Introduction to LFG

Mary Dalrymple
Centre for Linguistics and Philology
Oxford University

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Day 1
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To understand where linguistic theory is today, it’s helpful to look at how we got here.
Linguistics in 1957: *Syntactic Structures* (Chomsky, 1957):

- New goal for linguistics: provide a precise specification of the class of formalized grammars of human languages; describe and state generalizations/rules governing the infinite class of grammatical sentences of a language.
Some history

Linguistics in 1957: *Syntactic Structures* (Chomsky, 1957):

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- Focus on native speaker judgments/intuitions: need not find an example of a sentence in a corpus to know that it is a legitimate sentence of a language
Phrase structure rules for basic (“kernel”) sentences:

- Sentence $\rightarrow$ NP + VP
- NP $\rightarrow$ T + N
- VP $\rightarrow$ Verb + NP
- T $\rightarrow$ the
- N $\rightarrow$ man, ball, etc.
- Verb $\rightarrow$ hit, took, etc.
Basic rules don’t produce an analysis for all sentences of the language; **transformations** are needed to derive new sentences from basic sentences by moving, deleting, replacing, and combining parts of basic sentences.
Why transformations? Claim: This is the best way of capturing nonlocal relations, and showing how different kinds of sentences are related; grammars without transformations would be cumbersome or complex. Example: Auxiliary sequencing.
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- The man kicked the ball.
- The man was kicking the ball.
- The man has kicked the ball.
- The man has been kicking the ball.
- The ball was kicked.
- The ball has been being kicked.
Affix hopping

The ‘affix hopping’ transformation:

\[ s + [\text{have} + \text{en}] + [\text{be} + \text{ing}] + \text{read} \]

\[ \Rightarrow \text{have} + s + \text{be} + \text{en} + \text{read} + \text{ing} \]

\[ \Rightarrow \text{has been reading} \]
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$$\Rightarrow \text{have} + s + \text{be} + \text{en} + \text{read} + \text{ing}$$

$$\Rightarrow \text{has been reading}$$

Through the 1960s and 1970’s, transformations of various kinds were proposed to derive sentences with coordination, voice alternations, pronouns and reflexives, imperatives, relative clauses, questions, …
Ross (1967): Transformations must be constrained. Example: Wh-movement, defined as: Move a questioned element to the beginning of the sentence.

- Bill saw what ⇒ What did Bill see?
- Bill went where ⇒ Where did Bill go?
But without additional constraints, sentences like these are also produced:

- Coordinate Structure Constraint violation:
  *What did the man kick the ball and ___?
Movement constraints

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- Complex NP Constraint violation:
  *What did you regret the fact that the man kicked ___?
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  *What did the man kick the ball and ___?*

- Complex NP Constraint violation:
  *What did you regret the fact that the man kicked ___?*

- WH-Island Constraint violation:
  *What did you wonder who saw ___?*
Pronouns

Chomsky (1970): many relations that had been treated transformationally are actually best treated by rules relating lexical entries. Example: the pronominalization transformation, defined as: replace a noun phrase with a pronoun under identity with another noun phrase.
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- Bill thought that Bill should leave. ⇒
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- Bill thought that he should leave.

Problem: Bach-Peters sentences

- The pilot that shot at it hit the Mig that chased him.
Peters and Ritchie (1969): “There is a version of the theory of transformational grammar in which there is a fixed base grammar ... which will serve as the base component of a grammar of any natural language.”

Bad news: “whatever the facts of any natural language regarding grammaticality, ambiguity, and paraphrase turn out to be, a grammar can be found to fit them within any version of transformational theory that has been proposed, and there are furthermore a number of essentially different fixed base grammars.” Knowing about the structure of a language tells us nothing about its base grammar (input to transformations); transformational grammar makes no claim about the class of possible human languages.
Abandonment of 1960s/1970s-style transformational treatments, with many language-specific, construction-specific transformations, leading to a split in syntactic theories:

- Transformational theories: transformations were retained, but defined in very general terms ("move something somewhere"), or

- Constraint-based theories: Transformations were abandoned entirely.
The transformational approach

- Transformational/derivational theories, e.g. Government & Binding/Principles and Parameters/Minimalism:
  
  - Relations between linguistic levels are specified by transformations relating one aspect of linguistic structure (e.g., semantic role – bearing the role of agent or patient) to another (e.g., grammatical function – being a subject or object).
  
  - Transformations operate on trees to produce trees → All aspects of linguistic structure are represented by trees.
The transformational approach

- If abstract syntactic relations are expressed as tree configurations:

  ◆ Some relations that are expressed syntactically (multiple words or phrases) in one language are expressed morphologically (a single complex word) in other languages → parts of words (valence-increasing or decreasing morphemes, abstract syntactic features) appear as leaf nodes in the phrase structure; transformations are needed to assemble words from their minimal meaningful parts.

  ◆ Not all languages have the same word order or phrasal groupings → transformations must be used to change the abstract structures into structures appropriate for each language.
The constraint-based approach

Constraint-based theories (Lexical Functional Grammar, Head-Driven Phrase Structure Grammar, Construction Grammar, Simpler Syntax ...):

- Different aspects of linguistic structure are realized by different but related linguistic representations. Transformations do not play a role.
“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)

What theoretical architecture best reflects this view?
Theories and frameworks

Formal linguistic framework: A set of linguistic objects, and a formal vocabulary for talking about them. Example: X-bar theory: phrase structure trees and rules.
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- Embodies some assumptions about how language works: phrases (like VP) have heads (like V),
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Formal linguistic framework: A set of linguistic objects, and a formal vocabulary for talking about them. Example: X-bar theory: phrase structure trees and rules.

- Formally explicit: Provides a way of making systematic, clear, and testable claims about phrase structure.
- Embodies some assumptions about how language works: phrases (like VP) have heads (like V),
- but general enough to encompass a range of different theories of phrase structure.
Linguistic theory: A set of claims about the structure of language(s), which may (or may not) be stated with reference to a particular formal framework.
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- Example: The claim that all maximal X-bar projections have bar level 2 (there is no N''' or V''''').
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- Example: The claim that all maximal X-bar projections have bar level 2 (there is no N'''' or V'''''').

- A well-designed formal framework guides development of theory by providing explicit representations and theoretical vocabulary, and aids the linguist in developing better intuitions about language and better ways of analysing linguistic structure.
Formal framework of LFG:

- Different aspects of linguistic structure are represented in different ways, and are related to one another by piecewise correspondence (parts of one structure are related to parts of another structure).
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- The core of the formal framework of LFG has remained remarkably stable since its beginnings in the late 1970s.
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- LFG-based theories of linguistic phenomena have evolved substantially since that time, and continue to evolve as new areas are explored and new theoretical proposals are formulated and evaluated.
Two aspects of syntactic structure:

- **Functional structure** is the abstract functional syntactic organization of the sentence, familiar from traditional grammatical descriptions, representing syntactic predicate-argument structure and functional relations like subject and object.

- **Constituent structure** is the overt, more concrete level of linear and hierarchical organization of words into phrases.
LFG’s c-structure and f-structure

Introduction to LFG – 21 / 64
Since the inception of the theory, there has been much work on other linguistic levels and their relation to c-structure and f-structure:

- Argument structure and argument linking (Bresnan and Zaenen, 1990; Butt, 1996)
- The syntax-semantics interface: “glue” semantics (Dalrymple, 1999; Asudeh, 2004)
- Information structure and its relation to syntax and semantics (Butt and King, 2000)
- Prosodic structure and its relation to syntax and semantics (Mycock, 2007)
C-structure and f-structure

```
IP
   NP  I'
      N  VP
         David  V'
            V
               NP
                  greeted  N
                         Chris

[ [ PRED 'GREET⟨SUBJ,OBJ⟩' ]
  [ [ SUBJ [ PRED 'DAVID' ] ]
    [ [ OBJ [ PRED 'CHRIS' ] ] ]
]
```
What information does functional structure represent?
F-structure

- What information does functional structure represent?
- How do we know what the functional structure for a sentence is?
Functional Structure

- Represents abstract syntactic relations (familiar from traditional grammar) like subject, object, adjunct
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- Locus of subcategorization
Functional Structure

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- Locus of subcategorization
- Criteria: anaphoric binding patterns, long-distance dependencies, control, honorification, agreement, casemarking, ...
Functional Structure

- Represents abstract syntactic relations (familiar from traditional grammar) like subject, object, adjunct

- Locus of subcategorization

- Criteria: anaphoric binding patterns, long-distance dependencies, control, honorification, agreement, casemarking, ...

- F-structure vocabulary is universal across languages
Honorification: Only the subject is the target of honorific verbs in Japanese
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Anaphora: The antecedent of a pronoun in Hindi cannot be the subject
Functional Structure Diagnostics

- Honorification: Only the subject is the target of honorific verbs in Japanese
- Anaphora: The antecedent of a pronoun in Hindi cannot be the subject
- Relativization: Only objects can be relativized with a gap in Kinyarwanda
## Grammatical functions

<table>
<thead>
<tr>
<th>Non-argument</th>
<th>TOPIC, FOCUS</th>
<th>Discourse function</th>
<th>Non-discourse function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Argument (governable)</strong></td>
<td><strong>Core</strong></td>
<td><strong>SUBJ</strong></td>
<td><strong>Non-discourse function</strong></td>
</tr>
<tr>
<td></td>
<td><strong>OBJ</strong></td>
<td><strong>OBJ_\theta</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>NON-CORE</strong></td>
<td><strong>OBL_\theta</strong></td>
<td><strong>COMP</strong></td>
</tr>
<tr>
<td>Non-argument</td>
<td><strong>ADJ(unct)</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(from Börjars and Vincent 2004)
David gave George flowers.

\[
\begin{align*}
\text{PRED} & \quad \text{‘GIVE\{SUBJ,OBJ,OBJ Theme\}’} \\
\text{TENSE} & \quad \text{PAST} \\
\text{SUBJ} & \quad \text{PRED} \quad \text{‘DAVID’} \\
\text{OBJ} & \quad \text{PRED} \quad \text{‘GEORGE’} \\
\text{OBJ Theme} & \quad \text{PRED} \quad \text{‘FLOWER’} \\
\text{NUM PL} & 
\end{align*}
\]

\(\text{OBJ}_\theta\) is a family of thematically restricted object functions. English, like many other languages, has only \(\text{OBJ Theme}\).
Chris thought that David yawned.

\[
\begin{align*}
\text{PRED} & : \text{THINK} \langle \text{SUBJ,COMP} \rangle \\
\text{SUBJ} & : \begin{align*}
\text{PRED} & : \text{Chris'} \\
\text{COMP} & : \begin{align*}
\text{PRED} & : \text{YAWN} \langle \text{SUBJ} \rangle \\
\text{TENSE} & : \text{PAST} \\
\text{COMPFORM} & : \text{THAT} \\
\text{SUBJ} & : \begin{align*}
\text{PRED} & : \text{David'}
\end{align*}
\end{align*}
\end{align*}
\end{align*}
\]
Beans, David likes.

```

[ PRED  'LIKE<SUBJ,OBJ>' ]
[ TENSE  PRES ]
[ FOCUS  [ PRED  'BEANS' ] ]
[ SUBJ  [ PRED  'DAVID' ] ]
[ OBJ ]
```
Functional structure

\[
\begin{align*}
\text{PRED} & \quad \text{GO(SUBJ)}' \\
\text{TENSE} & \quad \text{PAST} \\
\text{SUBJ} & \quad \begin{align*}
\text{PRED} & \quad \text{DAVID'} \\
\text{NUM} & \quad \text{SG}
\end{align*}
\end{align*}
\]
Functional structure

\[
\begin{align*}
&\text{PRED} \quad \text{‘GO(SUBJ)’} \\
&\text{TENSE} \quad \text{PAST} \\
&\text{SUBJ} \quad \begin{align*}
&\text{PRED} \quad \text{‘DAVID’} \\
&\text{NUM} \quad \text{SG}
\end{align*}
\end{align*}
\]

- PRED, TENSE NUM: attributes
**Functional structure**

\[
\begin{array}{c}
\text{PRED} & \text{‘GO(SUBJ)’} \\
\text{TENSE} & \text{PAST} \\
\text{SUBJ} & \begin{array}{c}
\text{PRED} & \text{‘David’} \\
\text{NUM} & \text{SG}
\end{array}
\end{array}
\]

- **PRED, TENSE NUM**: attributes
- **‘GO(SUBJ)’, David, SG**: values
Functional structure

```
[ [ PRED 'GO⟨SUBJ⟩' ]
  TENSE PAST
  [ SUBJ [ [ PRED 'David' ]
    NUM SG ] ] ]
```

- PRED, TENSE NUM: attributes
- ‘GO⟨SUBJ⟩’, David, sg: values
- PAST, SG: symbols (a kind of value)
Functional structure

\[
\begin{bmatrix}
\text{PRED} & 'GO\langle\text{SUBJ}\rangle' \\
\text{TENSE} & \text{PAST} \\
\text{SUBJ} & \begin{bmatrix}
\text{PRED} & '\text{David}' \\
\text{NUM} & \text{SG}
\end{bmatrix}
\end{bmatrix}
\]

- PRED, TENSE NUM: attributes
- ‘GO\langle\text{SUBJ}\rangle’, David, SG: values
- PAST, SG: symbols (a kind of value)
- ‘BOY’, ‘GO\langle\text{SUBJ}\rangle’: semantic forms
F-structures

\[
\begin{array}{l}
\text{PRED} \quad \text{‘GO(SUBJ)’} \\
\text{TENSE} \quad \text{PAST} \\
\text{SUBJ} \quad \begin{cases}
\text{PRED} \quad \text{‘DAVID’} \\
\text{NUM} \quad \text{SG}
\end{cases} \\
\text{ADJ} \quad \{ \begin{cases}
\text{PRED} \quad \text{‘QUICKLY’}
\end{cases} \}
\end{array}
\]

An f-structure can be the value of an attribute.
F-structures

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F-structures

\[
\begin{bmatrix}
\text{PRED} & 'GO\langle\text{SUBJ}\rangle' \\
\text{TENSE} & \text{PAST} \\
\text{SUBJ} & \begin{bmatrix}
\text{PRED} & '\text{David}' \\
\text{NUM} & \text{SG}
\end{bmatrix} \\
\text{ADJ} & \{ \begin{bmatrix}
\text{PRED} & '\text{quickly}' 
\end{bmatrix} \}
\end{bmatrix}
\]

An f-structure can be the value of an attribute. Attributes with f-structure values are the grammatical functions: \text{SUBJ}, \text{OBJ}, \text{OBJ}_\theta, \text{COMP}, \text{XCOMP}, ...

A set of f-structures can also be a value of an attribute.
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A set of f-structures can also be a value of an attribute.
Sets of f-structures represent:

- adjuncts (there can be more than one adjunct) or
Sets of f-structures represent:

- adjuncts (there can be more than one adjunct) or
- coordinate structures (there can be more than one conjunct)
Describing F-structures

\[(f \text{ NUM}) = \text{SG}\]

is a functional equation.

\[(f \ a) = v\] holds if and only if \(f\) is an f-structure, \(a\) is a symbol, and the pair \(\langle a, v \rangle \in f\).

A set of formulas describing an f-structure is a functional description.
When does a functional equation hold?

\[(g \text{ NUM}) = \text{ SG}\]

Holds of: \[g[^{\text{NUM}} \text{ SG}]\]

Also holds of: \[g[^{\text{PRED}} \text{ ‘DAVID’}]\]

\[^{\text{GEND}} \text{ MASC}^{\text{NUM}} \text{ SG}\]
Which solution?: Minimality

The f-structure for an utterance is the minimal solution satisfying the constraints introduced by the words and phrase structure of the utterance.

F-description: \( (g \ \text{NUM}) = \text{SG} \)

Its minimal solution: \( g[\text{NUM} \quad \text{SG}] \)
More Complex Descriptions

\((f \ \text{SUBJ} \ \text{NUM}) = \text{SG}\)

\((f \ as) \equiv ((f \ a) \ s)\) for a symbol \(a\) and a (possibly empty) string of symbols \(s\).

\((f \ \epsilon) \equiv f\), where \(\epsilon\) is the empty string.
\[(f \text{ SUBJ NUM}) = \text{ SG}\]

\[f\left[\begin{array}{c}
\text{PRED} \quad \text{'GO(SUBJ)'} \\
\text{SUBJ} \\
g\left[\begin{array}{c}
\text{PRED} \quad \text{'DAVID'} \\
\text{NUM} \\
\text{SG}
\end{array}\right]
\end{array}\right]\]
Solving Complex Descriptions

\[(f \, \text{SUBJ}) \, \text{NUM}) = \text{SG}\]

\[
f \begin{bmatrix}
\text{PRED} & \text{GO(SUBJ)}
\end{bmatrix}
\]

\[
g \begin{bmatrix}
\text{PRED} & \text{DAVID'}
\end{bmatrix}
\]

\[
\begin{bmatrix}
\text{NUM} & \text{SG}
\end{bmatrix}
\]
(g NUM) = SG

\[
f\left[\begin{array}{c}
\text{SUBJ} \\
g\left[\begin{array}{c}
\text{NUM} \\
\text{SG}
\end{array}\right]
\end{array}\right]
\]

\[
f\left[\begin{array}{c}
\text{SUBJ} \\
g\left[\begin{array}{c}
\text{PRED} '\text{GO(SUBJ)}' \\
\end{array}\right]
\end{array}\right]
\]
Finding the Right F-structure

Hindi verbs show person, number, and gender agreement:

Ram calegaa
Ram go.FUTURE
‘Ram will go.’

Ram

\[
\begin{align*}
(g\ \text{PRED}) &= \text{‘Ram’} \\
(g\ \text{CASE}) &= \text{NOM} \\
(g\ \text{PERS}) &= 3 \\
(g\ \text{NUM}) &= \text{SG} \\
(g\ \text{GEND}) &= \text{MASC}
\end{align*}
\]

Calegaa

\[
\begin{align*}
(f\ \text{PRED}) &= \text{‘GO\langle\text{SUBJ}\rangle’} \\
(f\ \text{SUBJ CASE}) &= \text{NOM} \\
(f\ \text{SUBJ PERS}) &= 3 \\
(f\ \text{SUBJ NUM}) &= \text{SG} \\
(f\ \text{SUBJ GEND}) &= \text{MASC}
\end{align*}
\]

\[(f\ \text{SUBJ}) = g\]
F-description and its solution

\[
\begin{align*}
(g\ pred) &= \text{'Ram'} \\
(g\ case) &= \text{nom} \\
(g\ pers) &= 3 \\
(g\ num) &= \text{sg} \\
(g\ gend) &= \text{masc} \\
(f\ pred) &= \text{'go⟨subj⟩'} \\
(f\ subj\ case) &= \text{nom} \\
(f\ subj\ pers) &= 3 \\
(f\ subj\ num) &= \text{sg} \\
(f\ subj\ gend) &= \text{masc} \\
(f\ subj) &= g
\end{align*}
\]
F-description and its solution

\[ (g \ \text{pred}) = '\text{Ram}' \]
\[ (g \ \text{case}) = \text{nom} \]
\[ (g \ \text{pers}) = 3 \]
\[ (g \ \text{num}) = \text{sg} \]
\[ (g \ \text{gend}) = \text{masc} \]

\[ (f \ \text{pred}) = '\text{go}(\text{subj})' \]
\[ ((f \ \text{subj}) \ \text{case}) = \text{nom} \]
\[ ((f \ \text{subj}) \ \text{pers}) = 3 \]
\[ ((f \ \text{subj}) \ \text{num}) = \text{sg} \]
\[ ((f \ \text{subj}) \ \text{gend}) = \text{masc} \]
\[ (f \ \text{subj}) = g \]
F-description and its solution

$(g\ PRED) = \text{\textsc{Ram}}$
$(g\ CASE) = \text{NOM}$
$(g\ PERS) = 3$
$(g\ NUM) = \text{SG}$
$(g\ GEND) = \text{MASC}$

$(f\ PRED) = \text{\textsc{Go}}\langle\text{SUBJ}\rangle$
$(f\ CASE) = \text{NOM}$
$(f\ PERS) = 3$
$(f\ NUM) = \text{SG}$
$(f\ GEND) = \text{MASC}$

$(f\ SUBJ) = g$
Semantic Forms

\[(f \text{ PRED}) = \text{‘GO(Subj)’}\]

Semantic forms have **argument lists** that list the arguments they require. In traditional LFG, they represent the interface between syntax (f-structure) and semantics (argument structure, semantic structure). (Current theories of argument structure and semantics propose separate representations for these levels.)
Semantic Forms

\[(f \text{ PRED}) = 'GO\langle \text{SUBJ}\rangle'\]

Semantic forms have argument lists that list the arguments they require. In traditional LFG, they represent the interface between syntax (f-structure) and semantics (argument structure, semantic structure). (Current theories of argument structure and semantics propose separate representations for these levels.)

Equivalent notation:

\[(f \text{ PRED}) = 'GO\langle (↑ \text{SUBJ})\rangle'\]
Completeness

Completeness requires: All arguments which are listed in the semantic form must be present.

\[(f \text{ PRED}) = \langle \text{GO} \rangle\]

“Go” must have a SUBJ.
Coherence requires: No arguments which are not listed in the semantic form may be present.

\[(f \text{ PRED}) = 'GO\langle\text{SUBJ}\rangle'\]

“Go” may not have a OBJ.
Arguments which are associated with semantic roles appear inside the angled brackets and must have a \textsc{pred}.

\[(f \textsc{pred}) = \textit{`go⟨subj⟩'}\]

The \textsc{subj} of “go” must have a \textsc{pred}.
Arguments which appear outside the angled brackets are syntactically but not semantically selected by the verb.

\[(f \text{ PRED}) = \text{`RAIN}()\text{SUBJ'}\]

“Rain” must have a \text{SUBJ}, but it is not assigned a semantic role by the predicate. (Other parts of the \text{f-description} ensure that the subject is “it”.)

It rained.
  *Bill rained.
  *Rained.
Semantic Forms and Uniqueness

*wati ka parnka-mi karnta
man.ABS PRES run-NONPAST woman.ABS
‘The man runs the woman.’ (Warlpiri)

wati \( (g \text{ PRED}) = \text{‘MAN’} \)
karnta \( (g \text{ PRED}) = \text{‘WOMAN’} \)

Each use of a semantic form is unique.
Conflicting Semantic Forms

\[
\begin{align*}
\text{wati} & \quad (g \ \text{PRED}) = \ '\text{MAN}' \\
\text{karnta} & \quad (g \ \text{PRED}) = \ '\text{WOMAN}'
\end{align*}
\]

Ill-formed f-structure:

\[
\begin{bmatrix}
\text{PRED} & '\text{RUN(SUBJ)}' \\
\text{TENSE} & \text{PRES} \\
\text{SUBJ} & g\left[ \text{PRED} \ '\text{MAN'/'WOMAN'} \right]
\end{bmatrix}
\]
**Semantic forms and Uniqueness**

*Mirko ju je čitao.*
Mirko it\_ACC\_CLITIC aux.3SG read
‘Mirko read it.’ (Serbo-Croatian)

*Mirko je čitao nju.*
Mirko aux.3SG read it\_ACC
‘Mirko read it.’

\[\begin{array}{c}
ju \quad (g \text{ PRED}) = \text{‘PRO’} \\
nju \quad (g \text{ PRED}) = \text{‘PRO’}
\end{array}\]

\[\begin{array}{c}
PRED \quad \text{‘READ⟨SUBJ,OBJ⟩’} \\
\text{SUBJ} \quad \text{PRED} \quad \text{‘MIRKO’} \\
\text{OBJ} \quad g \quad \text{PRED} \quad \text{‘PRO’}
\end{array}\]
*Mirko *ju je čitao nju.
Mirko it.ACC.CLITIC aux.3SG read it.ACC
‘Mirko read it it.’

Ill-formed f-structure:
\[
\begin{bmatrix}
\text{PRED} & \text{‘READ}⟨\text{SUBJ},\text{OBJ}⟩\text{’} \\
\text{SUBJ} & \begin{bmatrix}
\text{PRED} & \text{‘MIRKO’} \\
\text{OBJ} & \begin{bmatrix}
\text{PRED} & \text{‘PRO}_1’/\text{‘PRO}_2’
\end{bmatrix}
\end{bmatrix}
\end{bmatrix}
\]
Chris thought that David yawned.
Chris thought that David yawned.

Chris thought David yawned.
Chris thought that David yawned.
Chris thought David yawned.
That David yawned surprised Chris.
Chris thought that David yawned.

Chris thought David yawned.

That David yawned surprised Chris.

*David yawned surprised Chris.
Imposing Functional Requirements

- Chris thought that David yawned.
- Chris thought David yawned.
- That David yawned surprised Chris.
- *David yawned surprised Chris.

Sentential subjects must have complementizer “that”.
Requirement for sentential subjects: \((f \text{ COMPFORM}) =_c \text{ THAT}\)
Constraining equations

Requirement for sentential subjects: \((f \text{ COMPFORM}) =_{c} \text{ THAT}\)

Constraining equations are written with a subscript ‘c’.
Constraining equations

Requirement for sentential subjects: \((f \text{ COMPFORM}) =_c \text{ THAT}\)

Constraining equations are written with a subscript ‘c’.

This constraining equation requires \([\text{COMPFORM} \quad \text{THAT}]\) in minimal solution of f-description of sentence (must be provided by something else in the sentence).
**Constraining equations**

Requirement for sentential subjects: \((f \ \text{COMPFORM}) =_c \text{THAT}\)

Constraining equations are written with a subscript ‘c’.

This constraining equation requires \([\text{COMPFORM} \quad \text{THAT}]\) in **minimal solution** of f-description of sentence (must be provided by something else in the sentence).

“that” contributes: \((f \ \text{COMPFORM}) = \text{THAT}\)
That David yawned surprised Chris.

$$\begin{array}{c}
\text{PRED} \ '\text{SURPRISE} (\text{SUBJ}, \text{OBJ})' \\
\text{TOPIC} \ f \ \text{TENSE} \ \text{PAST} \\
\text{OBJ} \ \text{PRED} \ '\text{Chris'}' \\
\end{array}$$
Complementizer not required

Chris thought David yawned.

\[
\begin{align*}
\text{PRED} & : \text{THINK}\langle\text{SUBJ,COMP}\rangle \\
\text{SUBJ} & : \begin{align*}
\text{PRED} & : \text{CHRIS'} \\
\end{align*} \\
\text{COMP} & : \begin{align*}
\text{PRED} & : \text{YAWN}\langle\text{SUBJ}\rangle \\
\text{TENSE} & : \text{PAST} \\
\text{SUBJ} & : \begin{align*}
\text{PRED} & : \text{DAVID'} \\
\end{align*} \\
\end{align*}
\end{align*}
\]
Constraining equations defined

\((f^a)_c^v\) holds if and only if \(f\) is an f-structure, \(a\) is a symbol, and the pair \(\langle a, v \rangle\) is in the minimal solution for the defining equations in the f-description of \(f\).
Disjunction

I met/have met him.

\[ \text{met} \quad (f \ \text{PRED}) = \text{‘MEET⟨SUBJ,OBJ⟩’} \]
\[ \quad \{(f \ \text{TENSE}) = \text{PAST} \mid (f \ \text{VFORM}) = \text{PASTPART}\} \]

\[
\begin{array}{l}
\[ f \left[ \begin{array}{c}
\text{PRED} \quad \text{‘MEET⟨SUBJ,OBJ⟩’} \\
\text{TENSE} \quad \text{PAST}
\end{array} \right] \\
\end{array}
\]

\[
\begin{array}{l}
\[ f \left[ \begin{array}{c}
\text{PRED} \quad \text{‘MEET⟨SUBJ,OBJ⟩’} \\
\text{VFORM} \quad \text{PASTPART}
\end{array} \right] \\
\end{array}
\]
Optionality

njûchi zi-ná-lúm-a alenje
bees SUBJ-PAST-bite-INDICATIVE hunters
‘The bees bit the hunters.’ (Chichewa)

zi-ná-lúm-a alenje
SUBJ-PAST-bite-INDICATIVE hunters
‘They bit the hunters.’

zi-ná-lúm-a: \((f \text{ SUBJ PRED}) = \text{‘PRO’}\)

zi-ná-lúm-a optionally contributes a PRED for its SUBJ.
Overt subject

njûchi zi-ná-lúm-a  alenje
bees  SUBJ-PAST-bite-INDICATIVE  hunters
‘The bees bit the hunters.’

\[
f \left[ \begin{array}{c}
PRED \ 'BITE\langle SUBJ,OBJ\rangle' \\
SUBJ \ \left[ PRED \ 'BEES' \\
\text{NOUNCLASS} \ 10 \right] \\
OBJ \ \left[ PRED \ 'HUNTERS' \\
\text{NOUNCLASS} \ 2 \right] \\
\end{array} \right]
\]
No overt subject

$zi$-$ná$-$lúm$-$a \quad alenje$

$SUBJ$-$PAST$-$bite$-$INDICATIVE \quad hunters$

‘They bit the hunters.’

\[
\begin{align*}
&f
\\
&\begin{array}{c}
&\text{PRED} \quad \text{‘BITE} \langle \text{SUBJ,OBJ} \rangle \text{’} \\
&\text{SUBJ} \\
&\text{OBJ}
\end{array}
\\
&\begin{array}{c}
&[\text{PRED} \quad \text{‘PRO’}] \\
&[\text{NOUNCLASS} \quad 10]
\end{array}
\\
&\begin{array}{c}
&[\text{PRED} \quad \text{‘HUNTERS’}] \\
&[\text{NOUNCLASS} \quad 2]
\end{array}
\end{align*}
\]
Juan vió a Pedro.
Juan saw PREP Pedro
‘Juan saw Pedro.’ (Spanish)

Juan lo vió.
Juan him.ACC.SG.CLITIC saw
‘Juan saw him.’

Juan lo vió a Pedro.
Juan him.ACC.SG.CLITIC saw PREP Pedro
‘Juan saw Pedro.’
Optionality: Clitics

\[ Pedro \quad (f \text{ pred}) = 'Pedro' \]
\[ lo \quad ((f \text{ pred}) = 'PRO') \]
Optionality: Clitics

\[
\begin{align*}
\text{Pedro} & \quad (f \text{ pred}) = \text{‘Pedro’} \\
\text{lo} & \quad ((f \text{ pred}) = \text{‘PRO’})
\end{align*}
\]

\textit{lo optionally contributes a PRED.}
Optionality: Clitics

Pedro \((f \text{ PRED}) = \text{‘Pedro’}\)
lo \(((f \text{ PRED}) = \text{‘PRO’})\)

lo **optionally** contributes a PRED.

Juan lo vió a Pedro.
Juan him.ACC.SG.CLITIC saw PREP Pedro
‘Juan saw Pedro.’
Pedro \( (f \text{ pred}) = '\text{Pedro}' \)

lo \( ((f \text{ pred}) = '\text{pro}' \)

lo optionally contributes a PRED.

Juan lo vió a Pedro.

Juan him.ACC.SG.CLITIC saw PREP Pedro

‘Juan saw Pedro.’

\[
\begin{bmatrix}
\text{PRED} & '\text{SEE}\langle\text{SUBJ,OBJ}\rangle' \\
\text{SUBJ} & \begin{bmatrix} \text{PRED} & '\text{JUAN}' \end{bmatrix} \\
\text{OBJ} & f\begin{bmatrix} \text{PRED} & '\text{PEDRO}' \end{bmatrix}
\end{bmatrix}
\]
Optionality and clitic doubling

Juan lo vió.
Juan him.ACC.SG.CLITIC saw
‘Juan saw him.’

\[
\begin{array}{l}
\text{PRED } \langle \text{SEE} (\text{SUBJ}, \text{OBJ}) \rangle \\
\text{SUBJ } [\text{PRED} \langle \text{JUAN} \rangle ] \\
\text{OBJ } f [\text{PRED} \langle \text{PRO} \rangle ] \\
\end{array}
\]

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