6

Long Distance Dependencies

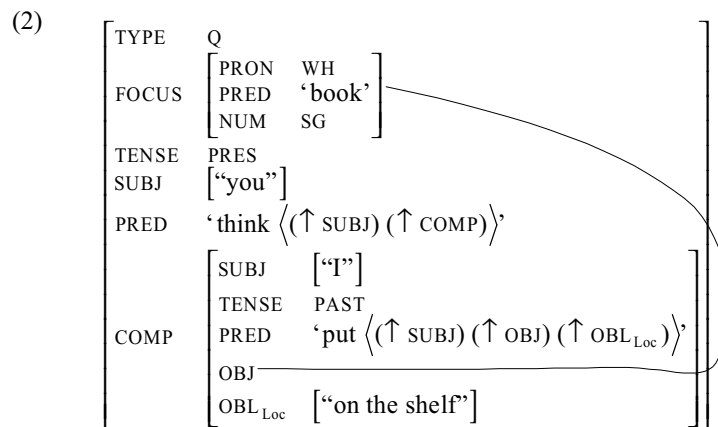## 6.1 Overview

We turn now to sentences like the following.

(1)　a.　Which book do you think I put on the shelf?
　　　b.　That theory, she told me she had never heard of.

In these sentences, the initial phrase can be conceptualized as belonging in two different clauses simultaneously, with a different function in each. Because the number of clauses between the two positions is unlimited,[1] these constructions are often called **long distance dependencies** or **unbounded dependencies**. In the transformational tradition the analysis of these sentences involves movement, so the construction can also be called "*wh* movement" or "Ā movement." We will not be using these derivationally oriented names here, although a name with a derivational flavor that is sometimes used in the nonderivational literature is **extraction**. The top end of the long distance dependency can be called the **filler** and the lower end can be called the **gap**.

In English, long distance dependencies involve a missing element at the gap position (whence the name *gap*). The content of the filler has two grammatical functions, one typical of the position in which the filler is located, and one typical of the gap. For example, in (1a) the filler is *which book* and the gap is the would-be DP or NP after *put*. The DP *which book* therefore has the functions typical of the position that it occupies and of the postverbal nominal position. The latter is clearly OBJ of the subordinate clause, while the former bears the grammaticized discourse function FOCUS.

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[1]In fact, it can be zero. The two functions can be in the same clause, as in (i).
(i)　　　　Which book did you read?

In the previous chapter, we introduced the notation of a curved line connecting two f-structure positions to indicate that one subsidiary f-structure fills two functions. Using the same notation here, the f-structure of (1a) is (2).

(2)
$$\begin{bmatrix} \text{TYPE} & \text{Q} \\ \text{FOCUS} & \begin{bmatrix} \text{PRON} & \text{WH} \\ \text{PRED} & \text{'book'} \\ \text{NUM} & \text{SG} \end{bmatrix} \\ \text{TENSE} & \text{PRES} \\ \text{SUBJ} & [\text{"you"}] \\ \text{PRED} & \text{'think} \langle (\uparrow \text{SUBJ}) (\uparrow \text{COMP}) \rangle\text{'} \\ \text{COMP} & \begin{bmatrix} \text{SUBJ} & [\text{"I"}] \\ \text{TENSE} & \text{PAST} \\ \text{PRED} & \text{'put} \langle (\uparrow \text{SUBJ}) (\uparrow \text{OBJ}) (\uparrow \text{OBL}_{\text{Loc}}) \rangle\text{'} \\ \text{OBJ} & \\ \text{OBL}_{\text{Loc}} & [\text{"on the shelf"}] \end{bmatrix} \end{bmatrix}$$

Assigning the filler position a discourse function is the LFG equivalent of calling it an Ā (nonargument) position in structural theories. However, the exact nature of the discourse function is not directly dependent on the structural position of the filler. There are two structural positions for fillers in English, [SPEC, CP] for *wh* phrases, and adjoined to IP (or S) for "topicalized" phrases. Elements in either position can have the function of either TOPIC or FOCUS. A TOPIC represents old information, while a FOCUS represents contrast (and thus new information). In [SPEC, CP] position, a question phrase has the function FOCUS while a relative pronoun has the function TOPIC. A constituent adjoined to IP (or S) can also be either FOCUS or TOPIC. These structural positions and their functions are licensed by the following ID rules.

(3) a. $\text{CP} \rightarrow$ XP , C′
$$(\uparrow \text{DF}) = \downarrow \qquad \uparrow = \downarrow$$
$$(\downarrow \text{PRON}) =_c \text{WH}$$

b. $\begin{Bmatrix} \text{IP} \\ \text{S} \end{Bmatrix} \rightarrow \quad \text{XP} \qquad , \quad \begin{Bmatrix} \text{IP} \\ \text{S} \end{Bmatrix}$

$\qquad\qquad\qquad (\uparrow \text{DF}) = \downarrow \qquad \uparrow = \downarrow$

$\qquad\qquad\qquad (\downarrow \text{PRON}) \neq \text{WH}$

By the Extended Coherence Condition (p. 64), a discourse function must be linked to an argument function; a FOCUS or TOPIC not identified with an argument function is ungrammatical.

6.2 Licensing the dependency

6.2.1 Functional uncertainty

Long distance dependencies, like everything in f-structure, must be licensed by functional equations. Consider the following sentences with long distance dependencies. (The position of the gap is represented by a line.)

(4) a. Who did you see ___ ?
     b. Who do you think ___ saw you?
     c. Who do you think you saw ___ ?
     d. Who did the hamster claim it thought ___ saw you?
     e. Who did the hamster claim it thought you saw ___ ?
     f. Who did the hamster claim it thought that the dinosaur said that the pterodactyl believes ___ saw you?

In each of these cases, some clause-internal grammatical function is identified with FOCUS. This is similar to functional control in that it involves feature sharing. But it is different in that the relationship between the two functions cannot be expressed as a finite expression. Consider what sorts of functional equations we would need to express these; we express these both as outside-in expressions starting from the clause of the filler and as inside-out expressions starting from the clause of the gap.

(5) a. Outside-in
         $(\uparrow \text{FOCUS}) = (\uparrow \text{OBJ})$
         $(\uparrow \text{FOCUS}) = (\uparrow \text{COMP SUBJ})$
         $(\uparrow \text{FOCUS}) = (\uparrow \text{COMP OBJ})$
         $(\uparrow \text{FOCUS}) = (\uparrow \text{COMP COMP SUBJ})$
         $(\uparrow \text{FOCUS}) = (\uparrow \text{COMP COMP OBJ})$
         $(\uparrow \text{FOCUS}) = (\uparrow \text{COMP COMP COMP COMP SUBJ})$

> b. Inside-out
> ($\uparrow$ OBJ) = ($\uparrow$ FOCUS)
> ($\uparrow$ SUBJ) = ((COMP $\uparrow$) FOCUS)
> ($\uparrow$ OBJ) = ((COMP $\uparrow$) FOCUS)
> ($\uparrow$ SUBJ) = ((COMP COMP $\uparrow$) FOCUS)
> ($\uparrow$ OBJ) = ((COMP COMP $\uparrow$) FOCUS)
> ($\uparrow$ SUBJ) = ((COMP COMP COMP COMP $\uparrow$) FOCUS)

However, as first observed by Kaplan and Zaenen (1989), the relationship can be expressed if we use the Kleene star operator.

(6)   a.   Outside-in   ($\uparrow$ DF) = ($\uparrow$ COMP* GF)
       b.   Inside-out   ($\uparrow$ GF) = ((COMP* $\uparrow$) DF)

Unlike the equations we have seen until now, here there is more than one possible f-structure configuration that will satisfy the equation; any number of COMPs can intervene. There is an infinite number of possible solutions to an equation such as this. Consequently, this kind of functional designation is called **functional uncertainty**. As we can see, it can take the form of outside-in functional uncertainty or inside-out functional uncertainty.
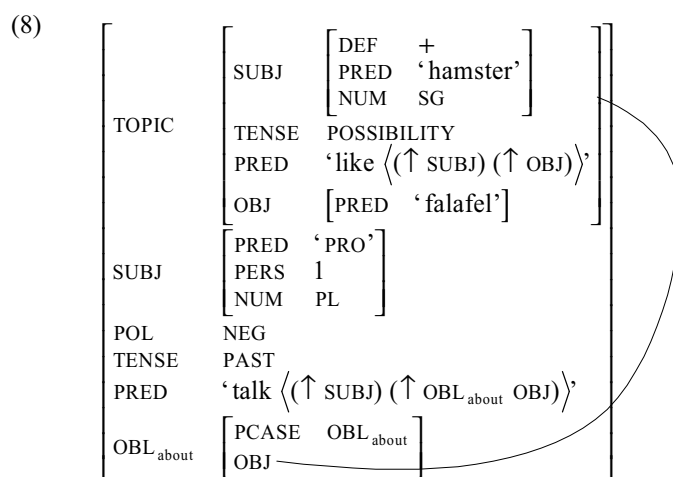
     Under the functional uncertainty formalism, long distance dependencies are licensed locally, from one f-structure "clause" to an immediately embedded one. This brings long distance dependencies into line with the observation (Chapter 1) that all relations in syntax are local. In transformational theories, *wh* movement is not intrinsically local, although it may be restricted to near-locality by principles such as subjacency.[2]

     By analyzing long distance dependencies in terms of functional uncertainty, LFG claims that c-structure properties are irrelevant to the behavior of the construction. This is in direct contrast with the movement analysis in transformational theories. The evidence favors the functional approach. For example, the filler and gap need not be the same category.

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[2]The analysis of long distance dependencies in Kaplan and Bresnan (1982) is also not local. In that analysis, called "constituent control" the formal system of c-structure–f-structure mapping is extended. In addition to the metavariables $\uparrow$ and $\downarrow$, where $\uparrow$ receives the same variable as the immediately dominating $\downarrow$, Kaplan and Bresnan use metavariables $\Uparrow$ and $\Downarrow$, which are paired up with the same variable at a distance. Kaplan and Zaenen's functional uncertainty formalism has superseded the constituent control formalism. This local licensing of long distance dependencies is also a property of the HPSG analysis, in which the SLASH feature is propagated through the tree one node at a time.

(7)   a.   [CP That the hamster might like falafel], we didn't talk about ___ .
        b. *We didn't talk about [CP that the hamster might like falafel].
        c.   We didn't talk about [DP the hamster's fondness for falafel].

The ungrammaticality of (7b) is due to the fact that the preposition *about* takes an OBJ, not a COMP. In English, the ID rules assign the OBJ function to the DP/NP position only. In a movement theory of long distance dependencies, the grammaticality of (7a) is surprising given the ungrammaticality of (7b). In LFG, it is unproblematic. The f-structure is:

(8)

$$
\begin{bmatrix}
\text{TOPIC} & \begin{bmatrix}
\text{SUBJ} & \begin{bmatrix} \text{DEF} & + \\ \text{PRED} & \text{`hamster'} \\ \text{NUM} & \text{SG} \end{bmatrix} \\
\text{TENSE} & \text{POSSIBILITY} \\
\text{PRED} & \text{`like} \langle (\uparrow \text{SUBJ}) (\uparrow \text{OBJ}) \rangle\text{'} \\
\text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`falafel'} \end{bmatrix}
\end{bmatrix} \\
\text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`PRO'} \\ \text{PERS} & 1 \\ \text{NUM} & \text{PL} \end{bmatrix} \\
\text{POL} & \text{NEG} \\
\text{TENSE} & \text{PAST} \\
\text{PRED} & \text{`talk} \langle (\uparrow \text{SUBJ}) (\uparrow \text{OBL}_{about} \text{OBJ}) \rangle\text{'} \\
\text{OBL}_{about} & \begin{bmatrix} \text{PCASE} & \text{OBL}_{about} \\ \text{OBJ} & \\ \end{bmatrix}
\end{bmatrix}
$$

There is nothing to rule out this f-structure. The fact that the constituent with the TOPIC function could not have been generated in the c-structure position normally associated with OBL_about OBJ is irrelevant. Since the sentence is grammatical, a theory which does not rule it out is preferable.

6.2.2   Direction of licensing

As we saw in the previous section, long distance dependencies can be licensed either by outside-in functional uncertainty or inside-out functional uncertainty. In the LFG literature, both approaches have been proposed: Kaplan and Zaenen (1989) use the outside-in approach, while Bresnan (1995a; 2001) argues for inside-out licensing. In this section, we will examine the details of the two approaches. We will reconcile them in the next section.

    We begin with outside-in licensing. Under this approach, any clause that
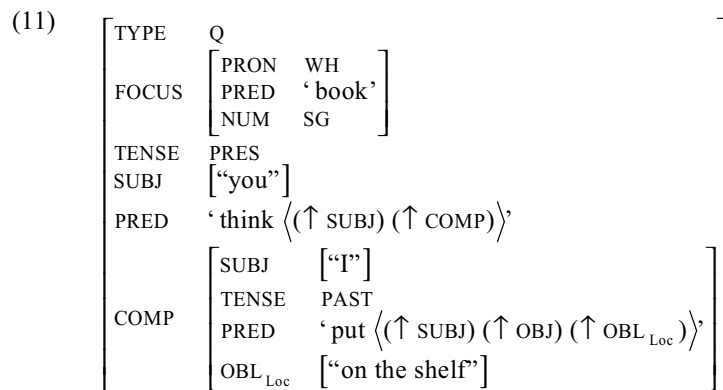
has a FOCUS or TOPIC will include the following equation.

(9) $(\uparrow \text{DF}) = (\uparrow \text{COMP* GF})$

The c-structure of (1a) would be:

(10)
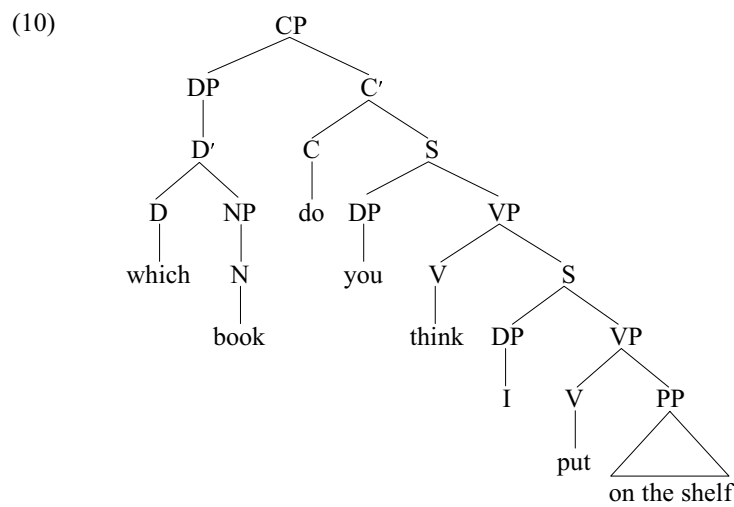
Ignoring the effect of the functional uncertainty equation, the f-structure associated with this c-structure is:

(11)

$$
\begin{bmatrix}
\text{TYPE} & \text{Q} \\
\text{FOCUS} & \begin{bmatrix} \text{PRON} & \text{WH} \\ \text{PRED} & \text{'book'} \\ \text{NUM} & \text{SG} \end{bmatrix} \\
\text{TENSE} & \text{PRES} \\
\text{SUBJ} & [\text{"you"}] \\
\text{PRED} & \text{'think} \langle (\uparrow \text{SUBJ}) (\uparrow \text{COMP}) \rangle\text{'} \\
\text{COMP} & \begin{bmatrix} \text{SUBJ} & [\text{"I"}] \\ \text{TENSE} & \text{PAST} \\ \text{PRED} & \text{'put} \langle (\uparrow \text{SUBJ}) (\uparrow \text{OBJ}) (\uparrow \text{OBL}_{\text{Loc}}) \rangle\text{'} \\ \text{OBL}_{\text{Loc}} & [\text{"on the shelf"}] \end{bmatrix}
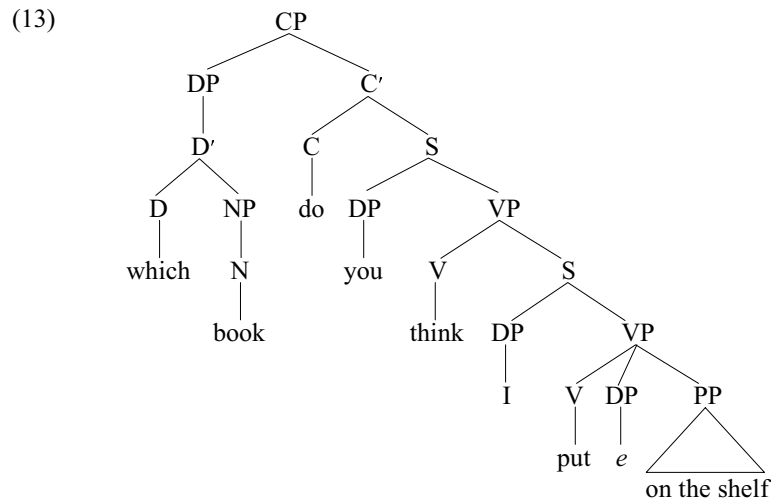\end{bmatrix}
$$

This f-structure is both incomplete and incoherent. It is incomplete because the verb *put* selects an OBJ, and there is none present in its local f-structure. It is incoherent because the discourse function FOCUS is not linked to an argument function, violating the Extended Coherence Condition. The functional uncertainty equation solves both problems, linking the FOCUS to *put*'s missing OBJ.

This analysis has several properties. First, there is no c-structure marking of the gap, analogous to the *wh* trace of movement theories. The only such analog is the argument function in f-structure. A c-structure gap is not needed; by Economy of Expression this means that there is none. Since c-structure is a model of the overt expression of syntax, and empty categories are, by definition, not overt, this is generally taken to be an advantage. Second, there are no constraints on identifying the gap. It can be anything any number of COMPs down. We will return to this presently. Third, it is unclear what node in the c-structure to associate the outside-in functional uncertainty equation with. Kaplan and Zaenen annotate it to the DF node itself, but this assumes that the DF is always present in the c-structure. This assumption is incorrect; in English relative clauses the DF need not be overt.

(12)   the book [you think I put on the shelf]

The picture is slightly different under the inside-out approach. An inside-out equation has to be associated with the gap. One straightforward way to do this would be to make the gap a c-structure element (a "trace").

(13)

```
                        CP
              ┌─────────┴─────────┐
             DP                   C′
              │              ┌─────┴─────┐
             D′             C            S
         ┌────┴────┐        │       ┌────┴────┐
         D        NP        do     DP        VP
         │         │         │      │    ┌────┴────┐
       which       N        you     V         S
                   │             think    ┌───┴────┐
                  book                    DP       VP
                                          │    ┌───┼────┐
                                          I    V  DP   PP
                                               │   │    △
                                              put  e  on the shelf
```

The verb *put* has an OBJ by virtue of being followed by a DP in normal OBJ position. The following rule licenses the empty category.

(14)   XP→
                               e
            $\uparrow = ((\text{COMP} * \text{GF} \uparrow) \text{DF})$

This has the opposite advantages and disadvantages of the outside-in analysis. The gap end of the long distance dependency is marked, constraining the link, but at the expense of postulating an empty category.

6.2.3   Subjects vs. nonsubjects

Any account of long distance dependencies needs to consider differences between extraction of subjects and nonsubjects, both in English and crosslinguistically. We will discuss some of these differences here, and suggest that they are relevant to determining the direction of the licensing of the long distance link. More precisely, we will distinguish between three cases: local linking of the DF to SUBJ (not involving functional uncertainty) long distance linking to SUBJ (outside-in functional uncertainty) and nonsubjects (inside-out functional uncertainty).

We begin by contrasting main clause subject questions from main clause nonsubject questions.

(15)   a.   Who put the book on the shelf?
        b.   What did you put on the shelf?

When a nonsubject is questioned, English is subject to "Subject-Aux Inversion", generally analyzed with the auxiliary in complementizer position instead of infl.
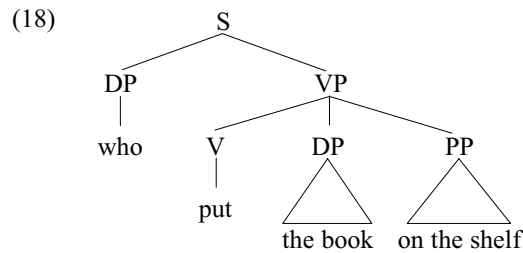
(16)
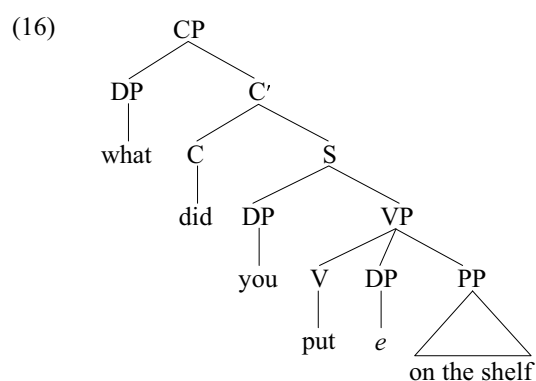
Formally, this can be achieved by lexically specifying auxiliaries as belonging ambiguously to either category.[3]

(17)   *did* I or C   ($\uparrow$ TENSE) = PAST
                     C $\Rightarrow$ ($\uparrow$ TYPE) = Q

What is puzzling is the lack of Subject-Aux Inversion effects when the subject is questioned. Instead, a subject question resembles an ordinary declarative sentence.

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[3]With "X$\Rightarrow$Y" meaning "if X then Y". This is slightly oversimplified, since auxiliaries can be C in some other constructions, too, such as:

(i)   Never in his life had he read such an interesting book.

(18)

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              S
          ┌───┴────┐
         DP        VP
          │     ┌───┼────┐
         who    V   DP   PP
                │   △    △
               put the book on the shelf
```

This structure has been proposed in GB by Grimshaw (1995). In a transformational theory, this would mean that subjects do not undergo *wh* movement.

We will adopt the "no movement" analysis as the best way to explain the lack of Subject-Aux Inversion. Recall that SUBJ is an overlay function, just like the discourse functions, and is the default topic. More generally, SUBJ seems to have an affinity for being identified with discourse functions. This can be expressed by annotating the subject DP with the following optional equation.

(19) $(\uparrow \text{DF}) = \downarrow$

Given this equation, *who* will be assigned some discourse function (such as FOCUS) in addition to SUBJ without need for the complementizer projection. The Economy of Expression principle prohibits unnecessary c-structure, so a complementizer projection will be ungrammatical.

Next, there are languages in which the gap of a long distance dependency can only be a SUBJ, such as many Austronesian languages. This observation, originally due to Keenan and Comrie (1977), suggests that SUBJ has a special status in long distance dependency constructions. In English, this special status is manifested, ironically, in what appears to be a special restriction on SUBJ extraction: the "*that*-trace" effect.

(20)   a.   Which shelf do you think I put the book on ___?
        b.   Which shelf do you think that I put the book on ___?
        c.   Who do you think ___ put the book on the shelf?
        d. *Who do you think that ___ put the book on the shelf?

Finally, note the similarity between the outside-in equation for long distance dependencies and the functional control equation.

(21) a. $(\uparrow \text{DF}) = (\uparrow \text{COMP* GF})$
      b. $(\uparrow \text{AF}) = (\uparrow \text{XCOMP GF})$; GF = SUBJ

In the functional control equation, the controllee is constrained by Universal Grammar to be SUBJ. One possible explanation for this is that SUBJ, uniquely among the argument functions, is an overlay function and therefore not exclusively related to its governing predicate.[4] Under the same logic, one would expect the gap end of the long distance equation to be SUBJ.

We will account for the special status of SUBJ extraction by adopting a mixed analysis, under which both outside-in and inside-out licensing of long distance dependencies are possible. Outside-in licensing is constrained to cases where the gap is SUBJ, while inside-out licensing involves (for English, at least) an empty category in c-structure. Languages that only allow extraction of SUBJ only allow outside-in licensing of long-distance dependencies. This approach is similar to one taken in early constraint-based theories; in both Generalized Phrase Structure Grammar (Gazdar 1981) and early LFG (Falk 1983b) it was proposed that SUBJ extraction is unique in not involving a structural empty category.

We note in passing that long-distance dependencies with resumptive pronouns in the gap position may provide further evidence for the three-way distinction drawn here. In languages that allow such a construction (such as Hebrew), resumptive pronouns are generally more likely to be used for non-SUBJ gaps than SUBJ gaps, with matrix SUBJ the least likely. Contrary to what is sometimes stated in the literature, it is not the case (at least for Hebrew) that SUBJ resumptive pronouns are always ungrammatical, but they do seem to be dispreferred. Unfortunately, resumptive pronouns are not understood well enough for us to propose an analysis, but the facts do suggest that SUBJ-gap long distance dependencies have a different status from non-SUBJ.

To conclude, long distance dependencies are licensed in three different ways.[5]

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[4]This idea is developed by Falk (2000).

[5]In the equation for embedded SUBJs we have replaced the Kleene star with the Kleene plus, because no COMPs would be the same as the matrix SUBJ equation. It is also limited to apply in cases where the DF and SUBJ are not locally identified.

(22) a. matrix SUBJs $(\uparrow DF) = \downarrow$ annotated to the SUBJ
    b. embedded SUBJs $(\uparrow DF) \neq (\uparrow SUBJ) \Rightarrow (\uparrow DF) = (\uparrow COMP^+ SUBJ)$
    c. nonsubjects $XP \rightarrow \quad e$
$$\uparrow = ((COMP * GF \uparrow) DF)$$

As we observed above, the outside-in equation cannot be associated with the structural position of the DF, since the DF need not be overt. We will analyze it as an optional lexical specification in the lexical entries of verbs.

As for the *that*-trace effect, despite the tradition that sees it as a structural property it seems to be a lexical property of the complementizer. In some languages, the effect is triggered by some complementizers and not others. Sobin (1987) reports that this is even true for some speakers of English, who allow *that*-trace violations when the complementizer is *that* but obey the constraint when the complementizer is *if* or *whether*. The ultimate source of the constraint may be the larger independence of finite complements as compared with nonfinite complements (Givón 1990: 517). This independence is reinforced by explicitly marking the complement with the finite complementizer. Complementizers that trigger the *that*-trace effect would be ones that explicitly mark their complements for conceptual independence from the clauses in which they are embedded. Since the SUBJ is the one argument that can be related to a higher clause (because SUBJ is an overlay function), this independence is expressed in the syntax by prohibiting the identification of the SUBJ with something higher.

(23) $(\uparrow SUBJ) \neq ((GF^+ \uparrow) GF)$

In standard English, *that* will include this lexical specification.

6.2.4 On empty categories

The analysis in the previous section requires us to recognize an empty element in c-structure. While this is familiar (and uncontroversial) in transformational theories, it runs counter to the trend in constraint-based theories of syntax and is controversial in LFG. There seem to be two basic reasons to question the existence of an empty category. First, it is not overt. C-structure represents the overt expression of a syntactic object. Representing covert elements in c-structure violates the defining characteristic of c-structure. Furthermore, it poses potential problems for language compre-hension, as the hearer would not know to parse an empty position. Second,

there is no evidence for empty elements.[6] They represent an unprovable (and unfalsifiable) theoretical construct. A theory that can do without them is therefore preferable. One theory that can do without them is the version of LFG in which all licensing of long distance dependencies is achieved through outside-in designation. In this section, we will argue that, at least for English, these objections to empty categories, while not without merit, are overstated.

We begin with the question of whether empty categories can be said to be "overt." Surprisingly, the answer is yes, at least for languages like English. An empty category is a position in the c-structure in which something should be present but is not. English is a language in which word order is very rigid and complements are rarely omissible. In the VP *put on the shelf* something clearly is missing. The verb *put* takes an OBJ argument, and OBJ in English is invariably realized by an NP or DP in postverbal position within the VP. Unlike other languages, English does not allow the OBJ of *put* to be omitted and understood elliptically, even when the discourse context is clear. Unlike other languages, English does not allow the OBJ to scramble to other positions in the clause. Given these properties of English, it is clear that something is missing *in the c-structure*. An empty element is simply the formal device to represent this: the something missing is there structurally, but unfilled or empty. In this sense, the empty element can be said to be overt, and thus a legitimate element of c-structure.[7]

Possible evidence for empty categories has been discussed by Bresnan (1995a, 2001). We will outline it here. The argument is based on the "weak crossover" effect.

(24)   a.   Who loves his mother? (*who* = *his*, possibly)
        b.   *Who does his mother love? (*who* ≠ *his*)

Bresnan argues that in English the following constraint holds.

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[6]It has occasionally been argued that there is psycholinguistic evidence for empty categories (response time, priming, etc.), or even for a distinction between different empty categories that have been proposed in the derivational literature ("NP-movement" vs. "*wh*-movement", subject vs. nonsubject). However, as argued cogently by Sag and Fodor (1994), too little is known about how to interpret the evidence in terms of linguistic theory. For example, the priming evidence could show that the semantics of the fronted element is accessed in the gap position, even without a syntactic c-structure gap.

[7]Obviously, an empty OBJ to the verb *put*, which has only a transitive lexical form, is in some sense "more overt" than an empty OBJ to a verb like *eat*, which also has an intransitive lexical form. In the latter case, the proper lexical form of the verb must be chosen to create a coherent f-structure. Once the right lexical form is chosen, however, there is no difference between *put* and *eat*.

(25)   An operator O may not bind a pronoun P if the rightmost part of the
        c-structure correspondent of P precedes the rightmost part of the
        c-structure correspondent of O.[8]

This constraint accounts for the ungrammaticality of (24b), but only if we
postulate an empty category in c-structure. The c-structure correspondent of
the pronoun consists of one part: the [SPEC, DP] of the DP *his mother*. The
operator in f-structure has two functions: FOCUS and OBJ. In a c-structure with
no empty category, this operator has a one-part c-structure correspondent as
well, [SPEC, CP]. However, [SPEC, CP] precedes the position of the
c-structure correspondent of the pronoun, which should lead us to believe that
coreference is possible. On the other hand, if there is an empty category in
the post-VP position it is also part of the c-structure correspondent of the
operator. It is the rightmost part of this correspondent, and it follows the
c-structure correspondent of the pronoun, correctly disallowing coreference.
This argument of Bresnan's is controversial, with some LFG theorists
proposing alternative accounts of the weak crossover facts (see, for example,
Dalrymple to appear). We will adopt Bresnan's approach here.

6.3   Islands and pied piping

It is well known that there are restrictions on the relation between filler and
gap in long distance dependency constructions. For example, extraction from
adjuncts is generally ungrammatical. These restrictions have come to be
known collectively as island constraints. A major contribution to the
understanding of these constraints is Kaplan and Zaenen's (1989) observation
that they are based on grammatical functions, not structure.

    The long distance dependency equations as we have stated them specify
that only the function COMP may occur on the path between filler and gap.
The inside-out equation associated with the c-structure gap is:

(26)   ↑ = ((COMP* GF ↑) DF)

Since NPs and DPs cannot bear the function COMP, the Complex NP
Constraint follows.

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[8]Or, if P f-precedes O, under the definition of f-precedence that Bresnan assumes.

(27)   *What did you deny the claim that you put *e* on the shelf?
        would require *e* to be annotated ↑ = ((OBJ COMP OBJ ↑) DF)

Similarly, a clause functioning as SUBJ is an island in English (the Subject Condition).

(28)   *What do you think that [to put *e* on the shelf] would be a good idea?
        would require *e* to be annotated ↑ = ((COMP SUBJ OBJ ↑) DF)

Extraction from adjuncts is generally ungrammatical, as shown by the following contrast.

(29)   a.   Which table did he put a book on?
        b.   *Which table did he use a computer on?

This cannot be expressed directly in a c-structure-based approach, which instead has to talk about adjuncthood indirectly through claims about distinct structural positioning. This can be made to work in some languages (such as English), but Kaplan and Zaenen claim that there are languages (Icelandic is their example) in which the islandhood facts are the same but no structural distinction between complements and adjuncts can be motivated. A functional account of islands can refer to complements and adjuncts explicitly.

However, restricting the path to COMPs is too restrictive for English. The path can also include the functions XCOMP and OBL$_\theta$.

(30)   a.   What did she seem to put *e* on the table?
             ↑ = ((XCOMP OBJ ↑) DF)

        b.   Which shelf did they take the book out of *e*?
             ↑ = ((OBL$_\theta$ OBL$_\theta$ OBJ ↑) DF)

We can accommodate this by altering the functional uncertainty equations.

(31)   a.   embedded subjects

$$(\uparrow \text{DF}) \neq (\uparrow \text{SUBJ}) \Rightarrow (\uparrow \text{DF}) = (\uparrow \left\{ \begin{array}{c} \text{COMP} \\ \text{XCOMP} \\ \text{OBL}_\theta \end{array} \right\}^+ \text{SUBJ})$$
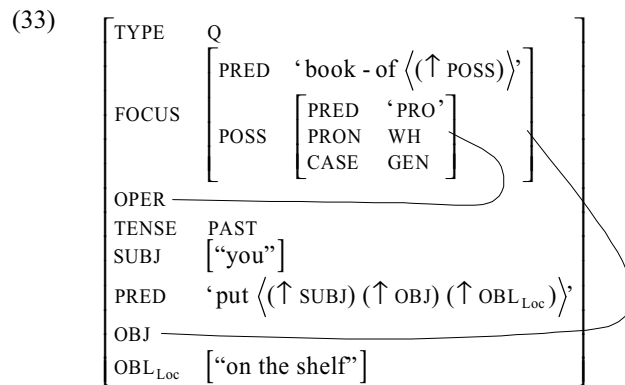
b. nonsubjects:

$$\text{XP} \rightarrow$$
$$\uparrow = ((\left\{\begin{array}{l} \text{COMP} \\ \text{XCOMP} \\ \text{OBL}_\theta \end{array}\right\}^{*} \quad \text{GF} \uparrow) \text{ DF})$$

with e above.

Island phenomena thus provide evidence for a functional approach to long-distance dependencies. Altering the functions on the path will result in different extraction patterns for different languages.

Related to islands is the phenomenon of "pied piping," where the FOCUS or TOPIC includes more than just the operator. This is related to islands because this is often used as a strategy to avoid island violations.

(32)   a.   *Whose did you put book on the shelf?
        b.   Whose book did you put on the shelf?

In this case, the FOCUS is *whose book*, but the operator is just *whose*. (Here we use OPER as the name of the grammatical function of the operator.)

(33)

$$\begin{bmatrix} \text{TYPE} & \text{Q} \\ \text{FOCUS} & \begin{bmatrix} \text{PRED} & \text{'book - of } \langle(\uparrow \text{POSS})\rangle\text{'} \\ \text{POSS} & \begin{bmatrix} \text{PRED} & \text{'PRO'} \\ \text{PRON} & \text{WH} \\ \text{CASE} & \text{GEN} \end{bmatrix} \end{bmatrix} \\ \text{OPER} & \text{———} \\ \text{TENSE} & \text{PAST} \\ \text{SUBJ} & [\text{"you"}] \\ \text{PRED} & \text{'put } \langle(\uparrow \text{SUBJ}) (\uparrow \text{OBJ}) (\uparrow \text{OBL}_{\text{Loc}})\rangle\text{'} \\ \text{OBJ} & \text{———} \\ \text{OBL}_{\text{Loc}} & [\text{"on the shelf"}] \end{bmatrix}$$

Our ID rule for CP, repeated below, does not allow this.

(34)   CP→   XP   ,   C′
                 $(\uparrow \text{DF}) = \downarrow$ $\uparrow = \downarrow$
                 $(\downarrow \text{PRON}) =_{\text{c}} \text{WH}$

This ID rule does not distinguish the DF (FOCUS or TOPIC) from the operator.

It is the operator that must have the [PRON WH] feature, not the DF. The operator is embedded at some undetermined depth within the DF (including potentially being identical); functional uncertainty can be used to model this.[9]

(35)   CP→   XP   ,   C′
                    $(\uparrow DF) = \downarrow$ $\uparrow = \downarrow$
                 $(\uparrow OPER) = (\downarrow GF*)$
              $(\uparrow OPER\ PRON) =_c WH$

Similarly, the non-*wh* ID rule needs to be updated.

(36) $\begin{Bmatrix} IP \\ S \end{Bmatrix} \rightarrow$ XP   , $\begin{Bmatrix} IP \\ S \end{Bmatrix}$
                              $(\uparrow DF) = \downarrow$ $\uparrow = \downarrow$
                       $(\downarrow GF*\ PRON) \neq WH$

6.4   Relative clauses

We conclude this chapter with discussion of restrictive relative clauses in English.[10] There are interesting intricacies in the structure of relatives, which we will describe using the analysis of long distance dependencies developed in this chapter.

The simplest type of relative clause is one with a relative pronoun. Relative pronouns, like interrogative pronouns, are *wh* elements and therefore occupy [SPEC, CP] position. The discourse function held by the relative pronoun is TOPIC.

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[9]This analysis of pied-piping is based on Kaplan and Bresnan (1982). Kaplan and Bresnan use the function name Q for our OPER.

[10]We will not discuss other kinds of relative clauses, such as nonrestrictive relatives or free relatives.

(36) a. the book which I put on the shelf

b.

```
                        DP
                        |
                        D′
                   ┌────┴────┐
                   D         NP
                   |    ┌─────┴─────┐
                  the  NP          CP
                   |    |      ┌────┴────┐
                   N    |     DP         S
                   |    |      |    ┌────┴────┐
                 book which   DP   VP
                          |   |  ┌──┼────────┐
                          I   V  DP         PP
                              |  |          △
                             put e      on the shelf
```

c.

$$
\begin{bmatrix}
\text{DEF} & + \\
\text{PRED} & \text{`book'} \\
\text{NUM} & \text{SG} \\
\text{ADJ} & \left\{
\begin{bmatrix}
\text{TYPE} & \text{REL} \\
\text{TOPIC} & \begin{bmatrix} \text{PRED} & \text{`PRO'} \\ \text{PRON} & \text{WH} \end{bmatrix} \\
\text{OPER} & \text{—} \\
\text{SUBJ} & [\text{``I''}] \\
\text{PRED} & \text{`put} \left\langle (\uparrow \text{SUBJ})\,(\uparrow \text{OBJ})\,(\uparrow \text{OBL}_{\text{Loc}}) \right\rangle \\
\text{TENSE} & \text{PAST} \\
\text{OBJ} & \text{—} \\
\text{OBL}_{\text{Loc}} & \begin{bmatrix} \text{PCASE} & \text{OBL}_{\text{Loc}} \\ \text{OBJ} & \begin{bmatrix} \text{DEF} & + \\ \text{PRED} & \text{`shelf'} \\ \text{NUM} & \text{SG} \end{bmatrix} \\ \text{PRED} & \text{`on} \left\langle (\uparrow \text{OBJ}) \right\rangle \end{bmatrix}
\end{bmatrix}
\right\}
\end{bmatrix}
$$
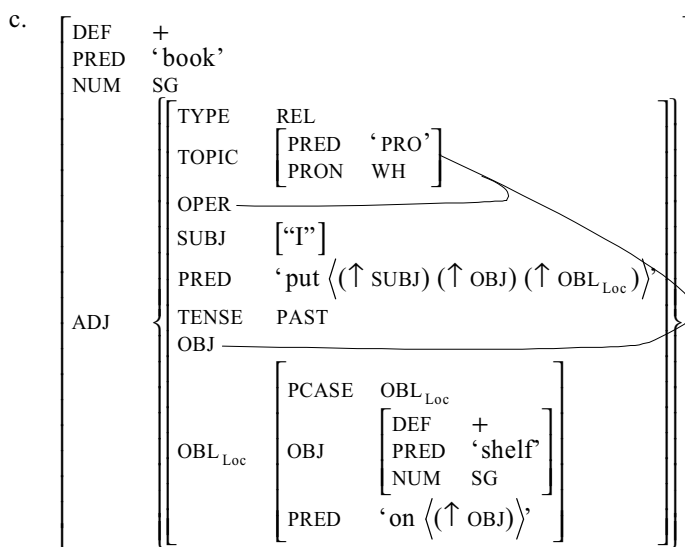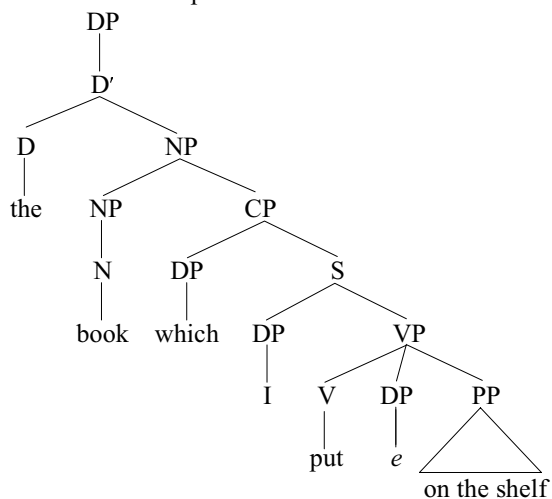
Our existing rules generate such relative clauses, with the addition of an ID rule allowing CP to be adjoined to NP.

The status of the relative pronoun as TOPIC can be shown by the

interaction of relative clauses with other constructions. TOPIC is a syntacticized discourse function. As such, it represents part of the interface between syntax and discourse. A topic in discourse grammar is old information; it is therefore incompatible with constructions that serve to introduce new entities into the discourse (see Bresnan and Mchombo 1987). One such construction is the *there* construction. Note:

(38)   *the book which there is *e* on the table

This confirms the analysis of *which* as TOPIC.

However, this is not the only type of relative clause in English. There are also relative clauses that lack a relative pronoun. Such relatives can be either CPs introduced by the complementizer *that* (which is not a relative pronoun) or IPs (or Ss) introduced by no complementizer.
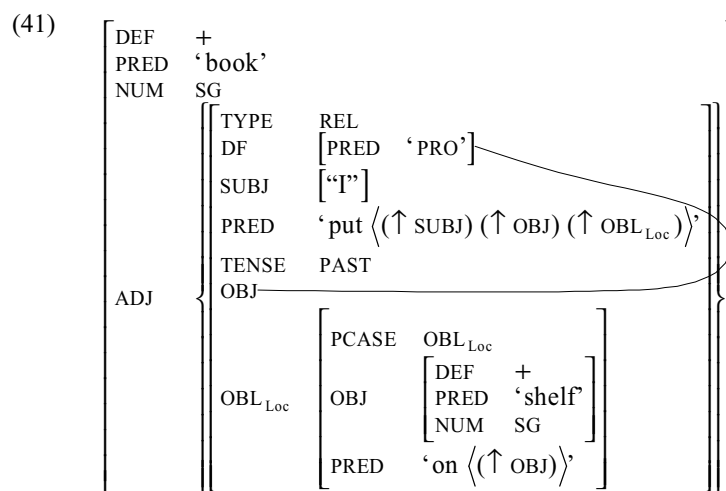
(39)   a.   the book that I put on the shelf
        b.   the book I put on the shelf

Unlike the construction introduced by a relative pronoun, these do not appear to involve a *wh* element. However, they do include a gap, just like the *wh* relative. Furthermore, it can be shown that they involve long distance dependencies: they obey island constraints.

(40)   a.   *the book that I denied the claim that I put *e* on the shelf
        b.   *the book that to put *e* on the shelf would be a mistake

It is for this reason that derivational theories have postulated the movement of an "empty operator" or a deleted relative pronoun.

The f-structure of *wh*-less relatives must be something like:

(41)

$$
\begin{bmatrix}
\text{DEF} & + \\
\text{PRED} & \text{'book'} \\
\text{NUM} & \text{SG} \\
\text{ADJ} & \left\{ \begin{bmatrix}
\text{TYPE} & \text{REL} \\
\text{DF} & \begin{bmatrix} \text{PRED} & \text{'PRO'} \end{bmatrix} \\
\text{SUBJ} & \begin{bmatrix} \text{"I"} \end{bmatrix} \\
\text{PRED} & \text{'put} \langle (\uparrow \text{SUBJ})\ (\uparrow \text{OBJ})\ (\uparrow \text{OBL}_{\text{Loc}}) \rangle \text{'} \\
\text{TENSE} & \text{PAST} \\
\text{OBJ} & \\
\text{OBL}_{\text{Loc}} & \begin{bmatrix}
\text{PCASE} & \text{OBL}_{\text{Loc}} \\
\text{OBJ} & \begin{bmatrix} \text{DEF} & + \\ \text{PRED} & \text{'shelf'} \\ \text{NUM} & \text{SG} \end{bmatrix} \\
\text{PRED} & \text{'on} \langle (\uparrow \text{OBJ}) \rangle \text{'}
\end{bmatrix}
\end{bmatrix} \right\}
\end{bmatrix}
$$

Such an f-structure embodies the analysis of *wh*-less relatives as long distance dependencies.

Next, we must determine the nature of the DF in this f-structure. In *wh* relatives, the functions TOPIC and OPER are both involved because, as we have seen, sometimes the operator is embedded within the fronted phrase. In *wh*-less relatives, there is no evidence for two distinct elements. Furthermore, there is evidence against analyzing the unexpressed filler as TOPIC. Unlike the fronted *wh* relative pronoun, the unexpressed relative pronoun can be used in the *there* construction.[11]

(42) a. *the book which there is *e* on the table
   b. the book that there is *e* on the table

We therefore conclude that the unexpressed filler in the *wh*-less relative clause has the function OPER. In a sense, this is similar to the notion of "empty operator" in derivational theories, with "empty" reinterpreted as meaning "present in f-structure but not c-structure." Since this "empty operator" is a property of the relative clause construction, the most natural

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[11]This contrast was noted in a post by Joan Bresnan on 21 March 2000 to the LFG List, and Bresnan's judgment matches that of the author of this textbook. There are apparently people for whom the contrast does not hold. It is possible that there are idiolectal differences, and that for some people the understood relativized element *is* TOPIC.

source for it would be the ID rule that licenses the relative clause.

(43)   NP→ NP , $\begin{Bmatrix} CP \\ IP \\ S \end{Bmatrix}$

$\uparrow = \downarrow$ $\downarrow \in (\uparrow \text{ADJ})$
$\big((\downarrow \text{ OPER PRED}) = \text{'PRO'}\big)$

Not surprisingly, infinitives (which are CPs) can also be relative clauses. However, the details are interesting. Note the following.

(44)   a.   a shelf [on which to put the books]
         b.   a shelf [to put the books on]
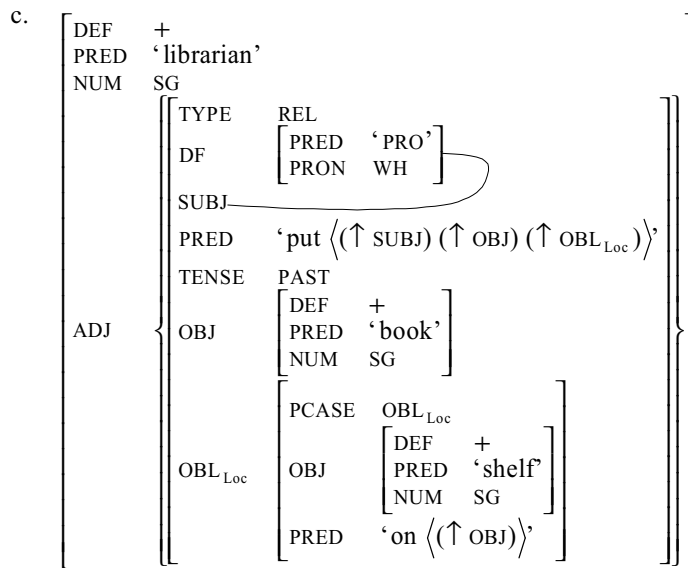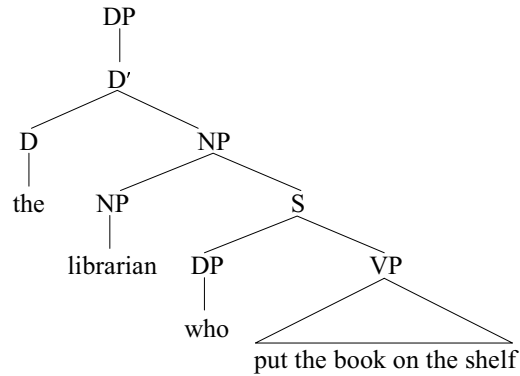   c.   *a shelf [which to put books on]

What these examples show is that an overt *wh* element is possible only in the pied piping construction. From the perspective of the LFG analysis developed here, this means only when the TOPIC (if there is one) is not identical to OPER. The Economy of Expression principle provides a way to rule out (c): if the same f-structure can result from a c-structure with fewer phrasal nodes, the more complex c-structure is ruled out. It appears that in infinitival relatives, unlike finite ones, an "empty operator" can also have the function of TOPIC, thus blocking an overt TOPIC. This can be achieved by associating an optional equation with the infinitival complementizer *to*.

(45) $(\uparrow \text{OPER}) = (\uparrow \text{TOPIC})$

6.5   Subjects revisited

In light of the addition of relative clauses to our analysis of long distance dependencies, we need to reconsider the "extraction" of matrix SUBJs. Our analysis is that matrix SUBJs receive a DF in situ. Note how this applies to a relative clause.

(46) a. the librarian [who put the book on the shelf]

b.
```
                DP
                |
                D′
              /    \
            D        NP
            |       /   \
           the    NP      S
                  |      /  \
              librarian DP    VP
                        |    /  \
                       who  put the book on the shelf
```

c.
$$
\begin{bmatrix}
\text{DEF} & + \\
\text{PRED} & \text{`librarian'} \\
\text{NUM} & \text{SG} \\
\text{ADJ} & \left\{ \begin{bmatrix}
\text{TYPE} & \text{REL} \\
\text{DF} & \begin{bmatrix} \text{PRED} & \text{`PRO'} \\ \text{PRON} & \text{WH} \end{bmatrix} \\
\text{SUBJ} & \\
\text{PRED} & \text{`put} \langle (\uparrow \text{SUBJ})\,(\uparrow \text{OBJ})\,(\uparrow \text{OBL}_{\text{Loc}}) \rangle\text{'} \\
\text{TENSE} & \text{PAST} \\
\text{OBJ} & \begin{bmatrix} \text{DEF} & + \\ \text{PRED} & \text{`book'} \\ \text{NUM} & \text{SG} \end{bmatrix} \\
\text{OBL}_{\text{Loc}} & \begin{bmatrix} \text{PCASE} & \text{OBL}_{\text{Loc}} \\ \text{OBJ} & \begin{bmatrix} \text{DEF} & + \\ \text{PRED} & \text{`shelf'} \\ \text{NUM} & \text{SG} \end{bmatrix} \\ \text{PRED} & \text{`on} \langle (\uparrow \text{OBJ}) \rangle\text{'} \end{bmatrix}
\end{bmatrix} \right\}
\end{bmatrix}
$$

The DF in the relative clause could be either TOPIC or OPER.

However, the OPER/TOPIC of a relative clause can also be identified with the SUBJ when there is a complementizer and no relative pronoun.

(47) a. the librarian that put the book on the shelf
b. a librarian to put the book on the shelf

On the other hand, in the absence of either a *wh* relative pronoun or a complementizer, the relativized element cannot be understood as SUBJ of the relative clause.

(48)   *[DP the librarian put the book on the shelf]

It therefore seems plausible to identify this ability as a lexical property of the complementizers. In the case of *that*, the SUBJ is identified with OPER (since, as we saw above, there is no TOPIC in *that* relatives). With *to*, on the other hand, the identification must be with TOPIC. This is because there is a contrast between relative clauses and interrogatives: FOCUS/OPER and SUBJ cannot be identified in an infinitival interrogative.

(49)   *I asked [who to put the books on the shelf].

These facts concerning SUBJs are quite intricate. They clearly show that SUBJ extraction is different from the extraction of other elements. They also show the need to develop careful detailed analyses.

Additional readings

As mentioned in the text, Kaplan and Zaenen (1989) originated the analysis of long-distance dependencies in terms of functional uncertainty. The formal implications are also discussed in Kaplan and Maxwell (1988a).

The earlier "constituent control" formalism of Kaplan and Bresnan (1982), although superseded by functional uncertainty, was the basis for some early studies such as Zaenen (1983) and Falk (1983b). The former discussed syntactic effects along the extraction path in some languages; the latter dealt with the *that*-trace effect, and proposed an analysis which shares some features with the analysis given here.

Discourse functions and structure in Russian are discussed within both GB and LFG by King (1995). Empty categories in German are considered in Berman (1997). The restriction of extraction to SUBJ in Tagalog is covered in Kroeger (1993). Bresnan (1998) examines crosslinguistic variation in weak crossover effects. As noted in the text, the discourse effects of the status of the relativized element as TOPIC were originally noted by Bresnan and Mchombo (1987).

Much of the detail in the analysis of English long-distance dependencies in this chapter is original, and some (including the subject/nonsubject distinction and the analysis of the *that*-trace effect) is drawn from Falk (2000).

Exercises

1. Explain the ungrammaticality of each of the following:

    a. *I think this book that you should read.
        (cf. ✓I think that this book you should read.)

    b. *What do you think I read the book?

    c. *Who did you deny the claim that I saw *e*?

    d. *This book, [that he read *e*] is most surprising.

    e. *What did he buy the newspaper [after he ate *e*]?

    f. *[_{DP} a shelf on which for you to put the book]
       (cf. ✓a shelf for you to put the book on)

2.   The analysis of the English possessive *'s* has always been a problem. The traditional analysis treats it as an inflectional morpheme (a Case marker). However, it does not always appear on the ostensibly genitive noun. For example, in a DP like *a friend of my wife's daughter* (meaning 'the daughter of a friend of my wife'), the noun that "should" be genitive is *friend*. An alternative analysis would be to treat *'s* as a syntactic head which takes a DP complement. However, heads in English precede their complements, and *'s* follows its ostensible complement. In LFG, the Lexical Integrity Principle forces an analysis of *'s* as an affix (i.e. the more traditional analysis). Show how inside-out functional uncertainty can be used to overcome the problems with this analysis.