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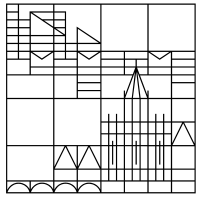

LFG
Anaphora and Inside-Out Functional Uncertainty

Miriam Butt, University of Konstanz

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Lecture 9
Anaphora and Inside-Out Functional Uncertainty

Background

The material in these slides is based mainly on Dalrymple (2001), Chapter 11.
In particular, pp. 278-291

Pay attention to the definitions on pp. 281 and 283.

Also relevant are pp. 174-179 in Sells (1985).

Classic Binding Theory

The Chomskyan Take (Chomsky 1981)

- Classic Binding Theory was formulated as part of the Theory of Government and Binding (GB).
- The generalizations revolved around understanding how *anaphora resolution* works.

Tabby McTat$_i$ licked himself$_i$.	(reflexive – called anaphor in GB)
Tabby McTat$_i$ licked him$_k$.	(pronoun)
Tabby McTat$_i$ licked Tabby McTat$_k$.	(R-expression = referring expression)

- Binding Theory looked at **syntactic** constraints on anaphora resolution.
- There are additional pragmatic and contextual constraints.
- Like the original Binding Theory, we leave those aside here and concentrate on the syntactic aspects.

- There are also constraints in terms of gender, number, etc. agreement.
- We assume those are operational as well.

Classic Binding Theory

Classic Binding Theory

- **Principle A:** An anaphor (reflexive) must be bound in its governing category.
- **Principle B:** A pronoun must be free in its governing category.
- **Principle C:** An R-expression must be free everywhere.

Tabby McTat$_i$ licked himself$_i$.	(reflexive – called anaphor in GB)
Tabby McTat$_i$ licked him$_k$.	(pronoun)
Tabby McTat$_i$ licked Tabby McTat$_k$.	(R-expression = referring expression)

- Determining the governing category is a complex business.
- In Classic Binding Theory, this involved notions of c-command.
- We here demonstrate the basic LFG approach.

LFG Approach

Anaphora Resolution at F-structure

The basic approach to anaphora resolution in LFG was worked out by Dalrymple (1993).

Dalrymple, Mary. 1993. *The Syntax of Anaphoric Binding.* CSLI Publications.

- Discussions and successive improvements since then.
- Dalrymple (2001) and Bresnan (2001) reflect the standardized state-of-the-art.

- Classic Binding Theory takes a tree-based approach.
- LFG identifies f-structure as the most relevant domain for stating binding relations.

LFG Approach

Core Approach

- Principle A: An anaphor (reflexive) must be bound in its governing category.
  LFG: Reflexives have to be bound in the minimal nucleus.

- Principle B: A pronoun must be free in its governing category.
  LFG: Pronouns have to be free in their co-argument domain.

- Principle C: An R-expression must be free everywhere.
  LFG: R-expressions are not bound anywhere.

Tabby McTat$_i$ licked himself$_i$.	(reflexive)
Tabby McTat$_i$ licked him$_k$.	(pronoun)
Tabby McTat$_i$ licked Tabby McTat$_k$.	(R-expression = referring expression)

LFG Approach

Core Definitions

- **Reflexives** have to be bound in the minimal nucleus they occur in.

- **Pronouns** have to be free in their co-argument domain.

Tabby McTat$_i$ licked himself$_i$.	(reflexive)
Tabby McTat$_i$ licked him$_k$.	(pronoun)

Minimal Complete Nucleus: A minimal f-structure with a SUBJ function

Co-argument Domain: Minimal Domain defined by a PRED and the grammatical functions (GFs) it governs (basically, the minimal domain of and element and its co-arguments).

LFG Approach – Examples

Pronouns have to be free in their co-argument domain.

Tabby McTat$_i$ licked him$_k$.

Co-argument Domain: Minimal Domain defined by a PRED and the grammatical functions (GFs) it governs.

```
PRED     `lick<(↑ SUBJ) (↑OBJ)>'
TNS-ASP  [TENSE PAST]
MOOD     INDICATIVE
SUBJ     [ PRED    `Tabby McTat' ]
OBJ      [ PRED    `PRO'
           PRONTYPE pers
           NUM sg
           PERS 3
           GEND masc ]
```

- The pronoun is the object.
- It's co-argument is the subject.
- Therefore:
  - the pronoun cannot refer to the subject
  - it must refer to some other entity.

LFG Approach – Examples

- **Reflexives** have to be bound in the minimal nucleus they occur in.

  Tabby McTat$_i$ licked himself$_i$.

Minimal Complete Nucleus: A minimal f-structure with a SUBJ function.

```
PRED     `lick<(↑ SUBJ) (↑OBJ)>'
TNS-ASP  [TENSE PAST]
MOOD     INDICATIVE

SUBJ     [ PRED    `Tabby McTat' ]

OBJ      [ PRED    `PRO'
           PRONTYPE refl
           NUM sg
           PERS 3
           GEND masc ]
```

- The reflexive is the object.
- The minimal f-structure is the entire f-structure (root domain).
- Therefore:
  - the reflexive must be bound in the f-structure.
- The only other referring expression in the f-structure is the SUBJ.
- So the SUBJ is the **antecedent** of the reflexive.

LFG Approach

More Complex Examples

Pronouns: must be free in co-argument domain

Jane$_i$ hopes that Max will hire her$_i$.
Jane$_i$ liked the story about her$_i$.
Jane$_i$ wrapped the blanket around her$_i$.

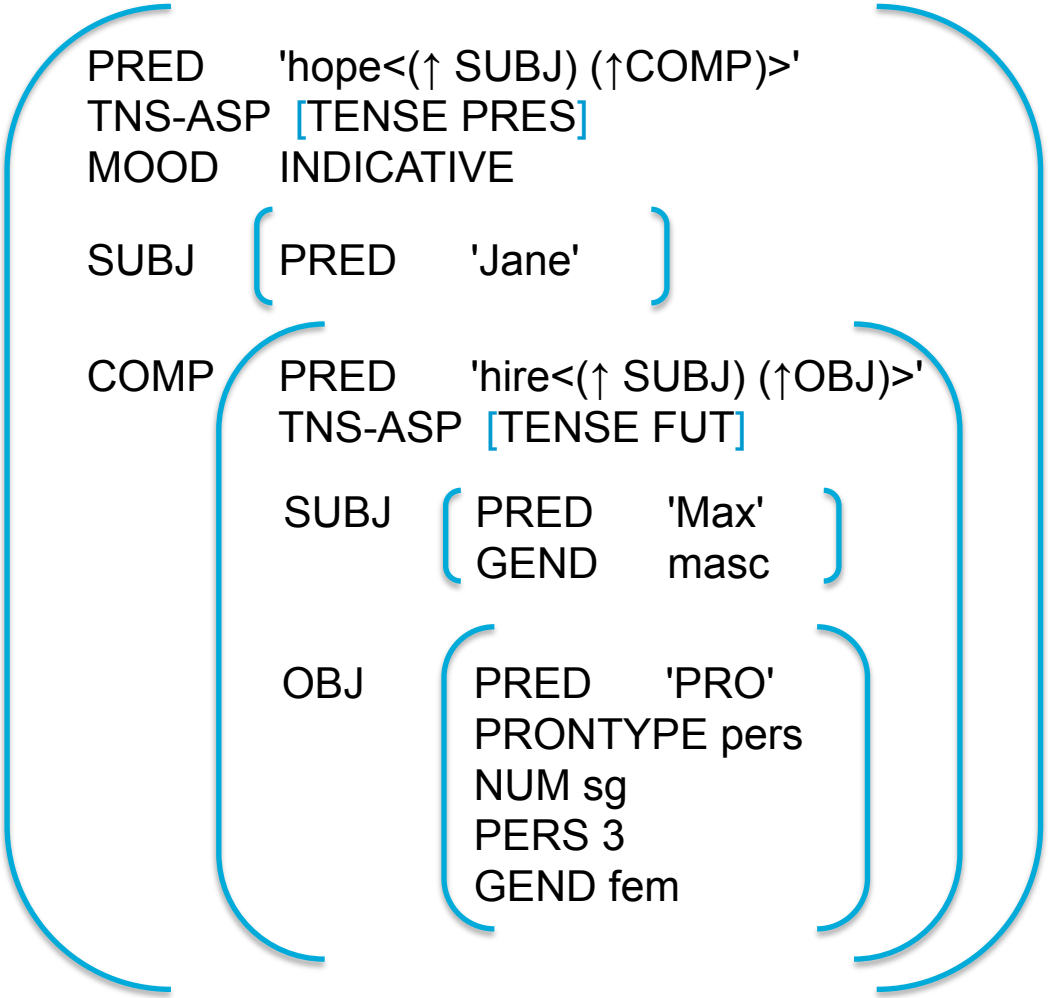
Reflexives: must be bound in minimal f-structure nucleus

*Jane$_i$ hopes that Max will hire herself$_i$.
Jane$_i$ liked the story about herself$_i$.
Jane$_i$ wrapped the blanket around herself$_i$.

LFG Approach – More Complex Examples

Pronouns have to be free in their co-argument domain.

Jane$_i$ hopes that Max will hire her$_i$.

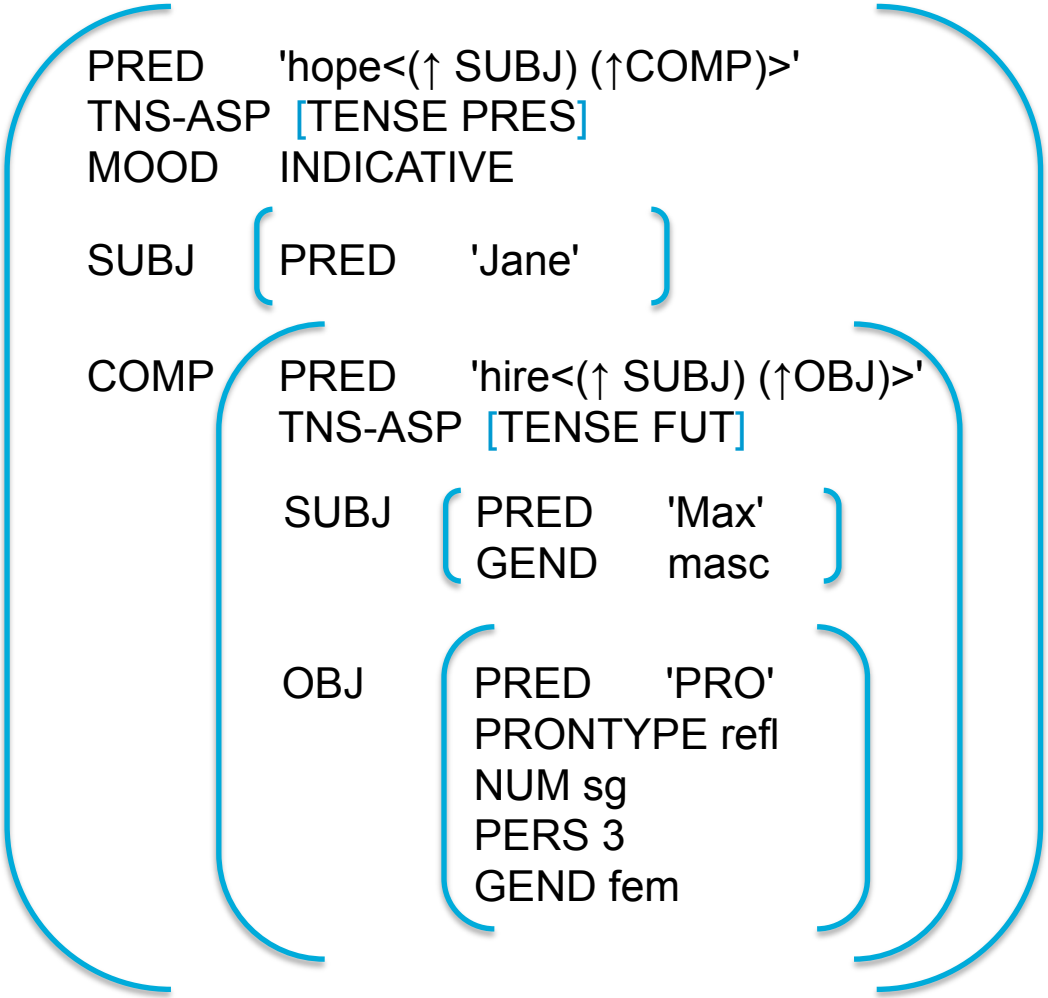


- The pronoun is the COMP OBJ.
- It's co-argument is COMP SUBJ.
- Therefore:
  - the pronoun cannot refer to *Max*
  - it must refer to some other entity
  - it can refer to *Jane* or some other entity outside of the clause.

LFG Approach – More Complex Examples

Reflexives have to be bound in the minimal nucleus they occur in.

*Jane$_i$ hopes that Max will hire herself$_i$.

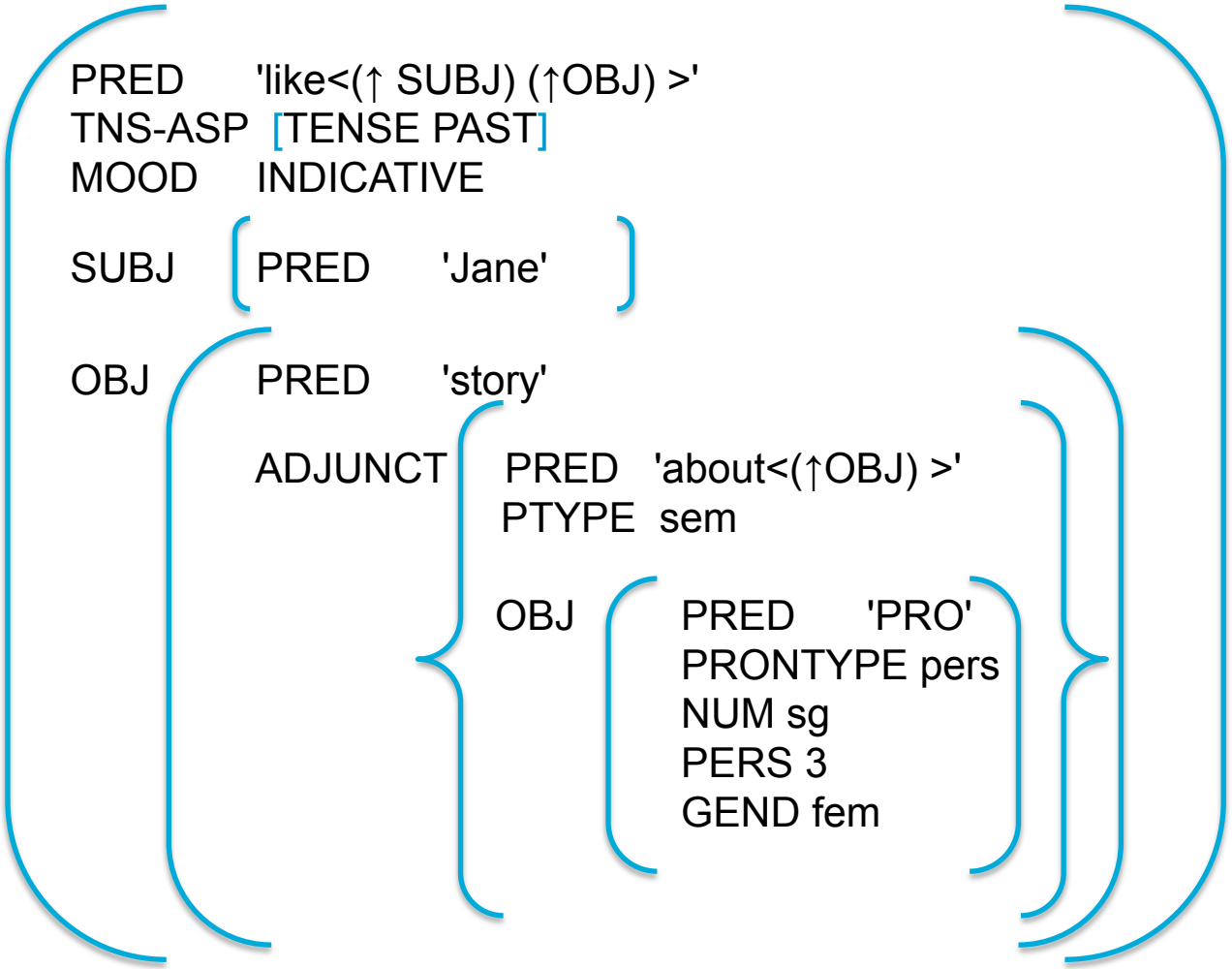


- The reflexive is the COMP OBJ.
- The minimal f-structure is the COMP.
- Therefore:
  - the reflexive must be bound within the COMP.
- The only other referring expression in COMP is the SUBJ.
- But *Max* is masculine, the reflexive is feminine so there is a mismatch.
- **Result**: no antecedent for the reflexive.

LFG Approach – More Complex Examples

Pronouns have to be free in their co-argument domain.

Jane$_i$ liked the story about her$_i$.

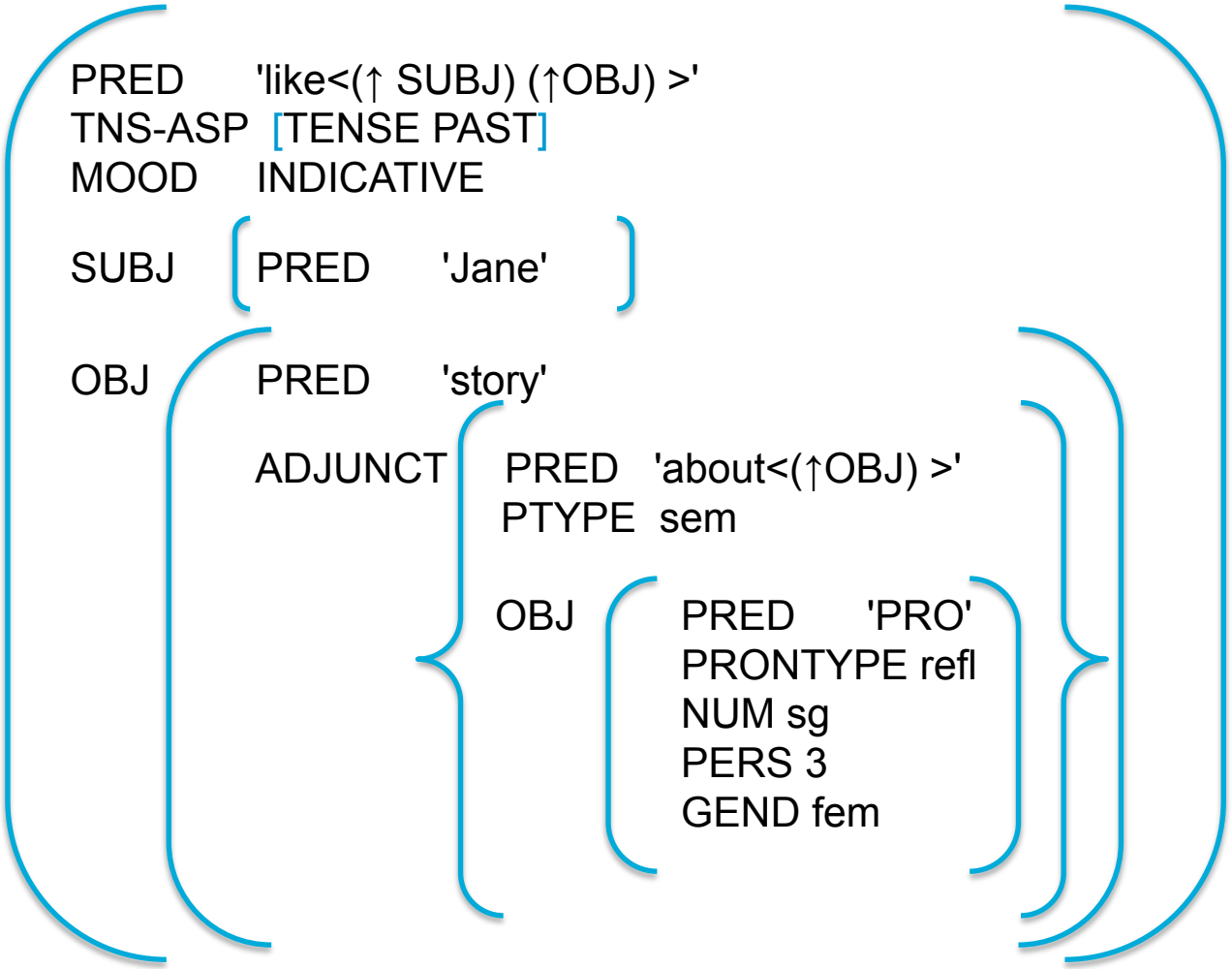


- The pronoun is the ADJUNCT OBJ.
- It has no co-arguments.
- Therefore:
  - the pronoun can refer to some entity outside of the ADJUNCT domain.
  - one possibility is *Jane*.

LFG Approach – More Complex Examples

Reflexives have to be bound in the minimal nucleus they occur in.

Jane$_i$ liked the story about herself$_i$.



- The reflexive is the ADJUNCT OBJ.
- The minimal f-structure is the entire f-structure.
- Therefore:
  - the reflexive must be bound within the entire f-str.
- *Jane* fits in terms of agreement (gender, number).
- So *Jane* is a possible antecedent for the reflexive.

Prepositional Phrases

Semantic vs. Non-Semantic Prepositions

- Recall that a distinction was drawn between semantic and non-semantic uses of prepositions.
- This distinction has a tangible effect with respect to anaphora resolution.

Semantic Preposition:

Jane$_i$ liked the story about her$_i$.
Jane$_i$ liked the story about herself$_i$.

Jane$_i$ wrapped the blanket around her$_i$.
Jane$_i$ wrapped the blanket around herself$_i$.

Non-Semantic Preposition:

*Jane$_i$ sent the book to her$_i$.
Jane$_i$ sent the book to herself$_i$.

LFG Approach – Prepositions

Pronouns have to be free in their co-argument domain.

*Jane$_i$ sent the book to her$_i$.

```
PRED      'send<(↑ SUBJ) (↑OBJ) (↑OBL)>'
TNS-ASP   [TENSE PAST]
MOOD      INDICATIVE

SUBJ      [ PRED     'Jane'
            GEND     fem ]

OBJ       [ PRED     'book' ]

OBL       [ PRED     'PRO'
            PRONTYPE pers
            NUM sg
            PERS 3
            GEND fem
            PTYPE nosem
            PCASE to ]
```

- The pronoun is the OBL.
- It's co-arguments are *Jane* and *book*.
- Therefore:
  - the pronoun cannot refer to either of these.

LFG Approach – Prepositions

Reflexives have to be bound in the minimal nucleus they occur in.

Jane$_i$ sent the book to herself$_i$.

```
PRED      'send<(↑ SUBJ) (↑OBJ) (↑OBL)>'
TNS-ASP   [TENSE PAST]
MOOD      INDICATIVE

SUBJ      [ PRED      'Jane'
            GEND      fem ]

OBJ       [ PRED      'book' ]

OBL       [ PRED      'PRO'
            PRONTYPE  refl
            NUM       sg
            PERS      3
            GEND      fem
            PTYPE     nosem
            PCASE     to ]
```

- The reflexive is the OBL.
- The minimal f-structure is the entire f-structure.
- Therefore:
  - the reflexive must be bound within the entire f-str.
- *Jane* fits in terms of agreement (gender, number).
- So *Jane* is a possible antecedent for the reflexive.

Further Complexity

Subject-like Grammatical Functions

- One also gets the following type of contrast.

  Jane$_i$ liked Louise's story about her$_i$.
  *Jane$_i$ liked Louise's story about herself$_i$.
  Jane liked Louise's$_i$ story about herself$_i$.

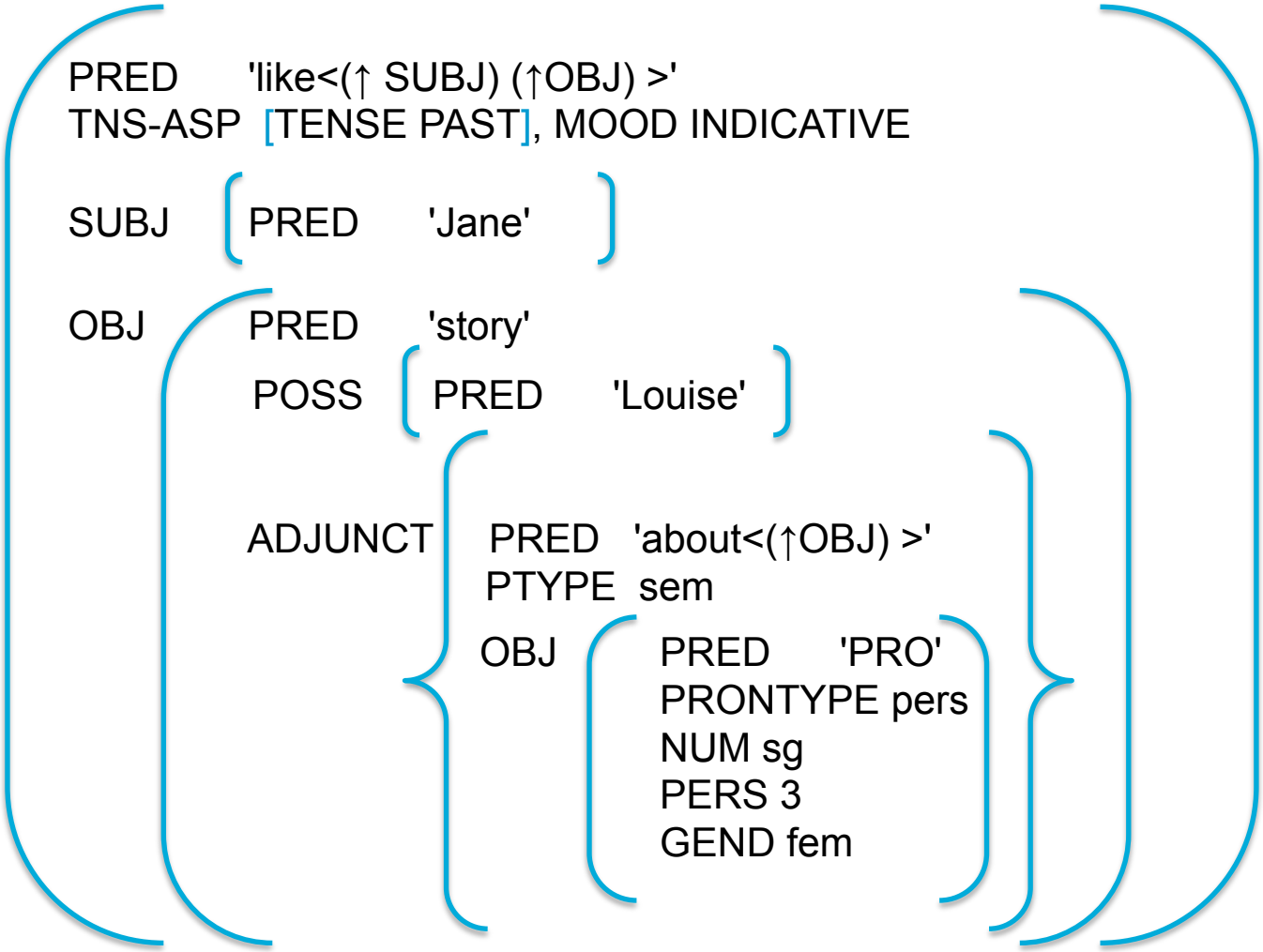
- This contrast is also explained nicely within the system that has already been introduced.
- However, one needs to assume a grammatical function POSS and assume that it is subject-like in certain ways.
- POSS corresponds to *Louise* in our examples and represents a possessive.
- In terms of anaphora resolution, POSS functions like SUBJ for determining a minimal complete nucleus.

- There is a continuing discussion within LFG about the role of POSS.

LFG Approach – More Complex Examples

Pronouns have to be free in their co-argument domain.

Jane$_i$ liked Louise's story about her$_i$.

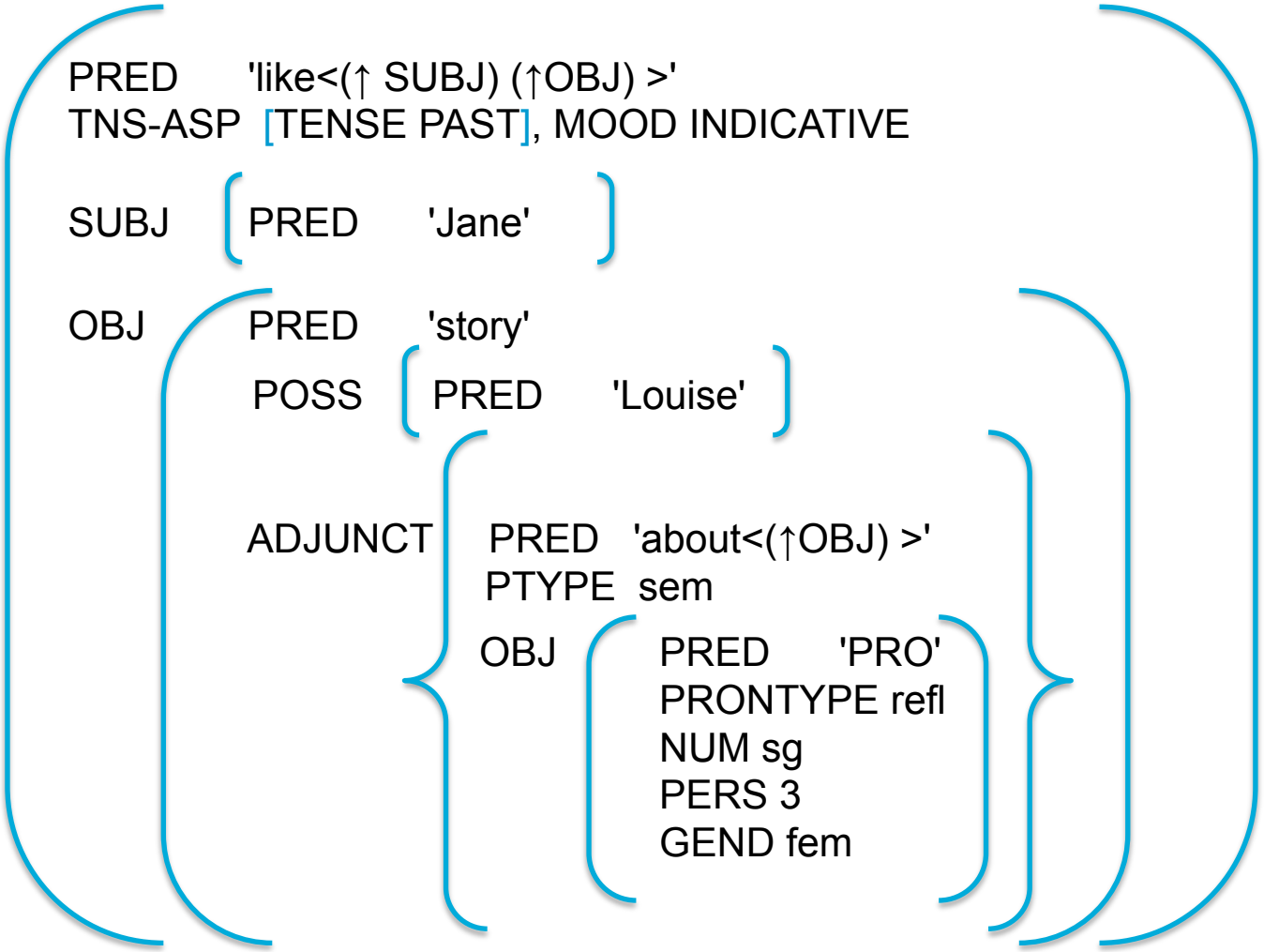


- The pronoun is the ADJUNCT OBJ.
- It has no co-arguments.
- Therefore:
  - the pronoun can refer to some entity outside of the ADJUNCT domain.
  - one possibility is *Jane*.

LFG Approach – More Complex Examples

Reflexives have to be bound in the minimal nucleus they occur in.

*Jane$_i$ liked Louise's story about herself$_i$.



- The reflexive is the ADJUNCT OBJ.
- The minimal f-structure is the OBJ (POSS=SUBJ).
- Therefore:
  - the reflexive must be bound within the OBJ.
- *Louise* fits in terms of agreement (gender, number).
- So *Louise* is the antecedent for the reflexive.

Inside-Out Functional Uncertainty

The Formal Part

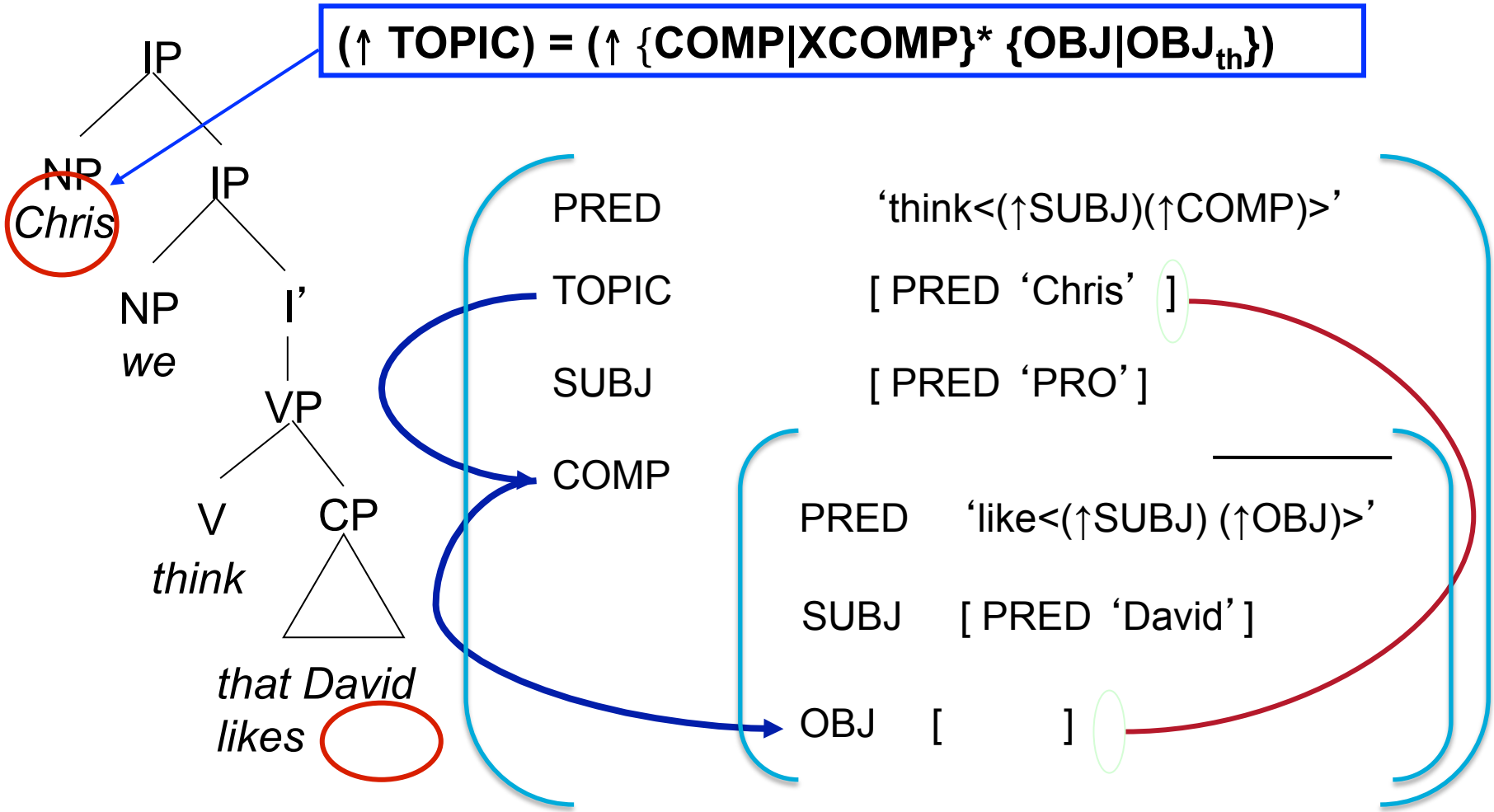
- We have now seen how anaphora resolution works via generalizations over f-structure relationships within LFG.
- There is another part to the overall approach in terms of the formal realization.
- Essentially, the way things work is that the anaphor (pronoun or reflexive) "looks around" to see which f-structure it is and in which f-structure its antecedent can be found.
- That is: one needs to begin **within** a given f-structure and figure out the path to the antecedent from there.
- This is much like the situation with **long distance dependencies**, except that we began from the outermost level of the f-structure and searched down a **Dependency Path**.

  (↑ TOPIC) = (↑ {COMP|XCOMP}* {OBJ|OBJ_{th}})
- This is called **Outside-in Functional Uncertainty.**

- For anaphora resolution, LFG **uses Inside-Out Functional Uncertainty.**

(Outside-In) Functional Uncertainty

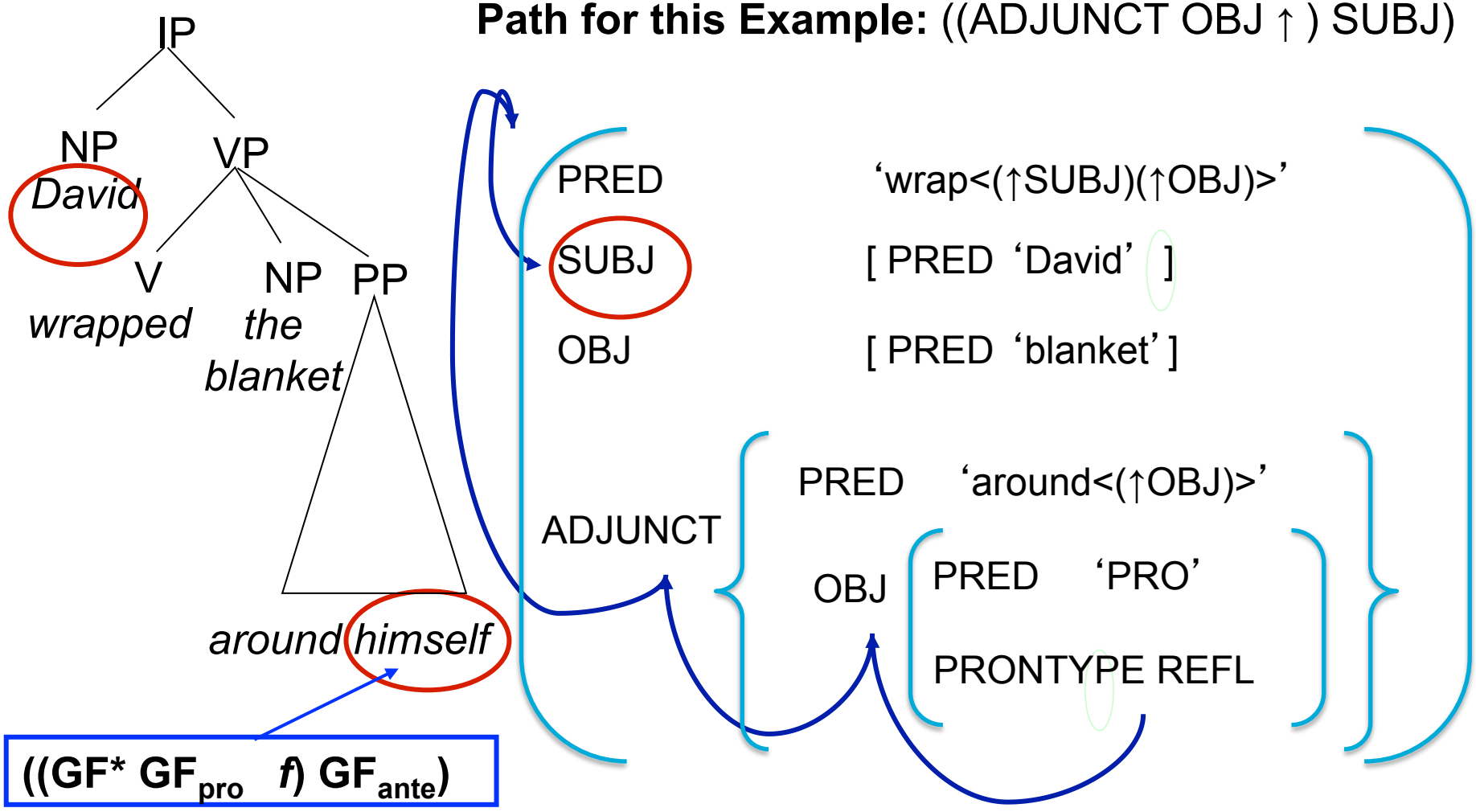
Path for this Example: (↑ COMP OBJ)



Inside-Out Functional Uncertainty

Binding Domain (f stands for an f-str)**:** ((GF* GF_{pro} *f*)

Path for this Example: ((ADJUNCT OBJ ↑) SUBJ)



Crosslinguistic Patterns

Typological Variation

- We have so far discussed only examples from English.
- Not all anaphora work the same crosslinguistically (though broadly they conform to the same patterns).
- See Dalrymple for a detailed discussion of anaphora in comparison.
- So far the following have been identified as being relevant for binding constraints.

- **Co-argument Domain** (as we have seen for English pronouns).
- **Minimal Complete Nucleus** (as we have seen for English reflexives).
- **Minimal Finite Domain:** minimal f-structure domain with a TENSE feature.
- **Root Domain:** f-structure of the entire utterance.

- More crosslinguistic work remains to be done!