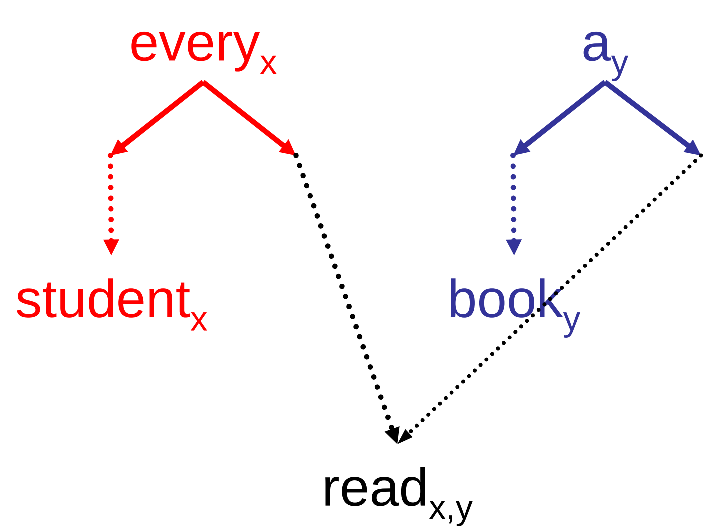
Example

- "Every student reads a book."
  - $every_x(student(x), a_y(book(y), read(x,y)))$
  - $a_y(book(y), every_x(student(x), read(x,y)))$



MRS as Dominance Constraints

- "Every student reads a book."
  - $every_x(student(x), a_y(book(y), read(x,y)))$
  - $a_y(book(y), every_x(student(x), read(x,y)))$

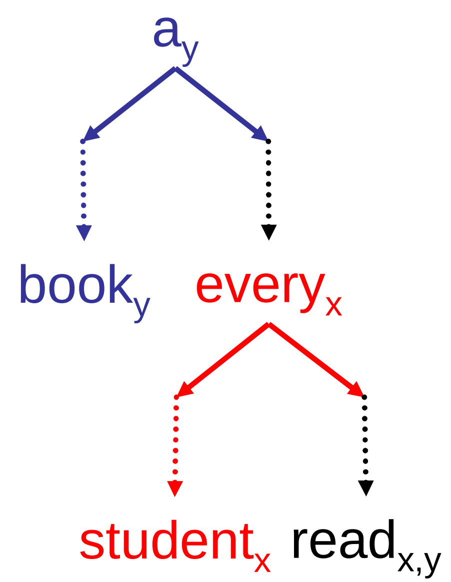


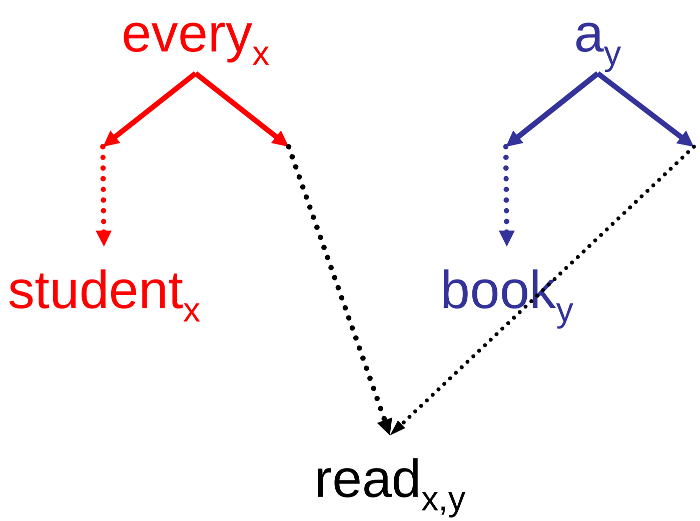
Interpretation (Informal)

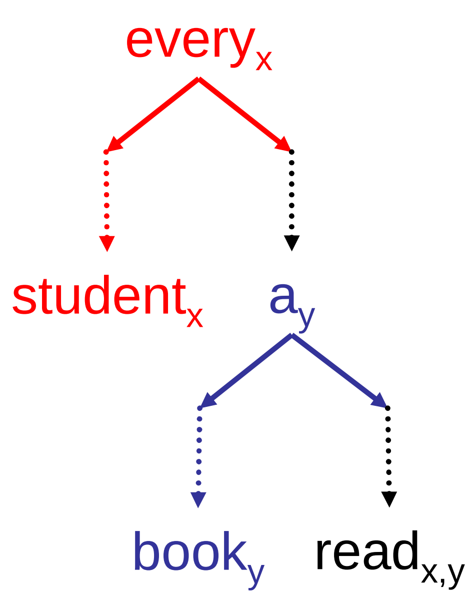
- Dominance constraint are interpreted in terms of finite trees, represented by solved forms.
- A solved form of a dominance constraint is a “tree shaped” dominance constraint.
  - A solved form of a dominance constraint must respect the dominance wishes.

Example

- "Every student reads a book."
  - $every_x(student(x), a_y(book(y), read(x,y)))$
  - $a_y(book(y), every_x(student(x), read(x,y)))$







Configurations ≠ Solved Forms

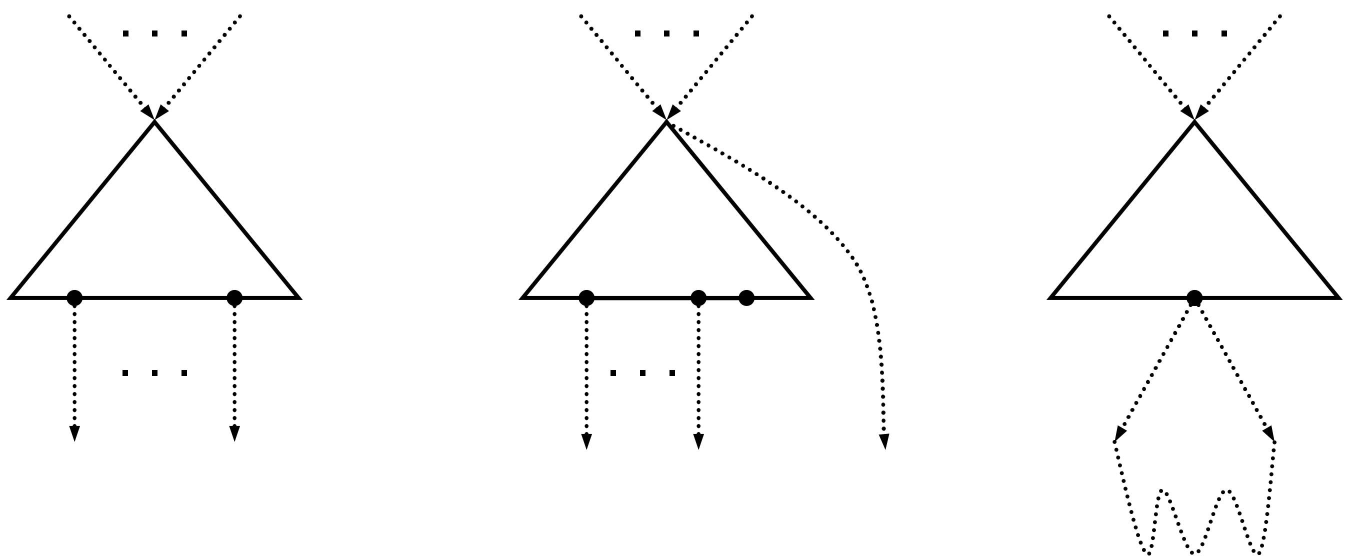
- The main difference between configurations and solved forms is that open “holes” must be filled in configurations.

What are Nets?

- Nets a a sub-class of underspecified descriptions for which configurations and solved forms coincide.
- Assumption: dotted lines in MRS graphs are interpreted as dominance wishes.

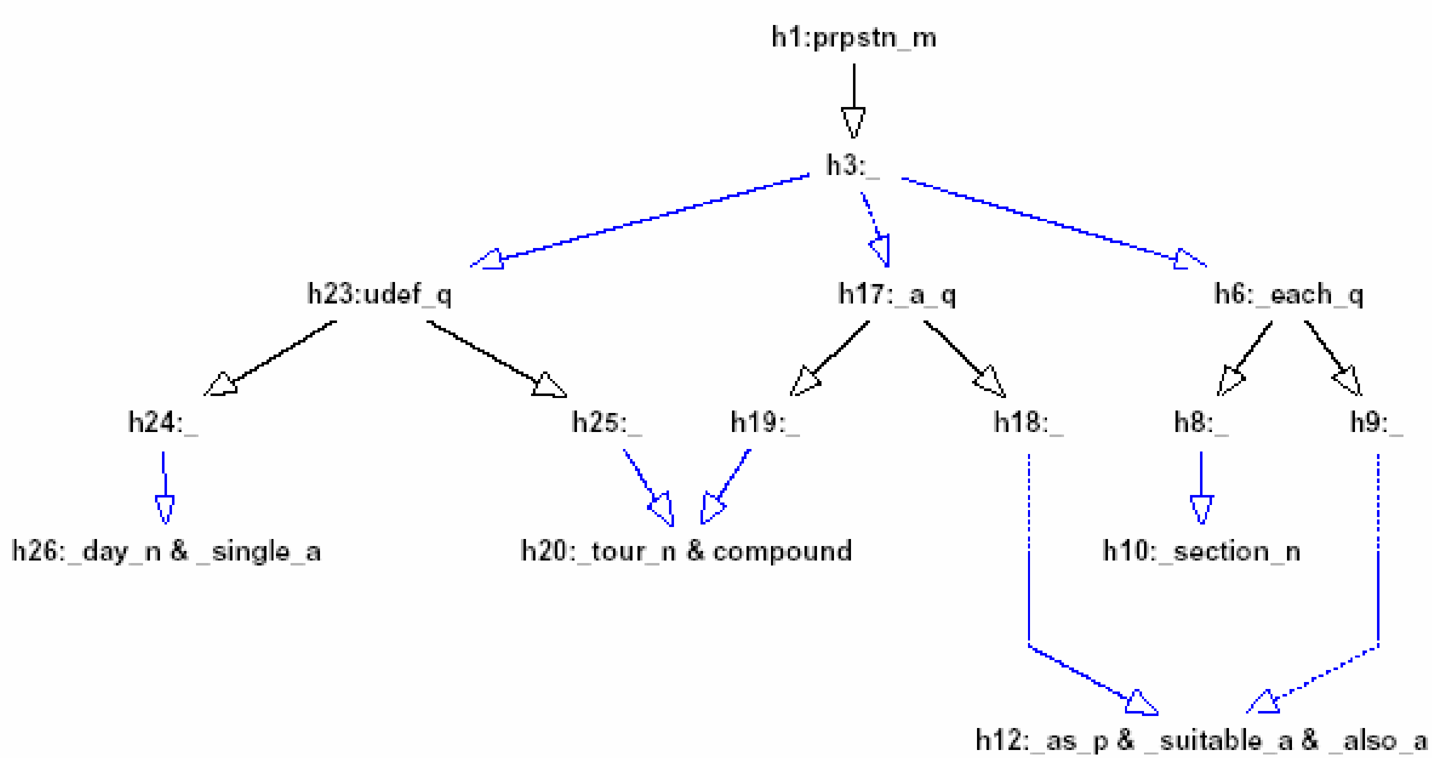
What are Nets?

- An MRS description (or dominance constraint) is a net iff all tree fragments satisfy one of the following schemata:



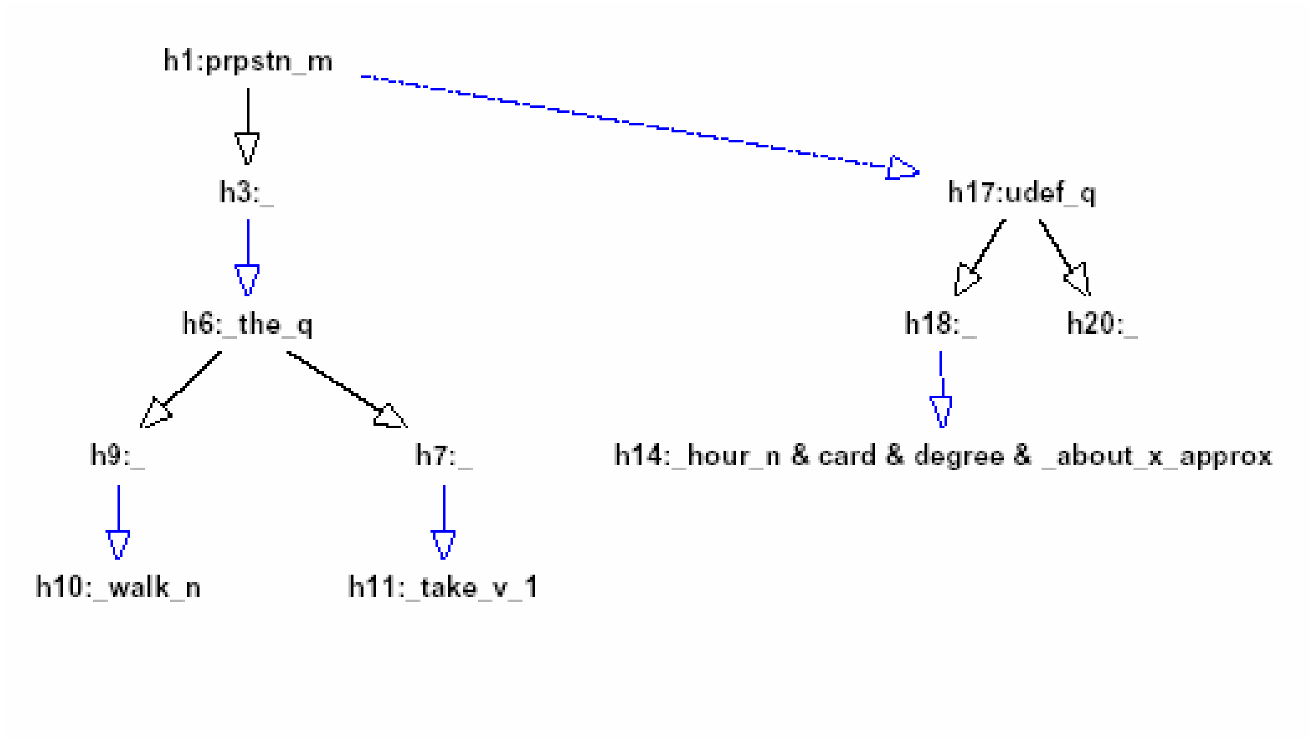
Example (Net)

- “Each section is also suitable as a single day tour.”



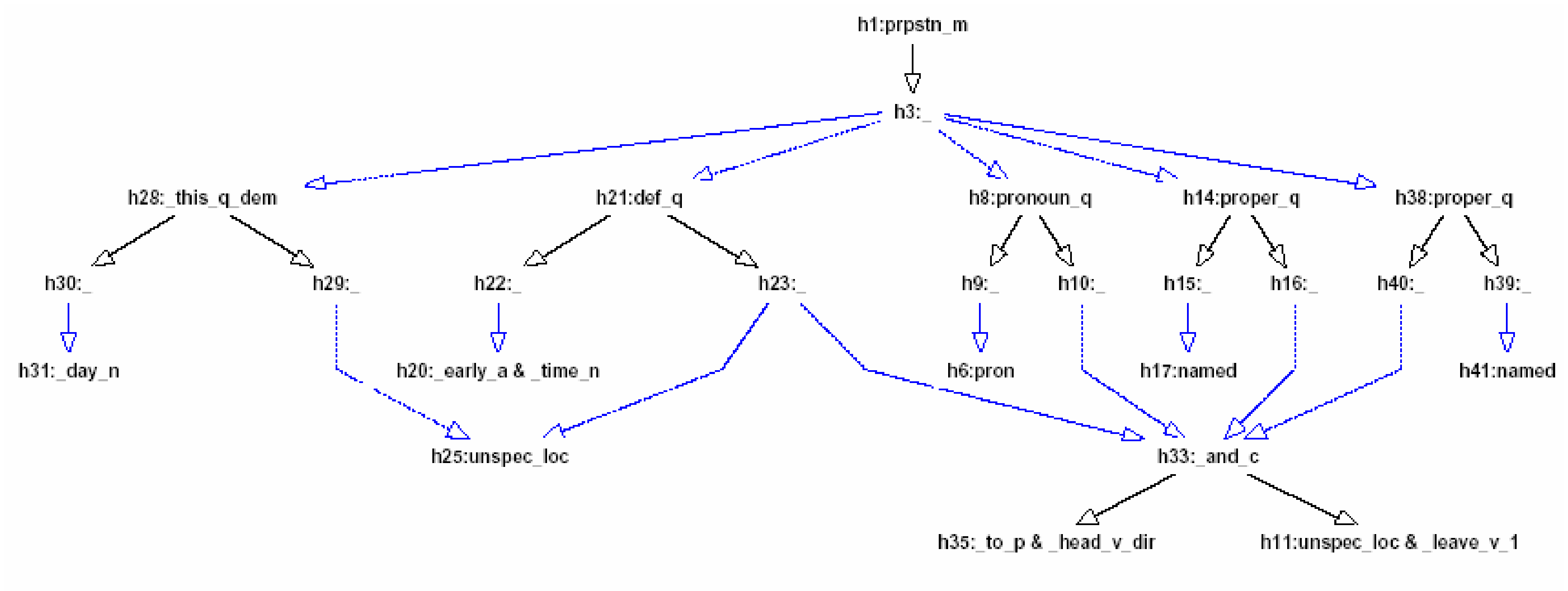
Example (Non-net)

- "The walk takes about 2-3 hours."



Example (Non-net)

- “We leave Doralseter early this day and head to Bjørnhollia.”



Evaluation

- English Resource Grammar
  - October 2004 release
- LKB System
  - Parser
  - Constraint-solver
- Rondane treebank
  - Hiking domain (Norwegian tourist information)
  - 1034 derivation trees and MRS structures.
  - 810 sentences could be parsed

Evaluation (all Parses)

- 44686 derivation trees
  - 75% nets
  - 25% non-net
- Distribution of nets and non-nets
  - 71.7% (49%) only nets
  - 4.8% (3.6%) only non-nets
  - 23.5% (47.4%) both nets and non-nets

Evaluation (Best Parse vs. Gold)

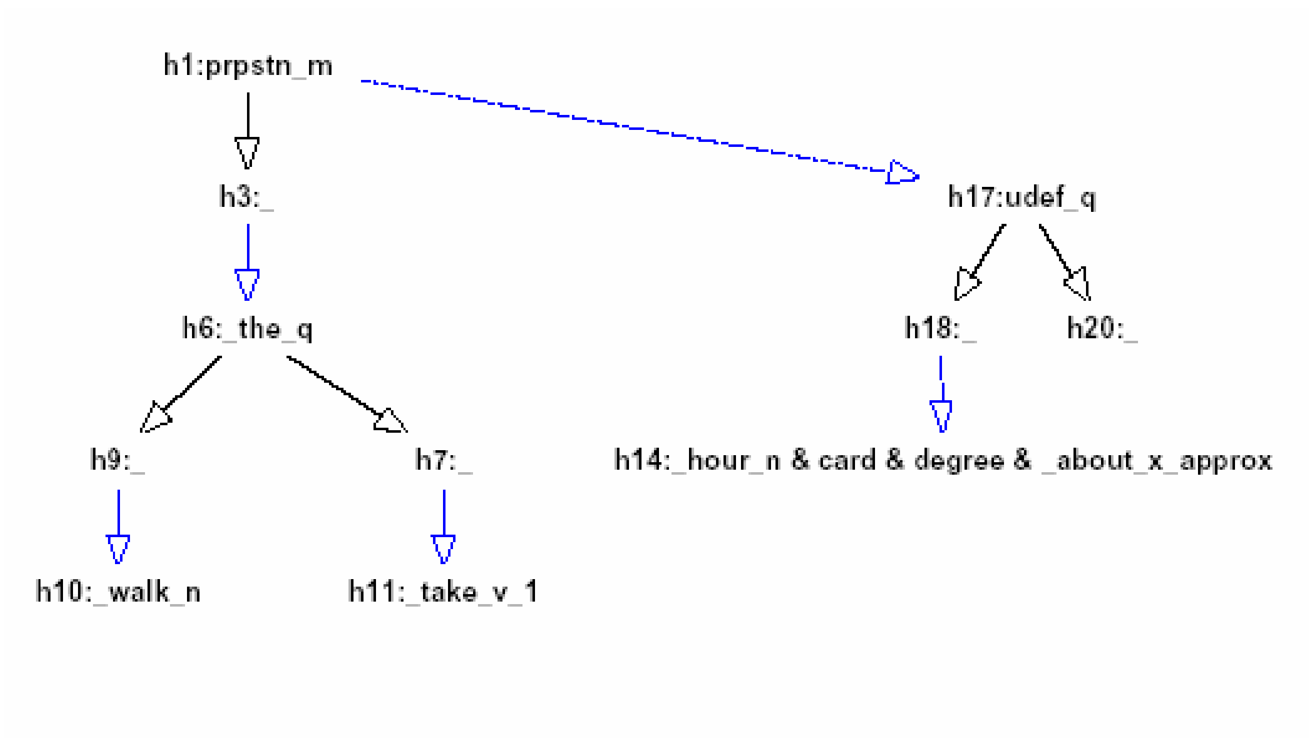
- First/best parse only
  - 86% nets
- Annotated derivations (all)
  - 83.2% nets
  - 84.7% nets (well-formed MRS only)
- Annotated derivations ("filtered")
  - * 87.9% nets
  - * 92.7% nets (well-formed MRS only)

Problem Rules

- Measure Noun Phrases
  - BARE_MEAS_NP (1347)
  - MEASURE_NP (2219)
- Sentence Fragments
  - FRAG_ADJ (78)
  - FRAG_PP_S (633)
  - FRAG_R_MOD_AP (30)
  - FRAG_R_MOD_I_PP (92)
- Coordinations
  - N_COORD_MID (830)
- […]

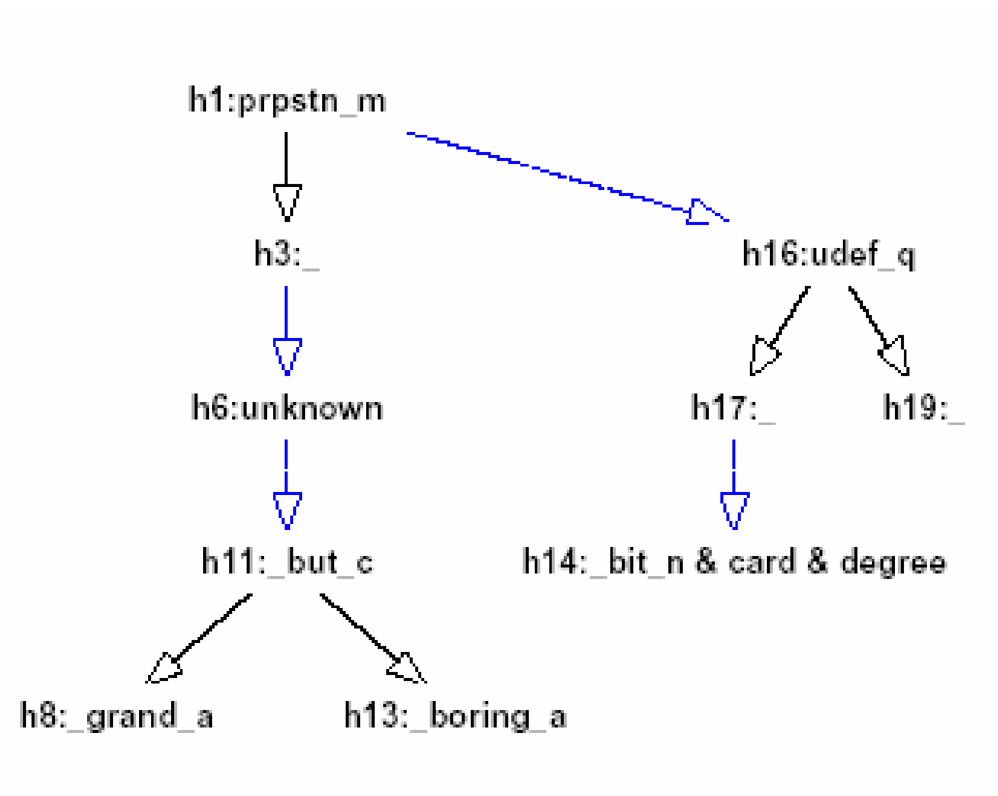
Measure Noun Phrases

- "The walk takes about 2-3 hours."



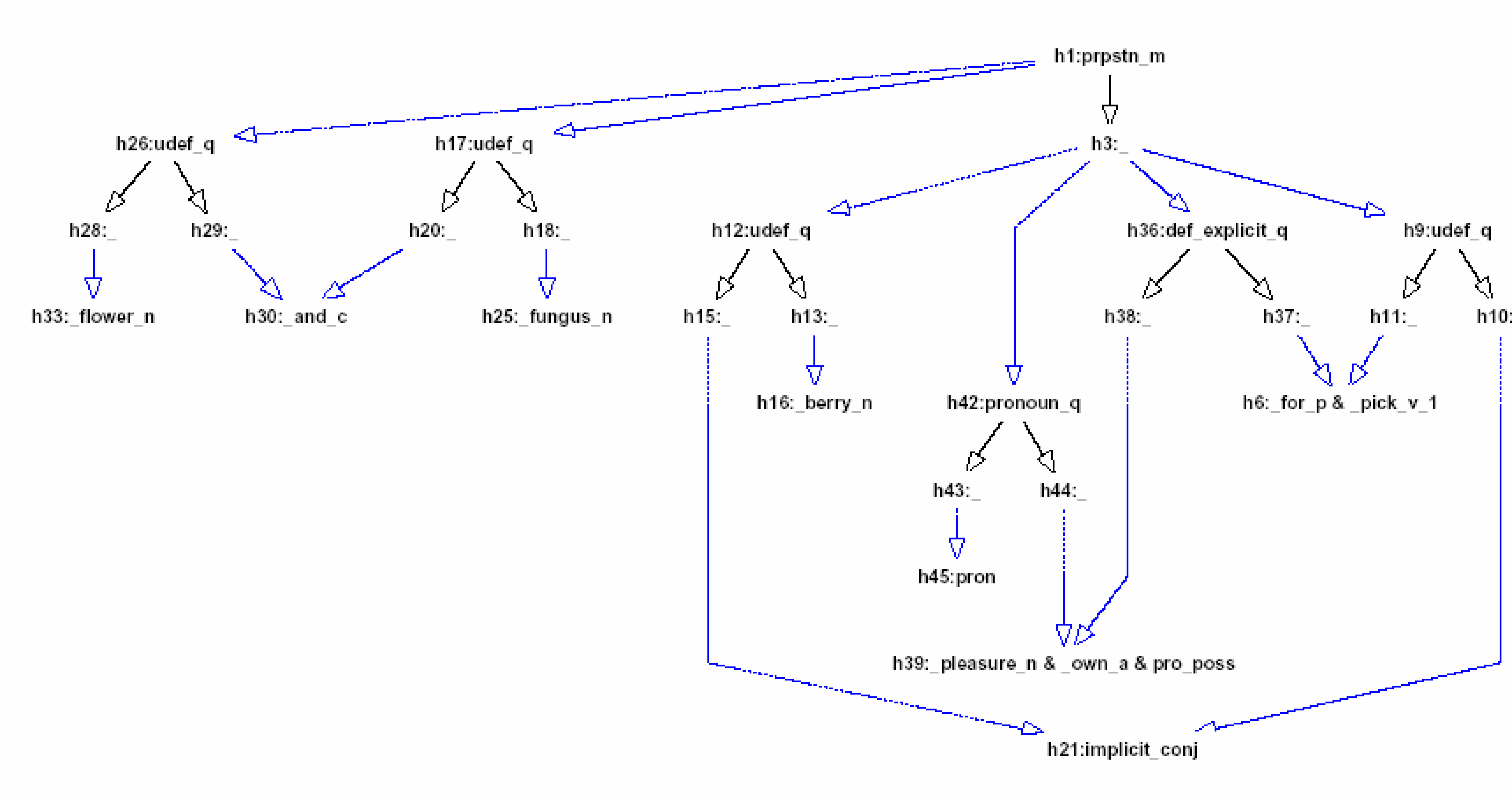
Sentence Fragments

- "Grand but a bit boring."



Coordinations

- "Pick berries, fungi and flowers for your own pleasure."



Evaluation (Gold)

- Further analysis of non-nets obtained by problem rules shows that they all follow the same pattern.
- This strongly suggests that all MRS obtained by a problem rule are “incomplete.”
- Only derivation trees without “problem rules”
  - 90.2% nets
  - 94 % nets (well-formed only)

Conclusions

- The data indicates that
  - Nets are intended (best parse vs. arbitrary parse)
    Possible explanation: frequent rules are better maintained
  - Non-nets using “problem rules” are incompleted