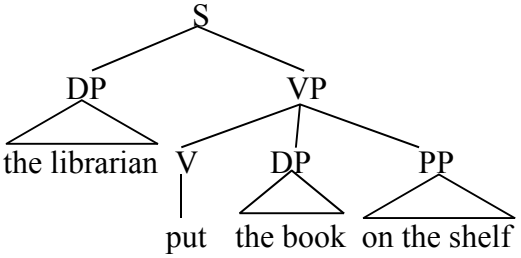
# A Formal Account, p. 1

## Some LFG Basics

Consider the sentence *The librarian put a book on the shelf*.

(1) constituent structure (c-structure):




functional structure (f-structure):

$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'librarian'} \\ \text{DEF} & + \end{bmatrix} \\ \text{TENSE} & \text{PAST} \\ \text{PRED} & \text{'put } \langle (\uparrow \text{SUBJ})(\uparrow \text{OBJ})(\uparrow \text{OBL}_{\text{Loc}}) \rangle \text{'} \\ \text{OBJ} & \begin{bmatrix} \text{DEF} & + \\ \text{PRED} & \text{'book'} \\ \text{NUM} & \text{SG} \end{bmatrix} \\ \text{OBL}_{\text{Loc}} & \begin{bmatrix} \text{PRED} & \text{'on } \langle (\uparrow \text{OBJ}) \rangle \text{'} \\ \text{OBJ} & \begin{bmatrix} \text{DEF} & + \\ \text{PRED} & \text{'shelf'} \\ \text{NUM} & \text{SG} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

In LFG, the two levels of representation, the structural and the functional, are in a relation of correspondence with each other. For example, the S, VP, and V nodes in the c-structure correspond to the outermost layer of f-structure, the DP node *the librarian* and all its daughter nodes correspond to the f-structure $\begin{bmatrix} \text{PRED} & \text{'librarian'} \\ \text{DEF} & + \end{bmatrix}$, etc.

The '↑' on the arguments in the specification of argument-taking predicates restricts the argument to a local one. For example, the OBJ argument of *put* is filled by *the book* and not *the table*, even though both bear the function OBJ. They bear the function in different local f-structures. (↑ OBJ) represents a path through the f-structure: '↑' means 'the local f-structure'.

(2)

$$\begin{bmatrix} \vdots & \vdots \\ \text{PRED} & \text{'put } \langle \ldots (\uparrow \text{OBJ}) \ldots \rangle \text{'} \\ \uparrow\text{:}\ \text{OBJ} & \begin{bmatrix} \text{DEF} & + \\ \text{PRED} & \text{'shelf'} \\ \text{NUM} & \text{SG} \end{bmatrix} \\ \text{OBL}_{\text{Loc}} & \begin{bmatrix} \vdots \end{bmatrix} \end{bmatrix}$$

Similarly, the OBJ which fills the argument position of *on* is in its local f-structure.

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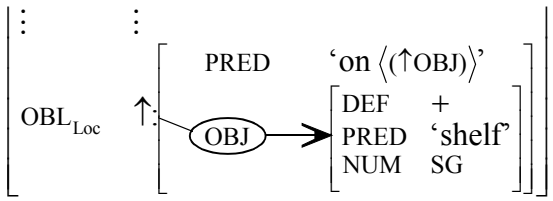
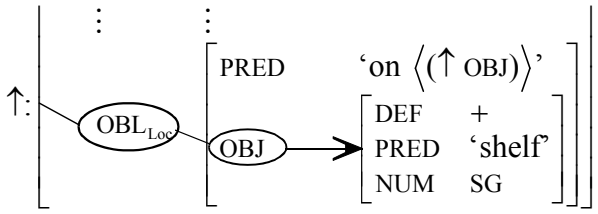
(3)



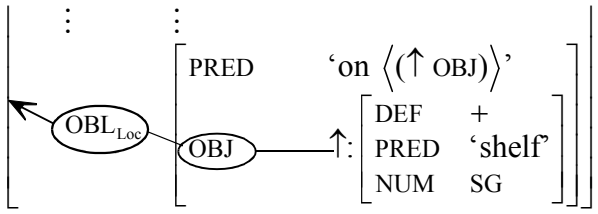

If we wanted to refer to the OBJ of *on* from the perspective of *put*, we would have to specify a two-step path: (↑ OBL$_{Loc}$ OBJ).

(4)




These are inward paths through the f-structure (called "outside-in"). We can also designate an outward ("inside-out") path. If we start at the f-structure corresponding to the OBJ of *on* (the one headed by 'table'), an inside-out path to the outermost f-structure would be: (OBL$_{Loc}$ OBJ ↑).

(5)




In addition to '↑', there is a '↓'. They both appear in annotations to phrase structure rules defining the c-structure–f-structure mapping.

(6) $S \rightarrow$ NP (↑ SUBJ) =↓ VP ↑=↓

The annotation on the NP means "the f-structure you get to by starting at the f-structure corresponding to S and going through the attribute SUBJ is the f-structure corresponding to NP", and the annotation on the VP means "the f-structure corresponding to the S is identical to the f-structure corresponding to the VP". For our purposes, we need not go into the formal details of the correspondence, but we will need to use the arrow notation. Technically, the arrows are called **metavariables**.

To make the structure-function mapping in a particular situation clear, we can annotate these equations to

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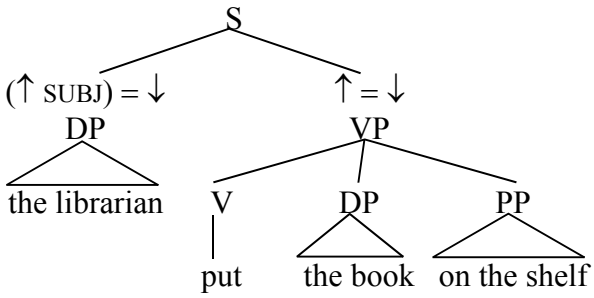
positions in the c-structure:

(7)




This is not a distinct level of representation in LFG; it is simply a notational convenience (like drawing an arrow representing movement in GB). In this handout, we will do this only where necessary for the point.

For a textbook-level introduction to LFG, see Falk 2001. More advanced references/textbooks are Bresnan 2001 and Dalrymple 2001.

## The representation of *wh* constructions

In LFG, the f-structure of *...what the librarian put on the shelf* can be represented as follows:

(8)

$$\begin{bmatrix} \left.\begin{matrix}\text{FOCUS}\\ \text{OBJ}\end{matrix}\right\} & [\text{“what”}] \\ \text{SUBJ} & [\text{“the librarian”}] \\ \text{TENSE} & \text{PAST} \\ \text{PRED} & \text{‘put } \langle (\uparrow \text{SUBJ})(\uparrow \text{OBJ})(\uparrow \text{OBL}_{\text{Loc}}) \rangle\text{’} \\ \text{OBL}_{\text{Loc}} & \begin{bmatrix} \text{PRED} & \text{‘on } \langle (\uparrow \text{OBJ}) \rangle\text{’} \\ \text{OBJ} & [\text{“the shelf”}] \end{bmatrix} \end{bmatrix}$$

Here, we have indicated that *what* is both the FOCUS and the OBJ of the clause, using a fairly intuitive (nonstandard) notation. The problem is that this way of representing multiple functions is difficult to use if the functions are in different clauses. We might do something like the following for *...what the teacher thinks the librarian put on the shelf*:

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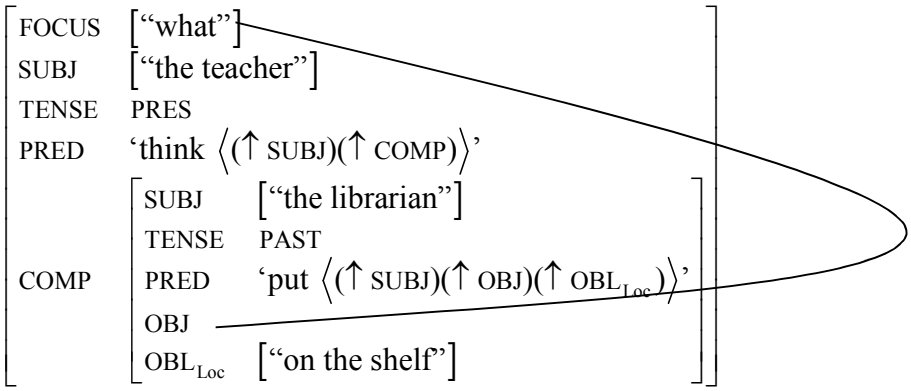
(9)
$$\begin{bmatrix} \text{FOCUS} & f \\ \text{SUBJ} & [\text{“the teacher”}] \\ \text{TENSE} & \text{PRES} \\ \text{PRED} & \text{‘think } \langle(\uparrow \text{SUBJ})(\uparrow \text{COMP})\rangle\text{’} \\ & \begin{bmatrix} \text{SUBJ} & [\text{“the librarian”}] \\ \text{TENSE} & \text{PAST} \\ \text{COMP} & \text{PRED} \quad \text{‘put } \langle(\uparrow \text{SUBJ})(\uparrow \text{OBJ})(\uparrow \text{OBL}_{\text{Loc}})\rangle\text{’} \\ & \text{OBJ} \quad f \\ & \text{OBL}_{\text{Loc}} \quad [\text{“on the shelf”}] \end{bmatrix} \end{bmatrix}$$

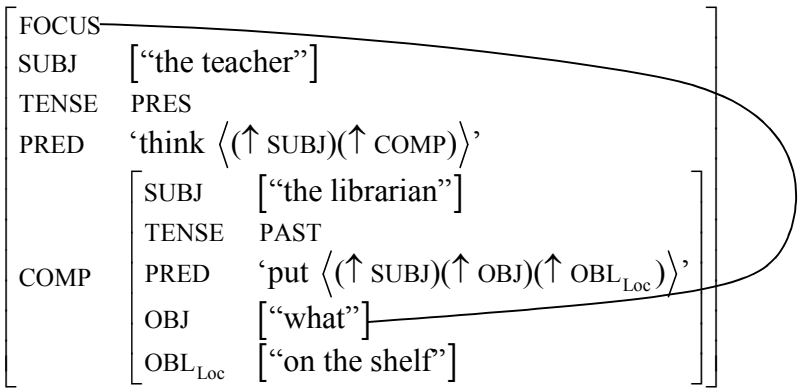
$f = [\text{“what”}]$

The usual LFG notation is to draw a curved line connecting the two functions. (This is usually done even when the two functions are in the same clause.)

(10) a.




b.



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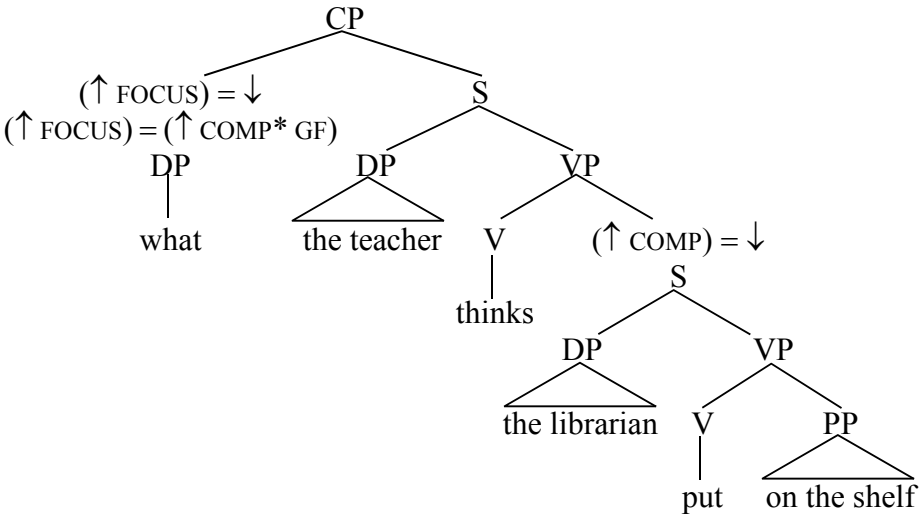
Whatever the notation, this shows *what* as being the FOCUS of the main clause and the OBJ of the subordinate clause. This is a direct representation of the multifunctionality of the *wh* element.

## Licensing *wh* constructions

The LFG system for licensing the multifunctionality of *wh* elements was first outlined by Kaplan and Zaenen (1989). The basic idea is that one element gets two functions by specifying the f-structure path between them. This can be done either by starting at the discourse function and working inward ("outside-in") to the argument function, or by starting at the argument function and working outward ("inside-out") to the discourse function. The c-structures look different in the two cases: going outside-in there is no need for an empty category in the position of the gap, but going inside-out there is one (or at least might be; we will discuss the question of empty categories in Semester B).

This can be illustrated by showing the c-structures of the sample sentence, including partial functional annotation. (For convenience, the trees are not full $\bar{X}$ trees.)

(11) a. outside-in licensing



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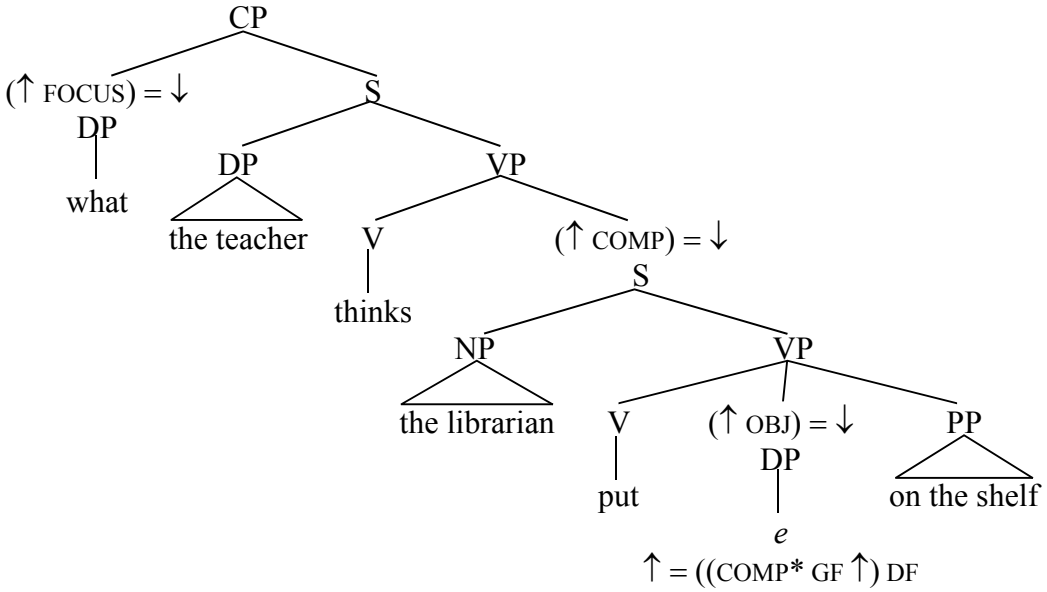
b. inside-out licensing (with empty category)




The outside-in licensing approach (without empty category) is the one taken in the original Kaplan and Zaenen article, and, more recently, by Dalrymple, Kaplan, and King (2001) and Dalrymple (2001). The alternative inside-out licensing approach (with empty categories) has been argued for by Bresnan (1995; 2001). Falk (2000; 2001; 2007) argues for a mixed approach, in which subject extraction is licensed outside-in and non-subject extraction is licensed inside-out.

Whether outside-in or inside-out, the path between the two grammatical functions is expressed in terms of a sequence of f-structure attributes (COMP in this example) of unspecified length (this is the meaning of the Kleene star operator on COMP). Because of the fact that the path is not unique (due to the unspecified length of the sequence of COMPs) this kind of specification is called **functional uncertainty**. One of the advantages of this approach to *wh* constructions is that the "long-distance" relationship is licensed locally, one layer of f-structure at a time.

Constructional properties of *wh* constructions can be linked to an f-structure feature specifying (CLAUSE)TYPE. Limiting ourselves to the values DECL, REL, and Q, since the complementizer *that* can occur in declaratives and relative clauses, it will have the lexical specification:

(12) (↑ TYPE) = DECL | REL

On the other hand, clause type is not always expressed by the complementizer; a clause introduced by *what* in [SPEC, CP] has to be a question, for example. The lexical entry of *what* includes the following lexical specification:

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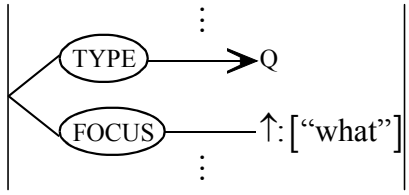
(13) ((FOCUS ↑) TYPE) = Q

The path here is a combination of inside-out and outside-in specification:

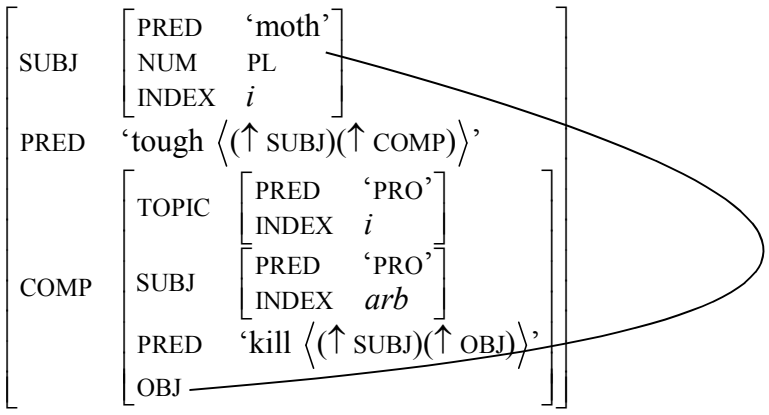
(14)




For "*wh*" constructions with no overt filler, LFG generally adopts what is essentially a functional equivalent of the empty operator analysis. For example, in a study of the *Tough* Movement construction, Dalrymple and King (2000) argue for the following f-structure. (This is somewhat simplified; the layer of structure associated with *are* has been omitted.)

(15) a. Moths are tough to kill.

b.




The TOPIC of the complement is an unexpressed pronoun. The lower end of the *tough* LDD must be an OBJ; one way to do this (slightly different from Dalrymple and King) is to have the following as part of the lexical entry of *tough*:

(16) (OBJ (↑ COMP TOPIC))
i.e. *tough*'s complement's topic is an object

Pied-piping constructions are analyzed by treating the relationship between the actual operator and the entire filler as another LDD construction. The f-structure of *Whose book did the librarian put on the shelf?* is:

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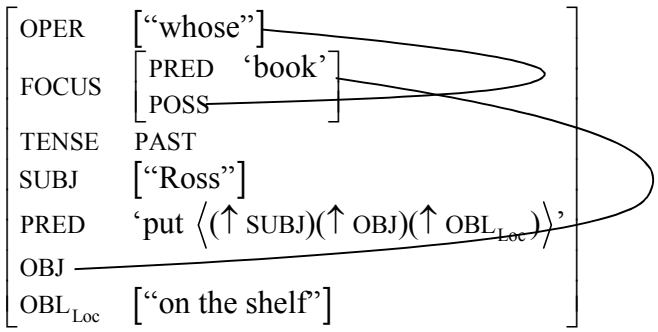
(17) a.




b.

$$\begin{bmatrix} \text{OPER} & g \\ \text{FOCUS} & f \\ \text{TENSE} & \text{PAST} \\ \text{SUBJ} & [\text{“Ross”}] \\ \text{PRED} & \text{‘put } \langle (\uparrow \text{SUBJ})(\uparrow \text{OBJ})(\uparrow \text{OBL}_{\text{Loc}}) \rangle \text{’} \\ \text{OBJ} & f \\ \text{OBL}_{\text{Loc}} & [\text{“on the shelf”}] \end{bmatrix}$$

$$f = \begin{bmatrix} \text{PRED} & \text{‘book’} \\ \text{POSS} & g \end{bmatrix}$$

$$g = [\text{“whose”}]$$

This is licensed by associating the following functional specification with the [SPEC, CP] node:

(18) $(\uparrow \text{OPER}) = (\uparrow \text{GF}^*)$

(This specific implementation is based on Falk 2001; see also Kaplan and Bresnan 1982 and Dalrymple 2001).

## Of Historical Interest Only

Early LFG (e.g. Kaplan and Bresnan 1982) licensed multifunctionality in *wh* constructions not directly at the level of f-structure but rather indirectly through c-structure. In this system, the filler constituent is associated with a $\Downarrow$ metavariable and an empty category in the gap position is associated (nonlocally!) with a matching $\Uparrow$ metavariable. Bounding nodes, à la Subjacency, block the matching of $\Downarrow$ and $\Uparrow$. (The boxed node is a bounding node, and the dotted lines show how the long-distance metavariables are matched up.)

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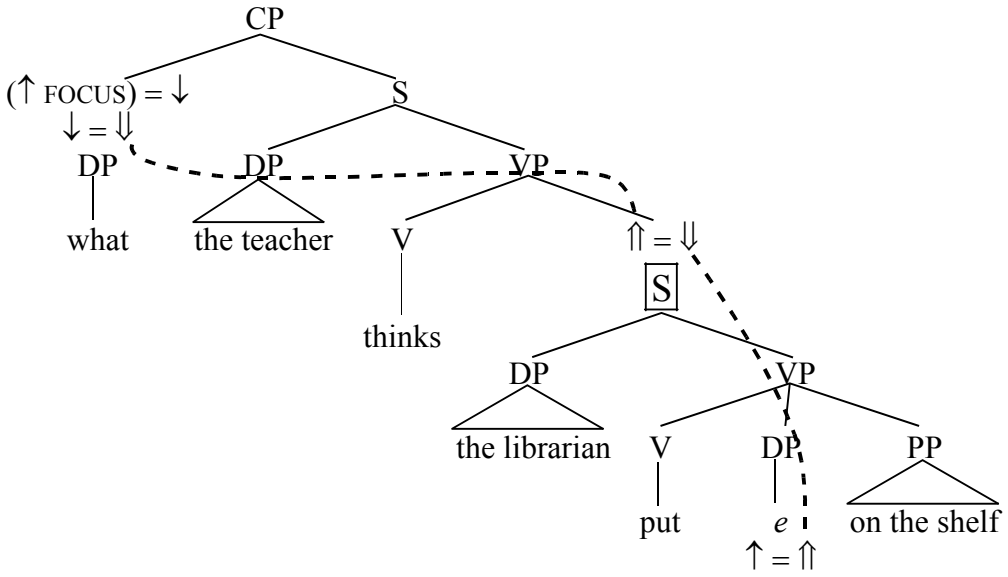
(19)




Within this framework, Falk (1983) argued (following Gazdar's work in GPSG) that subject *wh* constructions are different, and do not have an empty category (or trace). There were a few other studies of *wh* constructions in this framework as well; we will be reading one later in the course.

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