Introduction to LFG

Mary Dalrymple
Centre for Linguistics and Philology
Oxford University

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“Semantic roles, syntactic constituents, and grammatical functions belong to parallel information structures of very different formal character. They are related not by proof-theoretic derivation but by structural correspondences, as a melody is related to the words of a song. The song is decomposable into parallel melodic and linguistic structures, which jointly constrain the nature of the whole. In the same way, the sentences of human language are themselves decomposable into parallel systems of constraints – structural, functional, semantic, and prosodic – which the whole must jointly satisfy.”

Bresnan (1990)

If our theory does not include movement or other derivational processes, how do we treat nonlocal relations between a predicate and its argument?
Nonlocal phenomena:

- **Raising**: David seemed to yawn.
Nonlocal phenomena:

- Raising: David seemed to yawn.
- Control: David tried to catch the ball.
Nonlocal phenomena:

- **Raising**: David seemed to yawn.
- **Control**: David tried to catch the ball.
- **Wh-questions**: Who do you think David took to the party?
Nonlocal phenomena:

- **Raising**: David seemed to yawn.
- **Control**: David tried to catch the ball.
- **Wh-questions**: Who do you think David took to the party?

How are these treated in a nontransformational, constraint-based theory?
“Raising” verbs like *seem* were treated in early transformational grammar by raising the subject of a subordinate clause up into the main clause (hence the term “raising”):

This captures the intuition that the raising verb does not assign a semantic role to the raised argument.
Raising to subject

David seemed to yawn.

- **C-structure:** No evidence that there is a trace or other phrasal material in subject position in the subordinate clause.

- **F-structure:** Functionally, the “raised” argument *David* behaves as both the subject of *seem* and the subject of the subordinate clause. This is **functional control**.
Raising to subject: ‘seem’

Line from David f-structure to XCOMP SUBJ indicates functional control: the same f-structure is the SUBJ and the XCOMP SUBJ.
Evidence for subjecthood in matrix clause:

- Position
- Verb agreement: David \textit{seems}/*\textit{seem} to yawn; they \textit{seem}/*\textit{seems} to yawn
Raising to subject

Evidence for subjecthood in matrix clause:

- Position
- Verb agreement: David seems/*seem to yawn; they seem/*seems to yawn

Evidence for subjecthood in subordinate clause:

- Reflexivization: English reflexives are clause-bound. David$_i$ believed that [Jane$_j$ voted for herself$_j$/*himself$_i$]. A reflexive is possible in the subordinate clause: David seemed to like himself.
Raising to object

David believed Chris to know the answer.

- C-structure: Again, no evidence that there is a trace or other phrasal material in subject position in the subordinate clause.

- F-structure: Functionally, the “raised” argument *Chris* behaves as the object of *believe* and the subject of the subordinate clause.
Raising to object: ‘believe’

The object of believe functionally controls the subject of know.
Accusative case for “raised” argument:
David believed him to know the answer.

Reflexivization: A reflexive in raised object position is possible.
David believed himself to be the best candidate.

Reflexivization: A reflexive in the subordinate clause can have the raised object as its antecedent.
David$_i$ believed Chris$_j$ to like himself$_{i,j}$.
Nonthematic arguments

It is raining.

\[
\begin{array}{c}
\text{PRED} & \text{‘RAIN}{\langle}\text{SUBJ}{\rangle} \\
\text{SUBJ} & \text{[FORM IT]} \\
\end{array}
\]

Nonthematic arguments appear outside angled brackets in semantic form.
Nonthematic arguments

It seems to be raining.

There seems to be a problem.

David believed it to be raining.

David believed there to be a problem.
Nonthematic arguments

\[ \text{It seems to be raining.} \]

\[
\begin{align*}
\text{PRED} & \quad \text{\textbf{SEEM} (XCOMP) SUBJ} \\
\text{SUBJ} & \quad \text{\textbf{FORM} IT} \\
\text{XCOMP} & \quad \text{PRED \textbf{RAIN} SUBJ} \\
\text{SUBJ} & \quad \text{SUBJ}
\end{align*}
\]

Since \textit{seems} does not assign a semantic role to its subject, a semantically empty subject is allowed as the raised argument.
David believed it to be raining.

```
[ PRED 'BELIEVE⟨SUBJ,XCOMP⟩OBJ' ]
[ SUBJ [ PRED 'David' ] ]
[ OBJ [ FORM IT ] ]
[ XCOMP [ PRED 'RAIN⟨⟩SUBJ' ] ]
[ SUBJ ]
```

Accusative subject:

*Drengina* vantar mat.
boys.ACC lacks food
‘The boys lack food.’

Accusative subject:

*Drengina vantar mat.*
boys.ACC lacks food
‘The boys lack food.’

Accusative “raised” object:

*Hann telur mig (í barnaskap sínum) vanta peninga.*
he believes me.ACC (in foolishness his) to.lack money
‘He believes me (in his foolishness) to lack money.’

Adverb placement shows that *mig* appears in object position in the main clause.
Same f-structure is the subject of *lack* and the object of *believe* → the raised object must obey the case requirements appropriate to the subject of *lack*.

```
[ PRED  'BELIEVE⟨SUBJ,XCOMP⟩OBJ' ]
[    SUBJ  [ PRED  'HE' ] ]
[    OBJ  [ PRED  'ME' ] ]
[      CASE  ACC ]
[ XCOMP  [ PRED  'LACK⟨SUBJ,OBJ⟩' ] ]
[    SUBJ ]
[    OBJ  [ PRED  'MONEY' ] ]
```
Dative subject:

\[ \text{Barninu} \quad \text{batnaði} \quad \text{veikin}. \]

child.DEF.DAT recovered.from disease.DEF.NOM

‘The child recovered from the disease.’
Dative subject:

*Barninu* batnaði veikin.
child.DEF.DAT recovered.from disease.DEF.NOM
‘The child recovered from the disease.’

Dative “raised” object:

*Hann telur barninu (í barnaskap sínum) hafa* 
he believes child.DEF.DAT (in foolishness his) to.have
*batnað veikin.* 
recovered.from disease.DEF.NOM
‘He believes the child (in his foolishness) to have recovered from the disease.’
Raising verbs and case: Icelandic

Genitive subject:

Verkjanna  gætir  ekki.
pains.DEF.GEN  is.noticeable  not
‘The pains are not noticeable.’
Raising verbs and case: Icelandic

Genitive subject:

Verkjanna gætir ekki.
pains.DEF.GEN is.noticeable not
‘The pains are not noticeable.’

Genitive “raised” object:

Hann telur verkjanna (í barnaskap sínum) ekki
he believes pains.DEF.GEN (in foolishness his) not
gæta.
noticeable
‘He believes the pains (in his foolishness) not to be noticeable.’
Rules and lexical entries

\[ V' \quad \longrightarrow \quad \left( \begin{array}{c} V \\ \uparrow = \downarrow \end{array} \right) \quad \left( \begin{array}{c} NP \\ \uparrow \text{OBJ} = \downarrow \end{array} \right) \quad \left( \begin{array}{c} VP \\ \uparrow \text{XCOMP} = \downarrow \end{array} \right) \]
Rules and lexical entries

$$V' \rightarrow \left( \begin{array}{c} V \\ \uparrow = \downarrow \end{array} \right) \left( \begin{array}{c} NP \\ \uparrow \text{OBJ} = \downarrow \end{array} \right) \left( \begin{array}{c} VP \\ \uparrow \text{XCOMP} = \downarrow \end{array} \right)$$

**seemed**

$$V \ (\uparrow \text{PRED}) = \text{SEEM}(\text{XCOMP}\text{SUBJ})$$

$$\ (\uparrow \text{SUBJ}) = (\uparrow \text{XCOMP \ SUBJ})$$

**believed**

$$V \ (\uparrow \text{PRED}) = \text{BELIEVE}(\text{SUBJ},\text{XCOMP}\text{OBJ})$$

$$\ (\uparrow \text{OBJ}) = (\uparrow \text{XCOMP \ SUBJ})$$
Control verbs like *try* were treated in early transformational grammar by the “equi-NP deletion” transformation, and are still sometimes called “equi” verbs:

This captures the intuition that a controlled argument gets two semantic roles: one from the control verb, and one from the subordinate verb.
Control verbs

David tried to leave.

\[
\begin{align*}
\text{PRED} & \quad \langle \text{TRY, SUBJ, COMP} \rangle \\
\text{SUBJ} & \quad \langle \text{PRED, 'DAVID'} \rangle \\
\text{COMP} & \quad \langle \\
& \quad \langle \text{PRED, 'LEAVE, SUBJ'} \rangle \\
& \quad \langle \text{SUBJ} \quad \langle \text{PRED, 'PRO'} \rangle \rangle
\end{align*}
\]

Obligatory anaphoric control (Dalrymple, 2001, chapter 12): closed complement COMP, not open complement XCOMP. There is a semantic relation between the controller and the unpronounced pronominal subject of XCOMP, but they are different syntactic objects.
Control verbs

David tried to leave.

\[
\begin{align*}
\text{PRED} & \quad \langle \text{TRY} \langle \text{SUBJ}, \text{COMP} \rangle \rangle \\
\text{SUBJ} & \quad \langle \text{PRED} \langle \text{DAVID} \rangle \rangle \\
\text{COMP} & \quad \langle \text{PRED} \langle \text{LEAVE} \langle \text{SUBJ} \rangle \rangle \rangle \\
\text{SUBJ} & \quad \langle \text{PRED} \langle \text{PRO} \rangle \rangle
\end{align*}
\]

Semantic role assigned by control verb to controller, which appears inside angled brackets.
Control verbs

Alternative view (Bresnan, 1982; Falk, 2001; Asudeh, 2005): ‘try’ involves functional control, not anaphoric control.

```
PRED  'TRY⟨SUBJ,XCOMP⟩'
```

```
SUBJ  [ PRED  'DAVID' ]
```

```
XCOMP  [ PRED  'LEAVE⟨SUBJ⟩' ]
```

```
SUBJ
```

Ongoing theoretical debate within LFG: do control verbs involve functional control or anaphoric control? Do they all behave alike, or are there different subclasses?
Control verbs

Alternative view (Bresnan, 1982; Falk, 2001; Asudeh, 2005): ‘try’ involves functional control, not anaphoric control.

```
PRED 'TRY(SUBJ,XCOMP)'

SUBJ [PRED 'DAVID']

XCOMP [PRED 'LEAVE(SUBJ)'

SUBJ]
```

Ongoing theoretical debate within LFG: do control verbs involve functional control or anaphoric control? Do they all behave alike, or are there different subclasses?

Answers to these questions not dictated by formal framework of LFG, but by the linguistic facts.
Accusative subject:

*Drengina* vantar *mat.*
boys.*ACC* lacks  food

‘The boys lack food.’
Accusative subject:

*Drengina* vantar *mat.*
boys.ACC lacks food
‘The boys lack food.’

Subject control: No case preservation (Andrews, 1982)

*Ég* vonast til að vanta ekki *efni* í *ritgerðina.*
l.NOM hope to to lack not material for thesis
‘I hope to not lack material for the thesis.’
Control in Icelandic

Accusative subject:

*Drengina* vantar *mat*.
boys.*ACC* lacks *food*
‘The boys lack food.’

Subject control: No case preservation (Andrews, 1982)

*Ég* vonast til að vanta ekki *efni* í *ritgerðina*.
I.*NOM* hope to to lack not *material for thesis*
‘I hope to not lack material for the thesis.’

Conclusion: Anaphoric control, not functional control.
Object control verbs

David convinced Chris to leave.

```
[ PRED  'CONVINCE<SUBJ,OBJ,COMP>' ]
[ SUBJ  [ PRED  'DAVID' ] ]
[ OBJ  [ PRED  'CHRIS' ] ]
[ COMP  [ PRED  'LEAVE<SUBJ>' ]
  [ SUBJ  [ PRED  'PRO' ] ] ]
```

Object of *convince* anaphorically controls subject of *leave*.
Raising and control: C-structure

Raising and control verbs pattern alike at c-structure:
Raising and control: C-structure

Raising and control verbs pattern alike at c-structure:

The students seem clearly to be intelligent. (XCOMP)

The students tried hard to be on time. (COMP)

The students believed David to have left. (XCOMP)

The students convinced David to leave. (COMP)
Raising and control: C-structure

Raising and control verbs pattern alike at c-structure:

The students seem clearly to be intelligent. (XCOMP)

The students tried hard to be on time. (COMP)

The students believed David to have left. (XCOMP)

The students convinced David to leave. (COMP)

\[
V' \quad \rightarrow \quad \left( V \uparrow = \downarrow \right) \left( \left( \uparrow \right. \text{NP} \left. \text{OBJ} \right) = \uparrow \right) \left( \left( \uparrow \right. \left\{ \text{XCOMP} | \text{COMP} \right\} \right) = \downarrow \right)
\]
Lexical entries

Control verbs supply an unpronounced pronominal subject for their complements:

\[ \text{tried} \quad V \quad (\uparrow \text{PRED}) = '\text{TRY}(<\text{SUBJ},\text{COMP}>)' \]
\[ (\uparrow \text{COMP SUBJ PRED}) = '\text{PRO}' \]

\[ \text{convinced} \quad V \quad (\uparrow \text{PRED}) = '\text{CONVINCE}(<\text{SUBJ},\text{OBJ},\text{COMP}>)' \]
\[ (\uparrow \text{COMP SUBJ PRED}) = '\text{PRO}' \]
C-structure

```
IP
   NP    I'
  ↑=↓  ↑=↓
   ↓    ↓
   N    VP
  ↑=↓  ↑=↓
   ↓    ↓
   David    V'
  ↑=↓  ↑=↓
   ↓    ↓
       V
  ↑=↓  ↑=↓
   ↓    ↓
       tried
  ↑    ↓
   ↓    ↓
       V'
  ↑=↓  ↑=↓
   ↓    ↓
       VP
  ↑=↓  ↑=↓
   ↓    ↓
       V
  ↑=↓  ↑=↓
   ↓    ↓
       to
  ↑=↓  ↑=↓
   ↓    ↓
       leave
  ↑=↓  ↑=↓
   ↓    ↓
       VP
  ↑=↓  ↑=↓
   ↓    ↓
       V
  ↑=↓  ↑=↓
   ↓    ↓
       V
  ↑=↓  ↑=↓
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       V
  ↑=↓  ↑=↓
   ↓    ↓
       V
```
F-structure

\[
\begin{array}{c}
\text{PRED} \quad \text{‘TRY(SUBJ,COMP)’} \\
\text{SUBJ} \quad \text{[PRED ‘DAVID’]} \\
\text{COMP} \quad \text{[PRED ‘LEAVE(SUBJ)’]} \\
\quad \quad \text{SUBJ} \quad \text{[PRED ‘PRO’]} \\
\end{array}
\]
Object control

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Characteristics of control and raising verbs (Börjars and Vincent, 2004):

- the relation is **obligatory**: the control equation is introduced via the lexical entry of the control or raising verb

- the relation involves **command** (either c-command or f-command, the analogue at f-structure): the controlling verb is one clause up, and thus the controller necessarily commands the controllee
Nonlocal phenomena:

- Raising: David seemed to yawn.
- Control: David tried to catch the ball.
- Wh-questions: Who do you think David took to the party?
In English wh-questions, the wh-phrase appears at the beginning of the sentence and also plays a syntactic role within the clause:
Functional Uncertainty

What do you think Chris bought?

[FOCUS [PRED ‘WHAT’]]

[PRED ‘THINK⟨SUBJ,COMP⟩’]

[SUBJ [PRED ‘YOU’]]

[COMP [PRED ‘BUY⟨SUBJ,OBJ⟩’]]

[OBJ [PRED ‘Chris’]]
Questions

- What is the function of the displaced constituent?
Questions

- What is the function of the displaced constituent?
- What is its within-clause role?
Questions

- What is the function of the displaced constituent?
- What is its within-clause role?
- How and where is this relation defined?
What is the function of the displaced constituent?
What is the function of the displaced constituent?

Specifiers of functional categories bear grammaticized discourse functions TOPIC, FOCUS.

What is eating David

\[
\begin{array}{c}
\text{CP} \\
\text{NP} \\
N \\
\text{C} \\
\text{C'} \\
\text{IP} \\
\text{NP} \\
N \\
\text{is} \\
\text{NP} \\
N \\
\text{V} \\
\text{VP} \\
\text{OBJ} \\
\text{SUBJ} \\
\text{FOCUS} \\
\text{PRED} '\text{WHAT}' \\
\text{PRED} '\text{DAVID}' \\
\text{PRED} '\text{EAT}\langle\text{SUBJ},\text{OBJ}\rangle' \\
\end{array}
\]
What is the within-clause role of the displaced constituent?
■ What is the within-clause role of the displaced constituent?
■ Extended Coherence Condition:
What is the within-clause role of the displaced constituent?

Extended Coherence Condition: \texttt{FOCUS} and \texttt{TOPIC} must be linked to the semantic predicate argument structure of the sentence in which they occur, either by functionally or by anaphorically binding an argument.

\[
\begin{array}{c}
\text{PRED} \quad \text{‘EAT(SUBJ,OBJ)’} \\
\text{FOCUS} \quad \text{PRED} \quad \text{‘WHAT’} \\
\text{SUBJ} \quad \text{PRED} \quad \text{‘DAVID’} \\
\text{OBJ}
\end{array}
\]
How and where is this relation defined?
■ How and where is this relation defined?

■ Defined at f-structure, in terms of the f-structure path to clause-internal function.
The Path

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The diagram shows a syntactic tree for the sentence "What is David eating?" with the following labels:

- **CP** (C-structure Phrase)
- **NP** (Nominal Phrase)
- **IP** (Infinite Phrase)
- **VP** (Verb Phrase)
- **V** (Verb)
- **N** (Noun)
- **C** (Complement)
- **I** (Influent)

The tree structure and the corresponding LFG notation are as follows:

- **NP** (What is David eating?)
- **IP** (V)
- **VP** (What)
- **N** (David)
- **C** (is)
- **I** (eating)
- **FOCUS** (focus)
- **PRED** (pred 'what')
- **SUBJ** (pred 'David')
- **OBJ** (pred 'eat⟨subj,obj⟩')

This representation illustrates the mapping between syntactic structure and LFG notation in natural language processing.
Where are the constraints imposed? Ongoing theoretical debate:
Where are the constraints imposed? Ongoing theoretical debate:

- Constraints are associated with position of displaced constituent (Kaplan and Zaenen, 1989), or
Where are the constraints imposed? Ongoing theoretical debate:

- Constraints are associated with position of displaced constituent (Kaplan and Zaenen, 1989), or
- Constraints are associated with within-clause position (a “trace”) (Bresnan, 2001).

Traces are compatible with a nontransformational, constraint-based theory, but not required by theory-internal considerations; linguistic evidence determines which position is correct. More on this later in the lecture.
No traces:

```
NP  C'  IP
  NP  I'
    N  VP
      N  V
        eating

CP

[PREP 'eat⟨subj,obj⟩'
  FOCUS [PRED 'what']
  SUBJ [PRED 'David']
  OBJ ]
```

```
What is NP
  N  C
    C'

David I'
  N  V

[PREP 'eat⟨subj,obj⟩'
  FOCUS [PRED 'what']
  SUBJ [PRED 'David']
  OBJ ]
```
Long Distance Dependencies

With traces:

```
L  F  G
[48x2]L  F  G
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With traces:

C P
N P
N
C
N
What is NP
IP
C'
I'
David
VP
V
NP
eating
N
NP
IP
C'
N
C
NP
CP

[SUBJ [PRED 'David']]
[OBJ [PRED 'eat ⟨subj,obj⟩']]
[FOCUS [PRED 'what']]

[SUBJ [PRED 'David']]
[OBJ [PRED 'eat ⟨subj,obj⟩']]
[FOCUS [PRED 'what']]
```

```
[SUBJ [PRED 'David']]
[OBJ [PRED 'eat ⟨subj,obj⟩']]
[FOCUS [PRED 'what']]
```

```
[SUBJ [PRED 'David']]
[OBJ [PRED 'eat ⟨subj,obj⟩']]
[FOCUS [PRED 'what']]
```

```
[SUBJ [PRED 'David']]
[OBJ [PRED 'eat ⟨subj,obj⟩']]
[FOCUS [PRED 'what']]
```

```
[SUBJ [PRED 'David']]
[OBJ [PRED 'eat ⟨subj,obj⟩']]
[FOCUS [PRED 'what']]
```

```
[SUBJ [PRED 'David']]
[OBJ [PRED 'eat ⟨subj,obj⟩']]
[FOCUS [PRED 'what']]
```

```
[SUBJ [PRED 'David']]
[OBJ [PRED 'eat ⟨subj,obj⟩']]
[FOCUS [PRED 'what']]
```

```
[SUBJ [PRED 'David']]
[OBJ [PRED 'eat ⟨subj,obj⟩']]
[FOCUS [PRED 'what']]
```

```
[SUBJ [PRED 'David']]
[OBJ [PRED 'eat ⟨subj,obj⟩']]
[FOCUS [PRED 'what']]
```

```
[SUBJ [PRED 'David']]
[OBJ [PRED 'eat ⟨subj,obj⟩']]
[FOCUS [PRED 'what']]
```

```
[SUBJ [PRED 'David']]
[OBJ [PRED 'eat ⟨subj,obj⟩']]
[FOCUS [PRED 'what']]
```

```
[SUBJ [PRED 'David']]
[OBJ [PRED 'eat ⟨subj,obj⟩']]
[FOCUS [PRED 'what']]
```

```
[SUBJ [PRED 'David']]
[OBJ [PRED 'eat ⟨subj,obj⟩']]
[FOCUS [PRED 'what']]
```

```
[SUBJ [PRED 'David']]
[OBJ [PRED 'eat ⟨subj,obj⟩']]
[FOCUS [PRED 'what']]
```

```
[SUBJ [PRED 'David']]
[OBJ [PRED 'eat ⟨subj,obj⟩']]
[FOCUS [PRED 'what']]
```

```
[SUBJ [PRED 'David']]
[OBJ [PRED 'eat ⟨subj,obj⟩']]
[FOCUS [PRED 'what']]
```

```
[SUBJ [PRED 'David']]
[OBJ [PRED 'eat ⟨subj,obj⟩']]
[FOCUS [PRED 'what']]
```

```
[SUBJ [PRED 'David']]
[OBJ [PRED 'eat ⟨subj,obj⟩']]
[FOCUS [PRED 'what']]
```

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[SUBJ [PRED 'David']]
[OBJ [PRED 'eat ⟨subj,obj⟩']]
[FOCUS [PRED 'what']]
```

```
[SUBJ [PRED 'David']]
[OBJ [PRED 'eat ⟨subj,obj⟩']]
[FOCUS [PRED 'what']]
```

```
[SUBJ [PRED 'David']]
[OBJ [PRED 'eat ⟨subj,obj⟩']]
[FOCUS [PRED 'what']]
```

```
[SUBJ [PRED 'David']]
[OBJ [PRED 'eat ⟨subj,obj⟩']]
[FOCUS [PRED 'what']]
```

```
[SUBJ [PRED 'David']]
[OBJ [PRED 'eat ⟨subj,obj⟩']]
[FOCUS [PRED 'what']]
```

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[OBJ [PRED 'eat ⟨subj,obj⟩']]
[FOCUS [PRED 'what']]
```

```
[SUBJ [PRED 'David']]
[O
How is the path defined?
■ How is the path defined?

■ By **functional uncertainty**: regular expression over grammatical functions.
How is the path defined?

By **functional uncertainty**: regular expression over grammatical functions.

Example: COMP* OBJ stands for paths with any number of COMP functions followed by an OBJ function.
English WH-questions

\[ \text{CP} \rightarrow \text{XP} \]
\[ \uparrow \text{FOCUS} = \downarrow \]
\[ \uparrow \text{FOCUS} = (\uparrow \text{COMP}^* \text{GF}) \]

\[ \text{C'} \]
\[ \uparrow = \downarrow \]

\textit{Kleene star operator: *}

\text{COMP}^* \text{ represents: }

the empty path
COMP
COMP COMP
\ldots
Nonlocal Dependencies

What is eating

| What | is | eating | \\
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CP</td>
<td>NP</td>
<td>C'</td>
</tr>
<tr>
<td>NP</td>
<td>C</td>
<td>IP</td>
</tr>
<tr>
<td>N</td>
<td>N</td>
<td>VP</td>
</tr>
<tr>
<td>N</td>
<td>V</td>
<td>OBJ</td>
</tr>
<tr>
<td>C</td>
<td>IP</td>
<td></td>
</tr>
<tr>
<td>I'</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

pred 'eat' \[ subj, obj \]

focus [pred 'what']

subj [pred 'David']

subj [pred 'eat']


david

pred 'eat' [subj, obj]
What do you think Chris bought?
What do you think Chris hoped David bought?
What did David believe Chris to like

XCOMP

CP

NP

C′

NP

C

IP

V′

VP

N

V

NP

V′

VP

N

V

NP

V′

VP

N

V

VP

N

V

NP

V′

VP

N

V

NP

V′

VP

N

V
Augmenting the Path

\[
\begin{align*}
CP & \rightarrow XP \\
(↑ FOCUS) &= ↓ \\
(↑ FOCUS) &= (↑ \{XCOMP|COMP\}^* GF)
\end{align*}
\]

\{XCOMP|COMP\}^* represents:

the empty path
COMP
XCOMP
COMP XCOMP
COMP COMP
XCOMP COMP XCOMP...

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Sentential subject condition:

*What did [that Chris bought ___] surprise you?

SUBJ is not allowed as a component of Path:

```
FOCUS  [ PRED  'WHAT' ]
PRED   'SURPRISE⟨SUBJ,OBJ⟩'
    [ PRED  'BUY⟨SUBJ,OBJ⟩' ]
  SUBJ   [ PRED  'CHRIS' ]
    OBJ   [ PRED  'YOU' ]
```
(Outside-in/“regular”) functional uncertainty:

Path through $f$ leads to $g$

$$f : [ \text{COMP} \ \text{COMP} \ \text{COMP} \ldots \ \text{OBJ} \ \ g ]$$

$$(f \ \text{COMP}^* \ \text{OBJ}) = g$$
No traces

Constraints associated with fronted position.

\[
\text{CP} \rightarrow \left( \begin{array}{c}
\text{XP} \\
(\uparrow \text{FOCUS}) = \downarrow \\
(\uparrow \text{FOCUS}) = (\uparrow \{\text{xcomp}|\text{comp}\}^* \text{GF})
\end{array} \right) \quad (\uparrow = \downarrow)
\]
Inside-out functional uncertainty:
Path through $f$ leads to $g$

\[ f : \left[ \text{COMP} \ \text{COMP} \ \text{COMP} \ldots \ \text{OBJ} \quad g \right] \]

\[ f = (\text{COMP}^* \ \text{OBJ} \ g) \]
With traces

Constraints associated with trace.

\[ \text{CP} \rightarrow (\text{XP} (\uparrow \text{FOCUS}) = \downarrow) (\uparrow = \downarrow) \]
With traces

Constraints associated with trace.

\[ \text{CP} \rightarrow \left( \left( \uparrow \text{FOCUS} \right) = \downarrow \right) \left( \uparrow = \downarrow \right) \]

\[ \text{NP} \rightarrow \quad t \quad \uparrow = \left( \left( \{ \text{xcomp} \mid \text{comp} \}^* \text{ GF} \uparrow \right) \text{ FOCUS} \right) \]
Most arguments for the existence of traces have been discredited. Evidence from crossover has been more difficult to refute.

**Crossover** in transformational terms: a transformation cannot apply if it would result in a NP “crossing over” a coreferential NP.

**Crossover** in nontransformational terms, assuming traces: The trace of a displaced NP cannot appear to the right of a coreferential NP.
Weak and strong crossover

**Strong crossover violation:** coreferential pronoun precedes and c-commands extraction site

*Who$_i$ did he$_i$ greet $t$?
(cannot mean: Who greeted himself?)

**Weak crossover violation:** coreferential pronoun precedes but does not c-command extraction site

*Who$_i$ did his$_i$ mother greet $t$?
(cannot mean: Whose$_i$ mother greeted him$_i$?)

Crossover appears to provide evidence for traces: see Bresnan (1995) and Dalrymple et al. (2006) for discussion and debate.
We have examined the formal foundations and basic theoretical assumptions of LFG,
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and discussed some areas of current theoretical debate.

For more on LFG, visit the LFG website: http://www.essex.ac.uk/linguistics/LFG/
Wrapup

- We have examined the formal foundations and basic theoretical assumptions of LFG,
- and discussed some areas of current theoretical debate.
- For more on LFG, visit the LFG website: http://www.essex.ac.uk/linguistics/LFG/
- attend the Bresnan lectures (LSA.347) and the Asudeh/Toivonen lectures (LSA.309) in the main session at the Institute,
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and attend LFG07, here at Stanford, 28-30 July: http://www-csli.stanford.edu/thking/lfg07.html


Börjars, Kersti and Nigel Vincent. 2004. Introduction to LFG. Slides from the Winter School in LFG and Computational Linguistics, University of Canterbury

Bresnan, Joan. 1990. Parallel constraint grammar project. CSLI Calendar, 4 October 1990, volume 6:3


