

Lecture 4: More LFG Formalism

Stephen Wechsler
University of Texas at Austin

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- **constraining equations**
- **conditions on f-structures**
- **uniqueness of PRED values**

Defining vs. Constraining Equations

2 parts of f-description:

- defining equations: **build** f-structure
- constraining equations: **check** that f-structure for the presence of a feature

Suppose all the defining equations, taken together, build this f-structure for f1:

```
f1 [ PRED   'John' ]  
   | NUM    SG    |  
   [ PERS   3     ]
```

but the f-description includes this **constraining equation**:
(f1 CASE) =c NOM . Then f1 is ill-formed.

Ex. English nominative pronouns appear **only** as **SUBJ**
of tensed verbs:

1. **She** laughs.
2. [For **her**/***she** to laugh] would be rude.
3. I believe **her**/***she** to be a genius.
4. John sat next to **her**/***she**.
5. Who ate the last cookie? **Her!** / ***She!**
6. Who ate the last cookie? **She** **did!**

she: N, (↑ PRED) = 'pro'
(↑ NUM) = SG
(↑ PERS) = 3
(↑ CASE) =c NOM

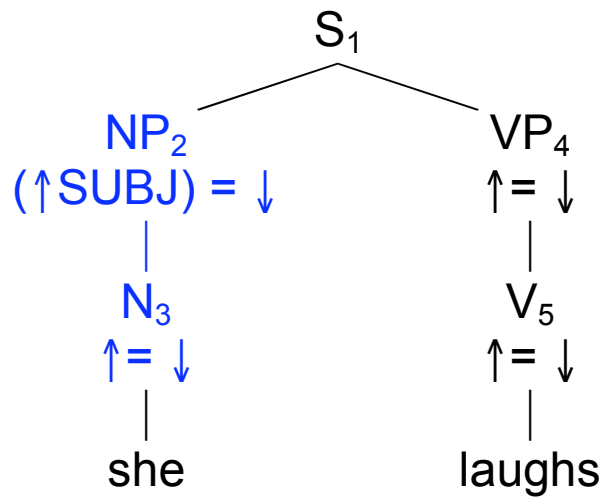
her: N, (↑ PRED) = 'pro'
(↑ NUM) = SG
(↑ PERS) = 3
(↑ CASE) = ACC

laughs: V, (↑ PRED) = 'laughs<(↑ SUBJ)>'
(↑ TENSE) = PRES
(↑ SUBJ NUM) = SG
(↑ SUBJ PERS) = 3
(↑ SUBJ CASE) = NOM

The constraining equation $(\uparrow \text{CASE}) =_c \text{NOM}$ checks for presence of the feature [CASE NOM] in the f-structure. This feature must be contributed by another source: the finite verb.

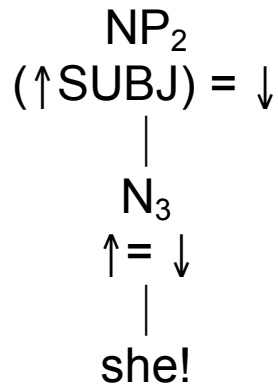
Solution algorithm:

1. create the minimal f-structure satisfying all *defining equations*
2. check that f-structure for satisfaction of the *constraining equations*.



f1	[PRED		'laugh<(↑SUBJ)>']			
f4		TENSE		PRES				
f5								
		SUBJ	f3	[PRED		'pro']
			f2		NUM		SG	
					CASE		NOM	
					PERS		3	

Who ate the last cookie? *She! / Her!



(\uparrow PRED) = 'pro'

(\uparrow NUM) = SG

(\uparrow PERS) = 3

(\uparrow CASE) =c NOM

[PRED	'pro']
	NUM	SG	
	PERS	3	

ill-formed! No [CASE NOM]!

This f-structure fails to satisfy the constraining equation!

Boolean operators:

disjunction has 'wide scope'; **alternative f-descriptions**

are, V. $(\uparrow \text{SUBJ NUM}) = \text{PL} \vee (\uparrow \text{SUBJ PERS}) = 2^{\text{nd}}$
 $(\uparrow \text{TENSE}) = \text{PRES}$
 ...etc.

This produces two alternative f-descriptions:

(i) $(f1 \text{ SUBJ NUM}) = \text{PL}$
 $(f1 \text{ TENSE}) = \text{PRES}$
 ...etc.

(ii) $(f1 \text{ SUBJ PERS}) = 2^{\text{nd}}$
 $(f1 \text{ TENSE}) = \text{PRES}$
 ...etc.

Accept any well-formed f-structure built from either f-description.

negation:

$\neg(f \text{ ATT}) = \text{VAL}$ (or $(f \text{ ATT}) \neq \text{VAL}$) is true iff $(f \text{ ATT}) =_c \text{VAL}$ is false.

Checks the f-structure, like a constraining equation.

Situations where $(f \text{ ATT}) =_c \text{VAL}$ is false:

1. The value for ATT is different from VAL.
2. There is no ATT at all.

$f1 \left[\begin{array}{ll} \text{PRED} & \text{'pro'} \\ \text{NUM} & \text{SG} \\ \text{PERS} & 3 \end{array} \right]$

Is $\neg(f1 \text{ NUM}) = \text{PL}$ true?

Is $\neg(f1 \text{ CASE}) = \text{ACC}$ true?

$f1 \left[\begin{array}{ll} \text{PRED} & \text{'pro'} \\ \text{NUM} & \text{SG} \\ \text{PERS} & 3 \end{array} \right]$

Is $\neg(f1 \text{ NUM}) = \text{PL}$ true?

Yes, since $(f1 \text{ NUM}) = \text{c PL}$ is false!

Is $\neg(f1 \text{ CASE}) = \text{ACC}$ true?

Yes, since $(f1 \text{ CASE}) = \text{c ACC}$ is false!

existential constraints: (f ATT) means f must have *some* value for attribute ATT.

(f1 SUBJ) means f1 must contain a value for SUBJ

E.g. predicate argument structures include existential constraints:

(↑PRED) = 'devour<(↑SUBJ)(↑OBJ)>'

The f-structure ↑ must contain a SUBJ feature and an OBJ feature.

conditional equations

$A \Rightarrow B$ (for equations A and B) means check for truth of A ; if it is true, then B holds of that f-structure.

Definition: $A \Rightarrow B =_{df} \neg A \vee (A_c \wedge B)$

(Not classical conditional: $A \Rightarrow B =_{df} \neg A \vee B$)

Why not? We will come back to that.

Well-formedness conditions on f-structures

Consistency: In a given f-structure, a particular attribute may have at most one value.

*The men smokes.

[PRED	'man']
	NUM	SG	
	NUM	PL	

Completeness: An f-structure must contain **all of the governable grammatical functions that its predicate (PRED) governs.**

e.g. *He devoured.

PRED	'devour<(↑SUBJ)(↑OBJ)>'		
TENSE	PAST		
SUBJ	PRED	'pro'	
	NUM	SG	
	CASE	NOM	
	PERS	3	

No OBJ function! Violates Completeness condition.

Coherence: All the governable functions that an f-structure contains must be governed by that f-structure's predicate (PRED).

e.g. *John laughed the banana.

PRED	'laugh<(↑SUBJ)>'
TENSE	PAST
SUBJ	[PRED 'John'
	NUM SG
	PERS 3
OBJ	[PRED 'banana'
	NUM SG
	PERS 3

Violates Coherence condition! OBJ is a governable function, but it is not governed by the PRED feature in this f-structure!

Extended Coherence (informal at this stage):
Non-argument functions such as **ADJUNCT**, **TOP** ('topic'), and **FOC** ('focus') must bear 'appropriate' relation to a PRED feature:

ADJUNCT's immediate f-structure must contain a PRED feature (i.e. adjuncts must be semantically interpretable)

TOP, FOC: must be linked to a governed function.