Simple Trees with Complex Semantics: On Epistemic Modals and Strong Quantifiers

Frank Richter & Manfred Sailer

Eberhard Karls Universität Tübingen and Universität Göttingen

August 14th, 2008

Goal of this Talk

Thesis:
An adequate syntax-semantics interface should

- treat syntax and semantics as separate modules of grammars
- not tie semantic ambiguity to syntactic ambiguity
- not force the grammar writer to turn semantic distinctions into syntactic features
- keep a computationally feasible architecture in sight.

Strategy:
Cross-linguistic study of the interaction of epistemic modals and strong quantifiers in English and in German.

Structure of the Talk

1. Data and LF-Syntax Analysis (LFS)
2. English
3. German
4. Concluding Remarks

1.1 Data

(1) a. Not every boy can make the basketball team.
$\neg \succ$ **CAN** $\succ \forall$
"It is not possible that every boy makes the basketball team" (Lechner 2006)

b. Nicht jeder kann gewinnen.
not everyone can win
$\neg \succ$ **CAN** $\succ \forall$
"It is not possible that everyone wins."

(2) $\lambda w.\neg\exists w'(\mathbf{acc}(w,w')\wedge\forall x(\mathbf{boy}(x)\rightarrow\mathbf{make\text{-}team}(w',x)))$

(3) a. It is not the case that every boy can make the team.
$\lambda w.\neg\forall x(\mathbf{boy}(x)\rightarrow\exists w'(\mathbf{acc}(w,w')\wedge\mathbf{make\text{-}team}(w',x)))$

b. It is possible that not every boy makes the team.
$\lambda w.\exists w'(\mathbf{acc}(w,w')\wedge\neg\forall x(\mathbf{boy}(x)\rightarrow\mathbf{make\text{-}team}(w',x)))$

1.1 Data

(1) a. Not every boy can make the basketball team.
$\neg \succ \textbf{CAN} \succ \forall$
"It is not possible that every boy makes the basketball team" (Lechner 2006)

b. Nicht jeder kann gewinnen.
not everyone can win
$\neg \succ \textbf{CAN} \succ \forall$
"It is not possible that everyone wins."

(2) $\lambda w.\neg\exists w'(\textbf{acc}(w,w')\wedge\forall x(\textbf{boy}(x)\rightarrow\textbf{make-team}(w',x)))$

(3) a. It is not the case that every boy can make the team.
$\lambda w.\neg\forall x(\textbf{boy}(x)\rightarrow\exists w'(\textbf{acc}(w,w')\wedge\textbf{make-team}(w',x)))$

b. It is possible that not every boy makes the team.
$\lambda w.\exists w'(\textbf{acc}(w,w')\wedge\neg\forall x(\textbf{boy}(x)\rightarrow\textbf{make-team}(w',x)))$

1.2 LFS Analysis: Lechner 2006

(4) The structure of the sentence according to Lechner:

$[_{NegP}$ NEG $[_{Neg^0}$ *can*$_i$ $[_{TP}$ *not every boy*$_j$ $[\mathrm{t}_i$
$\lambda p.\neg p$ $\lambda p\mathbf{CAN}(p)$ $\lambda P.\forall x(\mathbf{boy}(x)\rightarrow P(x))$
$[_{VP}$ t_j make the team $]]]]]]$
$\lambda x.\mathbf{make\text{-}team}(x)$

Assumptions:

L(1) strong NPs do not reconstruct under raising verbs,

L(2) NPs of the form *not NP* contain a semantically vacuous *not* but require to be contained in a NegP which contributes the negation,

L(3) the NegP is high in the tree (but has a variable position),

L(4) an epistemic modal can move over the subject in the syntax.

1.2 LFS Analysis: Lechner 2006

(4) The structure of the sentence according to Lechner:

$[_{NegP}$	NEG	$[_{Neg^0}$	*can*$_i$	$[_{TP}$	*not every boy*$_j$ $[\text{t}_i$
	$\lambda p.\neg p$		$\lambda p\textbf{CAN}(p)$		$\lambda P.\forall x(\textbf{boy}(x)\rightarrow P(x)$
$[_{VP}$ t$_j$	make the team]]]]]]				
	$\lambda x.\textbf{make-team}(x)$				

Assumptions:

L(1) strong NPs do not reconstruct under raising verbs,

L(2) NPs of the form *not NP* contain a semantically vacuous *not* but require to be contained in a NegP which contributes the negation,

L(3) the NegP is high in the tree (but has a variable position),

L(4) an epistemic modal can move over the subject in the syntax.

1.3 LFS Analysis: Problems

P(1) syntactic generalizations about English auxiliaries?

P(2) different syntax of finite auxiliaries in English and in German

P(3) generalizations at the syntax-semantics interface

1.3 LFS Analysis: Problems

P(1) syntactic generalizations about English auxiliaries?

P(2) different syntax of finite auxiliaries in English and in German

P(3) generalizations at the syntax-semantics interface

(5) a. Every student seems to have passed the test.
(only de re)

b. A student seems to have passed the test.
(de re and de dicto)

c. John seeks every unicorn. (only de re)
$\forall x(\mathbf{unicorn}(x) \rightarrow \mathbf{seek}(w', \mathbf{john}, \lambda w'' \lambda P.P(w'', x)))$
$\#\ \mathbf{seek}(w', \mathbf{john}, \lambda w'' \lambda P.\forall x(\mathbf{unicorn}(x) \rightarrow P(w'', x)))$

1.3 LFS Analysis: Problems

P(1) syntactic generalizations about English auxiliaries?

P(2) different syntax of finite auxiliaries in English and in German

P(3) generalizations at the syntax-semantics interface

G(1) If a strong quantifier occurs in a (surface) argument position of an opaque non-modal verb, it must take scope over the verb.
replaces (L(1) and L(4))

2.1 English: Preliminaries

Surface Syntax: English vs. German

(6) a. $[_S$ $[_{NP}$ Not every boy$]$ $[_{VP}$ can $[_{VP}$ make the team$]]]$
b. $[_{\overline{S}}$ $[_{NP}$ Nicht jeder$]_j$ $[_S$ kann$_i$ $[_{VP}$ t$_j$ gewinnen t$_i]]]$

2.2 English: Preliminaries

Semantic representations in LRS

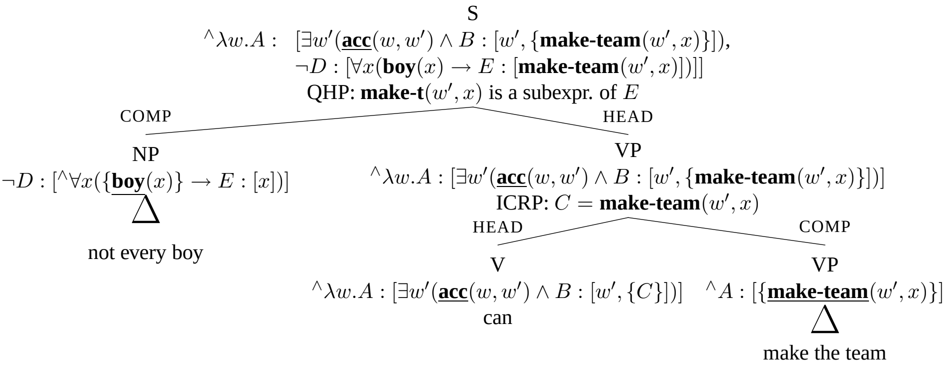
1. Lexical signs exhaustively contribute all meaning components of utterances

   $\Longrightarrow$ *nicht* and *no*, respectively, contribute negation (contra L(2))
   $\Longrightarrow$ no abstract negation (contra L(3))

2. Signs contribute constraints on the relationships between (pieces of) their semantic contributions
3. Semantic constraints *denote* semantic representations
4. Fundamental distinction between various aspects of meaning contributions:

   - main content, underlined: $\underline{\phi}$
   - internal content, between curly braces: $\{\psi\}$
   - external content, preceded by caret: $^\wedge\chi$

2.3 English: Analysis



S

${}^{\wedge}\lambda w.A : \; [\exists w'(\underline{\mathbf{acc}}(w,w') \wedge B : [w', \{\mathbf{make\text{-}team}(w',x)\}]),$
$\neg D : [\forall x(\mathbf{boy}(x) \rightarrow E : [\mathbf{make\text{-}team}(w',x)])]]$

QHP: $\mathbf{make\text{-}t}(w',x)$ is a subexpr. of E

COMP

HEAD

NP

$\neg D : [{}^{\wedge}\forall x(\{\underline{\mathbf{boy}}(x)\} \rightarrow E : [x])]$

not every boy

VP

${}^{\wedge}\lambda w.A : [\exists w'(\underline{\mathbf{acc}}(w,w') \wedge B : [w', \{\mathbf{make\text{-}team}(w',x)\}])]$

ICRP: $C = \mathbf{make\text{-}team}(w',x)$

HEAD

COMP

V

${}^{\wedge}\lambda w.A : [\exists w'(\underline{\mathbf{acc}}(w,w') \wedge B : [w', \{C\}])]$

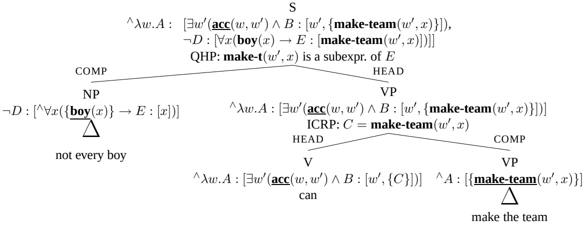
can

VP

${}^{\wedge}A : [\{\underline{\mathbf{make\text{-}team}}(w',x)\}]$

make the team

2.3 English: Analysis



S

$^\wedge\lambda w.A : \; [\exists w'(\underline{\mathbf{acc}}(w,w') \wedge B : [w', \{\mathbf{make\text{-}team}(w',x)\}]),$
$\neg D : [\forall x(\mathbf{boy}(x) \rightarrow E : [\mathbf{make\text{-}team}(w',x)])]]$

QHP: **make-t**(w',x) is a subexpr. of E

COMP

NP

$\neg D : [^\wedge\forall x(\{\underline{\mathbf{boy}}(x)\} \rightarrow E : [x])]$

not every boy

HEAD

VP

$^\wedge\lambda w.A : [\exists w'(\underline{\mathbf{acc}}(w,w') \wedge B : [w', \{\mathbf{make\text{-}team}(w',x)\}])]$

ICRP: $C = \mathbf{make\text{-}team}(w',x)$

HEAD

V

$^\wedge\lambda w.A : [\exists w'(\underline{\mathbf{acc}}(w,w') \wedge B : [w', \{C\}])]$

can

COMP

VP

$^\wedge A : [\{\underline{\mathbf{make\text{-}team}}(w',x)\}]$

make the team

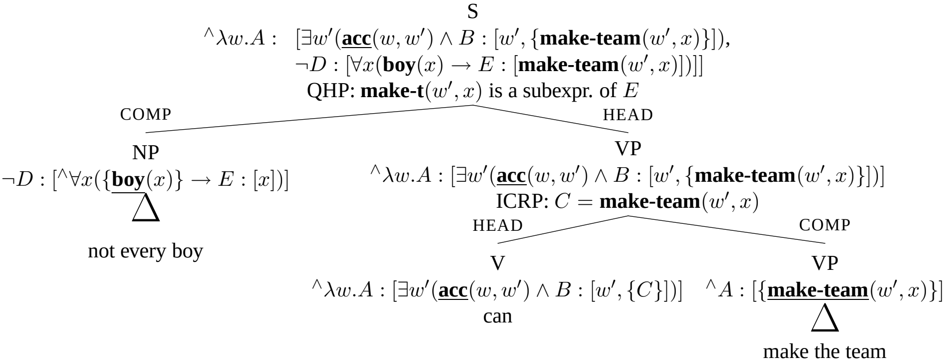
(7) INTERNAL CONTENT RAISING PRINCIPLE (ICRP)

In a head-complement structure,

if the main content of the head is not a subexpression of its internal content,
and the index or the main content of the complement is a subexpression of the head's internal content,

then the internal content of the head and internal content of the complement are identical.

2.3 English: Analysis



S

$^\wedge\lambda w.A : \; [\exists w'(\underline{\mathbf{acc}}(w,w') \wedge B : [w', \{\mathbf{make\text{-}team}(w',x)\}]),$

$\neg D : [\forall x(\mathbf{boy}(x) \rightarrow E : [\mathbf{make\text{-}team}(w',x)])]]$

QHP: $\mathbf{make\text{-}t}(w',x)$ is a subexpr. of E

COMP

HEAD

NP

$\neg D : [^\wedge\forall x(\{\underline{\mathbf{boy}}(x)\} \rightarrow E : [x])]$

not every boy

VP

$^\wedge\lambda w.A : [\exists w'(\underline{\mathbf{acc}}(w,w') \wedge B : [w', \{\mathbf{make\text{-}team}(w',x)\}])]$

ICRP: $C = \mathbf{make\text{-}team}(w',x)$

HEAD

COMP

V

$^\wedge\lambda w.A : [\exists w'(\underline{\mathbf{acc}}(w,w') \wedge B : [w', \{C\}])]$

can

VP

$^\wedge A : [\{\underline{\mathbf{make\text{-}team}}(w',x)\}]$

make the team

(8) QUANTIFIER-HEAD PRINCIPLE (QHP)
In a head complement structure, if the nonhead is a quantifier, then the head's internal content is a subexpression of the nonhead's scope.

2.3 English: Analysis

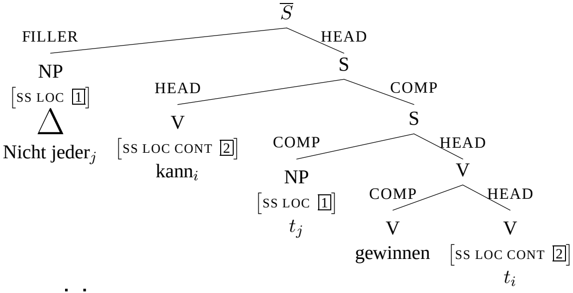
(9) STRONG QUANTIFIER RESTRICTION (SQR, G(1)):
For each verb *v* and each NP *n* that is selected by *v*: *n*'s index value may not be bound by a strong quantifier inside an argument position of *v*'s main content.

(10) a. LRS constraint of the verb *can*:
$^\wedge\lambda w.A : [\exists w'(\underline{\mathbf{acc}}(w, w') \wedge B : [w', \{C\}])]$

b. LRS constraint of the verb *seem*:
$^\wedge\lambda w.A : [\underline{\mathbf{seem}}(w, \lambda w'.B[w', \{C\}])]$

c. LRS constraint of the verb *seek*:
$^\wedge\lambda w.A : [\underline{\mathbf{seek}}(w, x, \lambda w'.B[w', \{C\}])]$

3.1 German: Preliminaries



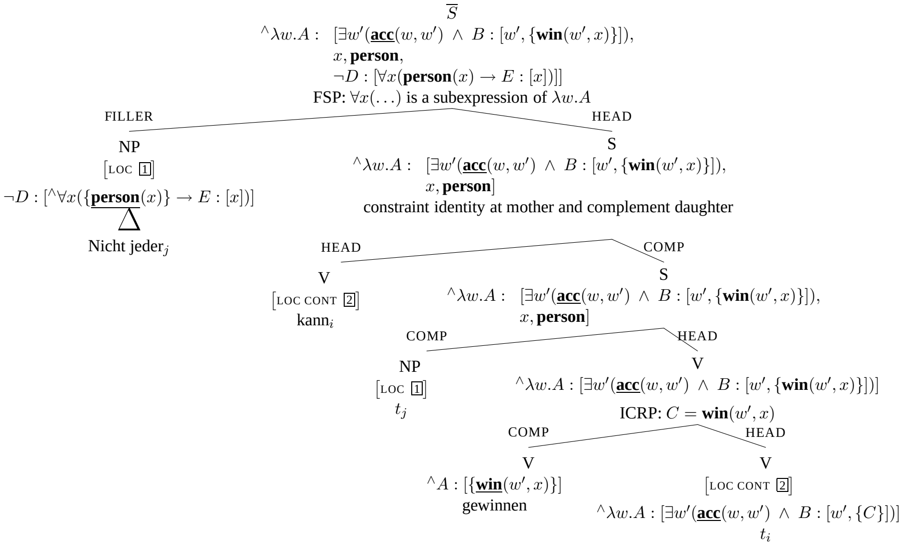
Special provisions:

(11) a. FILLER SCOPE PRINCIPLE (FSP)
In a head-filler structure, the external content of the filler must be a subexpression of the external content of the head.

b. nominal trace

c. verbal trace

3.2 German: Analysis



$\overline{S}$

$^\wedge\lambda w.A : \; [\exists w'(\underline{\mathbf{acc}}(w,w') \;\wedge\; B : [w', \{\mathbf{win}(w',x)\}]), x, \mathbf{person}, \neg D : [\forall x(\mathbf{person}(x) \rightarrow E : [x])]]$

FSP: $\forall x(\ldots)$ is a subexpression of $\lambda w.A$

FILLER

NP

$[\text{LOC } \boxed{1}]$

$\neg D : [^\wedge\forall x(\{\underline{\mathbf{person}}(x)\} \rightarrow E : [x])]$

Nicht jeder$_j$

HEAD

S

$^\wedge\lambda w.A : \; [\exists w'(\underline{\mathbf{acc}}(w,w') \;\wedge\; B : [w', \{\mathbf{win}(w',x)\}]), x, \mathbf{person}]$

constraint identity at mother and complement daughter

HEAD

V

$[\text{LOC CONT } \boxed{2}]$

kann$_i$

COMP

S

$^\wedge\lambda w.A : \; [\exists w'(\underline{\mathbf{acc}}(w,w') \;\wedge\; B : [w', \{\mathbf{win}(w',x)\}]), x, \mathbf{person}]$

COMP

NP

$[\text{LOC } \boxed{1}]$

t_j

HEAD

V

$^\wedge\lambda w.A : [\exists w'(\underline{\mathbf{acc}}(w,w') \;\wedge\; B : [w', \{\mathbf{win}(w',x)\}])]$

ICRP: $C = \mathbf{win}(w',x)$

COMP

V

$^\wedge A : [\{\underline{\mathbf{win}}(w',x)\}]$

gewinnen

HEAD

V

$[\text{LOC CONT } \boxed{2}]$

$^\wedge\lambda w.A : [\exists w'(\underline{\mathbf{acc}}(w,w') \;\wedge\; B : [w', \{C\}])]$

t_i

Conclusions

- The syntactic structure of a sentence should not depend on the interpretation of scopal elements.
- The semantic interpretation of a scope-taking expression should not necessarily affect the syntactic representation.
- Generalizations at the interface should not touch the internal structure of independently motivated grammar modules.
- Techniques:
  - constraint-based semantic representations
  - underspecification
  - suitable for computational implementation