Lecture 10: Basic LFG Binding Theory: nuclearity conditions

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Definition of binding.
In Government/Binding and related theories, binding is defined on phrase structure: α binds β iff α c-commands β, α and β coindexed. In LFG the definition of binding is roughly analogous, but defined on f-structure instead.

Relational hierarchy:
SUBJ > OBJ > OBJ_θ > OBL_θ > COMP > ADJ

α outranks β if α and β belong to the same f-s and α is more prominent than β on the relational hierarchy or α outranks some γ that contains β.

α <u>binds</u> β: α outranks β; α and β coindexed

(α INDEX)=(β INDEX)

1. $John_i$ saw $himself_i$. SUBJ > OBJ
   cp. *I prefer for $himself_i$ to see $John_i$

2. Mary showed $John_j$ $himself_j$. OBJ > OBJ_{th}

3. $John_i$ depends [on $himself_i$]γ. SUBJ > OBL_θ
   (OBL_θ contains *himself*)
   cp. *I prefer for $himself_i$ to depend on $John_i$

4. John$_i$ saw [a picture of himself$_i$]$_\gamma$.
   SUBJ > OBJ (OBJ contains *himself*)

5. Mary asked John$_j$ [about himself$_j$]$_\gamma$.
   OBJ > OBL$_\theta$ (OBL$_\theta$ contains *himself*)

6. John$_i$ prefers [for himself$_i$ to get the job]$_\gamma$.
   SUBJ > COMP (COMP contains *himself*)

Nuclearity conditions. GB binding principles are stated with respect to a local domain, the 'governing category' of the anaphor or pronoun: an anaphor/pronoun must/can't be bound in its governing category. The LFG f-structure analogue of governing category is called the *nucleus*.

Nucleus:
The nucleus of f-s *f* is the subset of *f* consisting of the PRED element and all of the elements whose attributes are functions designated by the PRED.

$$f\begin{bmatrix} \text{TOP} & \boxed{1}\,[\text{"Mary"}] \\ \textbf{SUBJ} & [\textbf{"they"}] \\ \text{POL} & - \\ \text{TENSE} & \text{PAST} \\ \textbf{OBJ} & \boxed{1} \\ \textbf{PRED} & \textbf{'see}\,\langle \textbf{(f SUBJ)(f OBJ)}\rangle\textbf{'} \end{bmatrix}$$

Mary, they didn’t see.

Binding Principles (version 1):

A. A nuclear pronoun must be bound in the minimal nucleus that contains it.

B. A nonnuclear pronoun must be free in the minimal nucleus that contains it.

C. Other nominals must be free.

exs. Ann saw herself.
*Ann's father saw herself.
*Herself yawned.
*Ann thinks that herself is great.

Problem: Sometimes reflexives can have a binder in a higher nucleus:

1. John$_i$ saw [a picture of himself$_i$]γ.
   SUBJ > OBJ (OBJ contains *himself*)

2. Mary asked John$_j$ [about himself$_j$]γ.
   OBJ > OBL$_\theta$ (OBL$_\theta$ contains *himself*)

3. John$_i$ prefers [for himself$_i$ to get the job]γ.
   SUBJ > COMP

Also many languages have possessive reflexives:

4. Jonas$_i$ gillar sin$_i$ / hans$_{*i}$ mor. (Swedish)
   Jonas likes self's / his mother

5. a. *Jonas likes himself's mother.
   b. *Mary thinks that herself is the best.

A morphological gap:
English lacks possessive and nominative case anaphors.
(Icelandic also lacks nominative anaphors, but an oblique subject anaphor is OK.)

Revise Principle A: A nuclear pronoun must be bound in the minimal nucleus that contains it and a subject outranking it. (='the minimal complete nucleus')

This follows the transformational 'specified subject' line; cp. especially Huang's paper. Note that 'discourse binding' is still a problem:

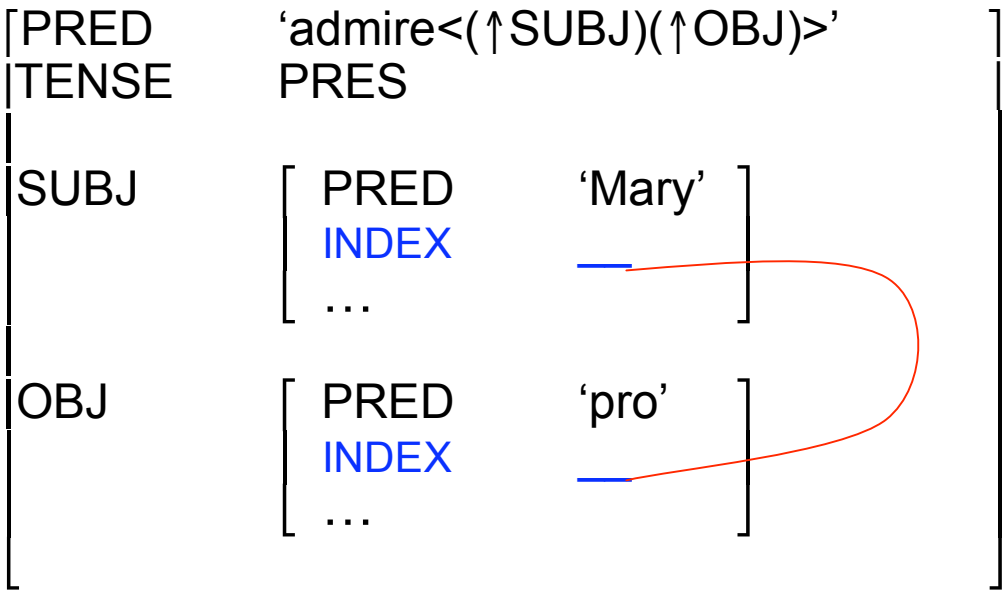
> John was mad. That picture of himself in the newspaper would wreck his career.

The reflexive has no minimal complete nucleus at all, hence it violates Principle A.

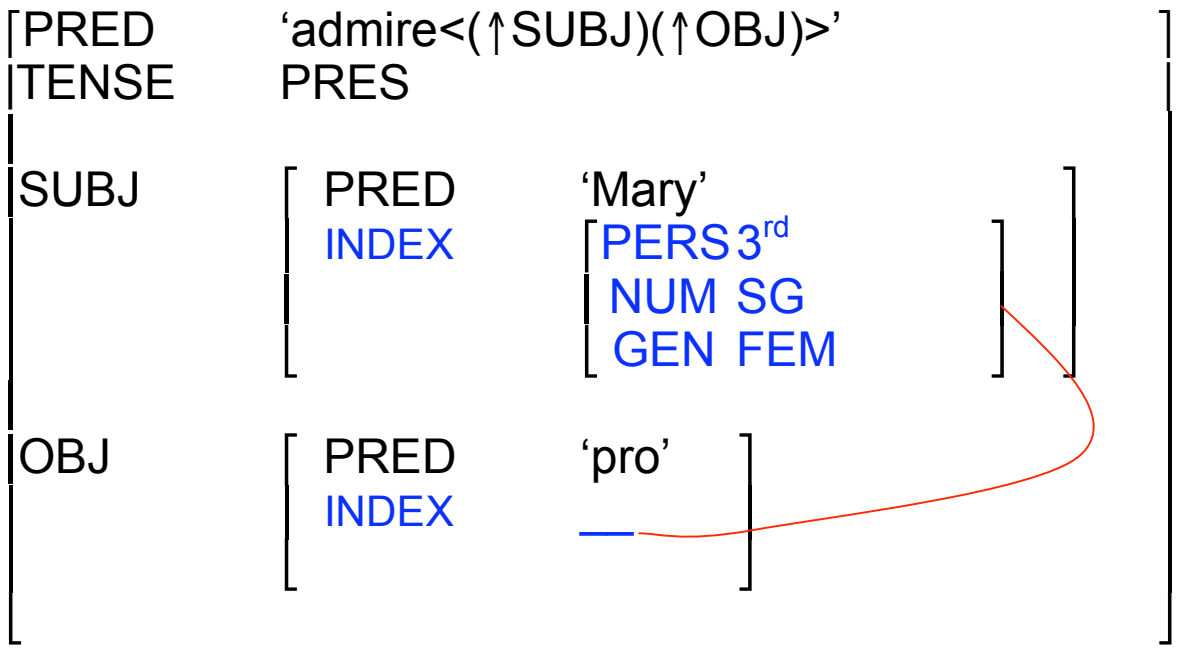
Formalizing the binding constraints

Mary$_i$ admires herself$_i$.

Mary and *herself* share the same referential INDEX:



INDEX could contain PERS, NUM, and GEN features (Pollard & Sag; Wechsler & Zlatic; i.a.):



This automatically captures pronoun-antecedent agreement.

Nuclear [+NCL] pronouns:

herself, N

(↑PRED) = 'PRO'

(↑INDEX PERS) = 3rd

(↑INDEX NUM) = SG

(↑INDEX GEN) = FEM

((GF* GF_{pro} ↑) GF_{ante} INDEX) = (↑INDEX)

¬(→SUBJ)

Non-nuclear [–NCL] pronouns:

her, N (↑PRED) = 'PRO'
(↑INDEX PERS) = 3rd
(↑INDEX NUM) = SG
(↑INDEX GEN) = FEM
((GF* GF_{pro} ↑) GF_{ante} INDEX) ≠ (↑INDEX)
¬(→PRED)

Let's unpack these equations…

Mary$_i$ admires herself$_i$.

$$
\begin{array}{lllll}
 & \lceil \text{PRED} & \text{`admire<(}\uparrow\text{SUBJ)(}\uparrow\text{OBJ)>'} & & \rceil \\
f1 & \lfloor \text{TENSE} & \text{PRES} & & \rfloor \\
 & \text{SUBJ} & f2 \left[\begin{array}{ll} \text{PRED} & \text{`Mary'} \\ \text{INDEX} & \text{3.sg.f} \end{array} \right] & & \\
 & \text{OBJ} & f3 \left[\begin{array}{ll} \text{PRED} & \text{`pro'} \\ \text{INDEX} & \text{3.sg.f} \end{array} \right] & &
\end{array}
$$

herself, N

$$((\ GF^* \quad GF_{pro} \uparrow) \ GF_{ante} \ \text{INDEX}) = (\uparrow \text{INDEX})$$
$$\neg(\rightarrow \text{SUBJ})$$

Which f-structure corresponds to $\uparrow$? Ans:

What attribute is GF_{pro} ? Ans:

Which f-structure corresponds to $(GF_{pro} \uparrow)$? Ans:

Mary$_i$ admires herself$_i$.

$$
\begin{array}{lll}
 & \text{PRED} & \text{`admire<(}\uparrow\text{SUBJ)(}\uparrow\text{OBJ)>'} \\
f1 & \text{TENSE} & \text{PRES} \\
 & \text{SUBJ} & f2 \left[\begin{array}{ll} \text{PRED} & \text{`Mary'} \\ \text{INDEX} & \text{3.sg.f} \end{array} \right] \\
 & \text{OBJ} & f3 \left[\begin{array}{ll} \text{PRED} & \text{`pro'} \\ \text{INDEX} & \text{3.sg.f} \end{array} \right]
\end{array}
$$

herself, N

$$((\ GF^*\ \ GF_{pro}\ f3)\ GF_{ante}\ \text{INDEX}) = (f3\ \text{INDEX})$$

$\neg(\rightarrow \text{SUBJ})$

Which f-structure corresponds to $\uparrow$? Ans: f3

What attribute is GF_{pro} ? Ans:

Which f-structure corresponds to $(GF_{pro}\ \uparrow)$? Ans:

Mary$_i$ admires herself$_i$.

$$
\begin{array}{lll}
 & \text{PRED} & \text{`admire<(}\uparrow\text{SUBJ)(}\uparrow\text{OBJ)>'} \\
\text{f1} & \text{TENSE} & \text{PRES} \\
 & \text{SUBJ} & \text{f2}\left[\begin{array}{ll}\text{PRED} & \text{`Mary'}\\ \text{INDEX} & \text{3.sg.f}\end{array}\right] \\
 & \text{OBJ} & \text{f3}\left[\begin{array}{ll}\text{PRED} & \text{`pro'}\\ \text{INDEX} & \text{3.sg.f}\end{array}\right]
\end{array}
$$

herself, N

((~~GF*~~ OBJ f3) GF_{ante} INDEX) = (f3 INDEX)

~~¬(→SUBJ)~~

Which f-structure corresponds to ↑ ? Ans: f3

What attribute is GF_{pro} ? Ans: OBJ

Which f-structure corresponds to (OBJ f3) ? Ans:

(Assume GF* has no members.)

Mary$_i$ admires herself$_i$.

$$\begin{bmatrix} \text{PRED} & \text{'admire<(}\uparrow\text{SUBJ)(}\uparrow\text{OBJ)>'} \\ \text{TENSE} & \text{PRES} \\ \text{SUBJ} & f2 \begin{bmatrix} \text{PRED} & \text{'Mary'} \\ \text{INDEX} & \text{3.sg.f} \end{bmatrix} \\ \text{OBJ} & f3 \begin{bmatrix} \text{PRED} & \text{'pro'} \\ \text{INDEX} & \text{3.sg.f} \end{bmatrix} \end{bmatrix}_{f1}$$

herself, N

(f1 GF_{ante} INDEX) = (f3 INDEX)

Which f-structure corresponds to ↑ ? Ans: f3

What attribute is GF_{pro} ? Ans: OBJ

Which f-structure corresponds to (OBJ f3) ? Ans: f1

What attribute is GF_{ante} ? Ans:

Mary$_i$ admires herself$_i$.

$$\begin{bmatrix} \text{PRED} & \text{'admire<(↑SUBJ)(↑OBJ)>'} \\ \text{TENSE} & \text{PRES} \\ \text{SUBJ} & \text{f2} \begin{bmatrix} \text{PRED} & \text{'Mary'} \\ \text{INDEX} & \text{3.sg.f} \end{bmatrix} \\ \text{OBJ} & \text{f3} \begin{bmatrix} \text{PRED} & \text{'pro'} \\ \text{INDEX} & \text{3.sg.f} \end{bmatrix} \end{bmatrix}_{\text{f1}}$$

herself, N

(f1 SUBJ INDEX) = (f3 INDEX)

Which f-structure corresponds to ↑ ? Ans: f3

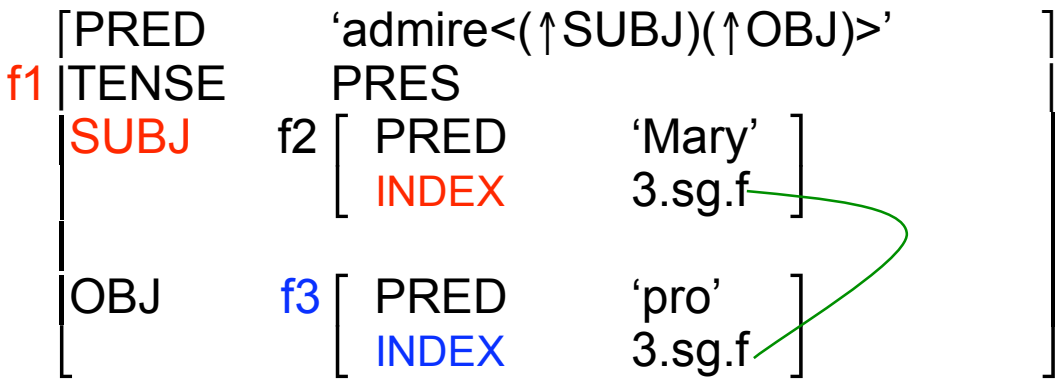
What attribute is GF_{pro} ? Ans: OBJ

Which f-structure corresponds to (OBJ f3) ? Ans: f1

What attribute is GF_{ante} ? Ans: SUBJ

What does this equation add to the f-structure?

Mary$_i$ admires herself$_i$.



herself, N

(f1 SUBJ INDEX) = (f3 INDEX)

*Mary$_i$ thinks I admire herself$_i$.

$$
\begin{array}{lll}
 & \lceil \text{PRED} & \text{`think<(}\uparrow\text{SUBJ)(}\uparrow\text{COMP)>'} \rceil \\
f1 & \lfloor \text{TENSE} & \text{PRES} \rfloor \\
 & \text{SUBJ} \quad f2 & \left[\begin{array}{ll} \text{PRED} & \text{`Mary'} \\ \text{INDEX} & \text{3.sg.f} \end{array} \right] \\
 & \text{COMP} \quad f3 & \left[\begin{array}{ll} \text{PRED} & \text{`admire…'} \\ \text{SUBJ} & \text{[…'I'…]} \\ \text{OBJ} \quad f4 & \left[ \begin{array}{ll} \text{PRED} & \text{`pro'} \\ \text{INDEX} & \text{3.sg.f} \end{array} \right] \end{array} \right]
\end{array}
$$

herself, N

$$((\ GF^*\quad GF_{pro}\uparrow)\ GF_{ante}\ \text{INDEX}) = (\uparrow\text{INDEX})$$
$$\neg(\rightarrow\text{SUBJ})$$

Which function is ↑ ?

*Mary$_i$ thinks I admire herself$_i$.

$$
\begin{array}{lll}
 & \lceil \text{PRED} & \text{`think<(}\uparrow\text{SUBJ)(}\uparrow\text{COMP)>'} \rceil \\
f1 & \lfloor \text{TENSE} & \text{PRES} \rfloor \\
 & \text{SUBJ} \quad f2 & \left[\begin{array}{ll} \text{PRED} & \text{`Mary'} \\ \text{INDEX} & \text{3.sg.f} \end{array} \right] \\
 & \text{COMP} \quad f3 & \left[\begin{array}{ll} \text{PRED} & \text{`admire…'} \\ \text{SUBJ} & \text{[…'I'…]} \\ \text{OBJ} & f4 \left[ \begin{array}{ll} \text{PRED} & \text{`pro'} \\ \text{INDEX} & \text{3.sg.f} \end{array} \right] \end{array} \right]
\end{array}
$$

herself, N

$$((\ \text{GF}^*\ \ \text{GF}_{pro}\ f4)\ \text{GF}_{ante}\ \text{INDEX}) = (f4\ \text{INDEX})$$

$\neg(\rightarrow\text{SUBJ})$

What's GF_{pro} ?

*Mary$_i$ thinks I admire herself$_i$.

$$
\begin{array}{lll}
 & \lceil \text{PRED} & \text{`think<(}\uparrow\text{SUBJ)(}\uparrow\text{COMP)>'} \rceil \\
f1 & \lfloor \text{TENSE} & \text{PRES} \rfloor \\
 & \text{SUBJ} \quad f2 & \left[\begin{array}{ll} \text{PRED} & \text{`Mary'} \\ \text{INDEX} & \text{3.sg.f} \end{array} \right] \\
 & \text{COMP} \quad f3 & \left[\begin{array}{ll} \text{PRED} & \text{`admire…'} \\ \text{SUBJ} & \text{[…'I'…]} \\ \text{OBJ} \quad f4 & \left[ \begin{array}{ll} \text{PRED} & \text{`pro'} \\ \text{INDEX} & \text{3.sg.f} \end{array} \right] \end{array} \right]
\end{array}
$$

herself, N

$$((\ \text{GF}^*\ \ \text{OBJ}\ f4)\ \text{GF}_{ante}\ \text{INDEX}) = (f4\ \text{INDEX})$$
$$\neg(\rightarrow \text{SUBJ})$$

What path is GF* ? (It has just one attribute.)

*Mary$_i$ thinks I admire herself$_i$.

$$
\begin{array}{lll}
 & \text{PRED} & \text{‘think<(↑SUBJ)(↑COMP)>’} \\
\text{f1} & \text{TENSE} & \text{PRES} \\
 & \text{SUBJ} & \text{f2}\left[\begin{array}{ll}\text{PRED} & \text{‘Mary’}\\ \text{INDEX} & \text{3.sg.f}\end{array}\right] \\
 & \text{COMP} & \text{f3}\left[\begin{array}{lll}\text{PRED} & \text{‘admire…’} & \\ \text{SUBJ} & \text{[…’I’…]} & \\ \text{OBJ} & \text{f4}\left[\begin{array}{ll}\text{PRED} & \text{‘pro’}\\ \text{INDEX} & \text{3.sg.f}\end{array}\right] & \end{array}\right]
\end{array}
$$

herself, N

((COMP OBJ f4) GF_{ante} INDEX) = (f4 INDEX)

¬(→SUBJ)

Does COMP satisfy the off-path constraint ? What is →?

*Mary$_i$ thinks I admire herself$_i$.

$$
\begin{array}{ll}
 & \left[\begin{array}{lll}
\text{PRED} & \text{`think<(}\uparrow\text{SUBJ)(}\uparrow\text{COMP)>'} & \\
\text{TENSE} & \text{PRES} & \\
\text{SUBJ} \quad \text{f2} & \left[\begin{array}{ll}\text{PRED} & \text{`Mary'}\\ \text{INDEX} & \text{3.sg.f}\end{array}\right] & \\
 & & \\
\text{COMP} \quad \text{f3} & \left[\begin{array}{ll}\text{PRED} & \text{`admire…'}\\ \text{SUBJ} & \text{[…'I'…]}\end{array}\right] & \\
 & & \\
 & \text{OBJ} \quad \text{f4} \left[\begin{array}{lll}\text{PRED} & \text{`pro'} & \\ \text{INDEX} & \text{3.sg.f} & \end{array}\right] &
\end{array}\right] \\
\text{f1} &
\end{array}
$$

herself, N

((COMP OBJ f4) GF_{ante} INDEX) = (f4 INDEX)

¬(→SUBJ)

→ is defined as the value of COMP: **f3**. This f-structure violates **¬(f3 SUBJ)**.

- The off-path constraint ¬(→SUBJ) on a GF means that the GF's value cannot contain a SUBJ attribute ('→' is the metavariable for the value).
- This gives the 'Specified Subject Condition': roughly, the binding domain for an anaphor cannot extend beyond the closest subject.

$$\begin{bmatrix} & \begin{bmatrix} & \begin{bmatrix} \text{GF} & \begin{bmatrix} \text{GF}_{\text{pro}} & [\text{INDEX}\ ] \\ (\text{GF}_{\text{ante}}) & \end{bmatrix} \end{bmatrix} \\ \text{GF} & \begin{bmatrix} \text{SUBJ} \\ (\text{GF}_{\text{ante}}) \end{bmatrix} \end{bmatrix} \\ *\text{GF}_{\text{ante}} & \end{bmatrix}$$