leftward and rightward extraction. Although a number of further asymmetries remain as stipulations, the claim is that enough of the asymmetries follow from the present theory as consequences of the combinatory projection of lexically specified directionality to vindicate the assumption of the Principle of Categorial Government, making symmetry the default.

3.1 Relativization

We can assume on the basis of their semantics that nominative and accusative relative pronouns respectively bear categories of the form \((N\backslash N)/\langle S\backslash NP\rangle\) and \((N\backslash N)/\langle S/\backslash NP\rangle\). That is simply to say that they are functions from predicates to noun modifiers that can be written in full as follows:

\[
\begin{align*}
1. & \quad \text{a. who, that, which} := (N_{agr}\backslash N_{agr})/\langle S\backslash NP_{agr}\rangle \\
& \quad \text{b. who}(m), \text{that}, \text{which} := (N_{agr}\backslash N_{agr})/\langle S/\backslash NP_{agr}\rangle
\end{align*}
\]

These categories accept the relative clauses in (112) of chapter 2, repeated here:

\[
\begin{align*}
2. & \quad \text{a. a man [who]_\langle N\backslash N\rangle/\langle S\backslash NP\rangle \quad [(suspects that Chapman) will eat the apples]_{\backslash NP}} \\
& \quad \text{b. the apples [that]_\langle N\backslash N\rangle/\langle S/\backslash NP\rangle \quad [Keats (suspects that Chapman) will eat]_{\backslash S/\backslash NP}} \\
& \quad \text{c. some articles [that]_\langle N\backslash N\rangle/\langle S/\backslash NP\rangle \quad [Keats (suspects that Chapman) will file without reading]_{\backslash S/\backslash NP}}
\end{align*}
\]

As we saw in chapter 2, the dependencies in such relative clauses are predicted to be unbounded for the same reason as right node raising—that is, because composition allows unboundedly large constituents of type \(S/\backslash NP\) to be assembled.

Examples like the following suggest that the second category in (1) should be schematized over a finite set of argument categories with valency bounded to three \(S/\backslash NP\), \((S/\backslash NP)/\backslash NP\), \((S/\backslash PP)/\backslash NP\), \((S/\backslash VP_\text{TO})/\backslash NP\), etc.
3. Pied-Piping

In order to capture pied-piping in relatives, we must assume, further generalizing Szabolcsi’s (1989) approach to reflexive pied-piping following Morrill (1988, 1994, 1995), that the wh-relative pronouns have a further pair of type-raised categories that allow them to combine with functions over NPs such as on, the covers of, and on the covers of, to yield the same categories for complex wh-items as for the relative pronoun. We can provisionally write the pied-piping categories as follows:

(6) a. who(m), which := \((N \backslash N)/(S/NP)\) \((NP/NP)\)
b. who(m), which := \((N \backslash N)/(S/PP)\) \((PP/NP)\)
c. who(m), which := \((N \backslash N)/(S/NP)\) \((NP/NP)\)

They therefore yield the following categories for the covers of which and on the covers of which:

(7) a. \((N \backslash N)/(S/NP)\)
b. \((N \backslash N)/(S/PP)\)
3.3 Strong Crossover

The relative pronoun categories in (1) capture without further stipulation the asymmetry between more and less oblique arguments that gives rise to "strong crossover" phenomena, as exhibited in the following examples:5

(11) a. *a man who(m)₁ he₁ thinks that Mary likes
    b. a man who₁ thinks that Mary likes him₁

As in many other theories, this result follows from Condition C.6 That is, the interpretations of the relative clause residues are as in the following categories:

(12) a. S/NP : λx.thinks'(like'(x mary')(pro' y))
    b. S\NP : λx.thinks'(like'(pro'y)mary')x

Although I continue to remain uncommitted on the way in which the free variables in pronouns become bound, if the variable y is ever identified with the variable x by such a binding, then the relative clause (11a) is illegal under Condition C.

This account is identical to the standard S-structural one, with a variable doing the work of trace, and the lambda acting as an operator much like a "moved" wh-element. The point is that this account can equally well apply at the level of predicate-argument structure or logical form, and in terms of the mechanism that standardly binds arguments to predicates.

The fact that predicate-argument structures respect obliqueness is also crucial in correctly predicting the fact that strong crossover effects generalize to all cases on which a less oblique pronoun c-commands a more oblique extracted argument, as in the following contrast:

(13) a. *a man who(m)₁ I told him₁ that Mary liked
    b. a man who(m)₁ I told that Mary liked him₁

On the assumption that pied-piping of relative pronouns is handled as in (6) and that whose pictures translates as pictures'(of' x), we also exclude the following example (see Safir 1986):

(14) a. *a man pictures of who(m)₁ he₁ (thinks that Mary) likes
    b. *a man whose₁ pictures he₁ (thinks that Mary) likes

In both cases the translations of the relative clauses are as in the following category:

(15) S/NP : λx.thinks'(like'(pictures'(of' x))mary')(pro'y)

Again, if pronoun binding unifies x and y then the interpretation is illegal.

On the further assumption that in situ wh-items also include a variable in their translation—so that for example the category of unrelativized who(m) is NP : x or the type-raised equivalent—we also exclude the following:

(16) *He₁ thinks Mary likes who(m)?

3.4 Subject/Object Asymmetries

3.4.1 The English Fixed Subject Constraint and the ECP

A number of constraints on long-range dependencies that are asymmetrical with respect to subjects and objects, and that have been argued to stem from Chomsky's (1981) Empty Category Principle (ECP), come for free in CCG. They arise simply because the categories reflect the different directionality of the subject and object arguments of the SVO verb, and because the combinatory rules are sensitive to the distinction. This ingredient of the theory captures directly in the lexicon and its projections under the combinatory rules the concept of "canonical government configuration" or "direction of government" (see Kayne 1983, 167–169; Pesetsky 1982; Koster 1987, 19), as Bach (1988, 29), among others, has pointed out. In present terms, this principle is an inevitable consequence of the Principle of Directional Inheritance.

For example, as has been noted before, the theory predicts the following familiar asymmetry in extractability of English subjects and objects, which goes by the name of the Fixed Subject Constraint (Bresnan 1977), and has been attributed to the ECP:7

(17) a. a man who(m) [I think that]₁S₁ [Keats likes]₁S₁/NP
    b. *a man who(m) [I think that]₁S₁ [likes Keats]₁S₁/NP

According to the present theory, this asymmetry is possible in languages like English that have an SVO lexicon because the crucial composition that would potentially permit subject extraction requires a different one of the four possible composition rules from the corresponding object-extraction case. A subject extraction like (17b) would require the addition of the "forward crossing" composition rule >Bₓ, (106b) of chapter 2, in order to compose the categories S/S and S\NP.
Although such rules are permitted by the theory, we could not use this rule to devise a grammar for a language identical to English, differing only in freely allowing subject extractions. Such a grammar would immediately lose another distinguishing property of English, namely, its configurationality. Word order would collapse entirely, allowing “scrambling” examples like the following:

(19) *I Keats [think (that) likes Chapman.]_{S(NP),NP}

The asymmetry in extraction possibilities for subjects and objects is therefore according to the present theory a necessary property of a configurational SVO language. In general, according to CCG, asymmetries in extractability between arguments of the same verb may arise when there are asymmetries in the directionality of those arguments.

The fact that this particular asymmetry tends to be characteristic of configurational SVO languages and constructions therefore follows without the stipulation of any version of the ECP, and without any distinction of subject and object predicate-argument relations in terms of “properness” of government or the A/Â distinction between “internal” and “external” arguments (Chomsky 1981). Nor is it necessary to stipulate a “Generalized Left-branch Condition” (Gazdar 1981) or to embody a distinction similar to A/Â in a SLASH termination metarule, the Head Feature Convention, and the assumption that SLASH is a head feature in later versions of GPSG (Gazdar et al. 1985). Nor do we require the even more specific Trace/Subject Condition(s) required by HPSG (Pollard and Sag, 1994, 195), or the alternative A/Â-like distinction between subjects and other subcategorized complements offered by the same authors (p. 347, following unpublished work by Borsley). Nor is the assumption that subjects are boundaries required, as in Hepple’s (1990, 56–57) categorial account.

It is often suggested, following Perlmutter (1971), that languages that are exempt from the Fixed Subject Constraint are that way because they permit subject pro-drop. Italian is often cited, because as Perlmutter points out, the verbs that permit such extractions are exactly those that permit pro-drop. The present theory does not directly predict such a dependency. However, Maling and Zaenen (1978), and much subsequent work including that of Chung (1983) and Engdahl (1985), show that pro-drop is not a necessary condition for subject extractability. Instead, they suggest that subject extractability is closely related to basic clause constituent order—in other words, to the lexical category of verbs, as the present theory would predict. For example, it is permitted in Dutch (an SOV language) and Chamorro (a VSO language), and Icelandic, (a verb-second or V2 language).8

Italian itself can be seen as supporting this alternative generalization. Rizzi (1982, 147) notes that, although Italian is usually regarded as an SVO language, certain Italian verbs that permit subject extraction (and also pro-drop) are exactly the verbs that permit the rightward extraposition of a subject, yielding VOS order. We find the following pattern:

(20) a. Credo che verrà qualcuno.
   (I believe that will-come someone
   b. Chi credi che verrà?
   Who think (you) that will-come

Although Perlmutter and Rizzi suggest that it is the possibility of pro-drop that engenders both rightward subject movement and subject extraction, it seems equally possible that it is the availability of a VOS lexical category for those verbs that engenders both extraction and pro-drop.

3.4.2 Some Other Phenomena Attributed to the ECP

Another phenomenon that has been attributed to the influence of the ECP arises from the grammar of certain “negative polarity” items discussed by Kayne (1983), which “link” to negation elsewhere in the sentence. The clearest example comes from the French ne ... personne construction. *Personne behaves much like English anyone in linking to sentential negation, except that it can act as a subject of a negated verb as well as an object:

(21) a. Je n’ai vu personne.
   I NEG have seen anyone
   ‘I didn’t see anyone.’
   b. Personne n’a vu Janine.
      Anyone NEG has seen Janine
      ‘No-one saw Janine.’

The linking of personne to sentential negation appears to be unbounded, like that of its English counterpart, so the following is a possible reply to the question *Qui avez-vous exigé qu’ils arrêtent? ‘Who did you require that they arrest?’ (see Kayne, 1983, 24).9
(22) Je n’ai exigé qu’ils arrêtent personne.
    I NEG have required that they arrest anyone
    ‘I didn’t require that they arrest anyone.’

However, subject personne cannot link in this way (23b), despite the fact that personne is in general allowed in embedded subjects (23b).

(23) a. *Je n’ai exigé que personne soit arrêté.
    I NEG have required that anyone be arrested
    ‘I didn’t require that anyone be arrested.’

b. J’ai exigé que personne ne soit arrêté.
    I have required that no-one, NEG be arrested
    ‘I required that no-one be arrested.’

These facts are predicted on the assumption that French has an SVO verb lexicon, like English, and that negation marks the result S of the predicate—say as \( S_{\text{NEG}} \)—as follows.

\[ \text{Personne} \text{ as the subject of an SVO verb must be } S/(S_{\text{NEG}}/NP). \text{ Personne as an SVO object must be } S/(S_{\text{NEG}}/NP). \]

The latter category permits the following derivation:

(24) \[ \frac{\text{Je}}{S/(S_{\text{NP}})} \frac{\text{n’ai}}{S_{\text{NEG}}/NP} \frac{\text{exigé}}{VP_{\text{EN}}} \frac{\text{que}}{S_{\text{NEG}}/NP} \frac{\text{qu’ils}}{S_{\text{NEG}}/NP} \frac{\text{arrêtent}}{NP} \frac{\text{personne}}{NP} }{b} \]

The subject category for personne causes the following derivation to block, because that category cannot “see” the negation:

(25) *Je n’ai exigé que personne soit arrêté.

On the other hand, the following derivation is fine:

(26) J’ai exigé que personne ne soit arrêté.

This account of negative linking of personne depends, like the earlier explanation of the Fixed Subject Constraint, on the involvement of SVO verbs. We must therefore predict that the Italian verbs that allow subject extraction and subject postposing, which were hypothesized to do so by having VOS lexical categories, should also allow the equivalent of personne linking in the similar non ... nessuno ... construction if and only if the polarity item nessuno is in the postposed position. Such appears to be the case. According to Rizzi (1982, 126), (27a) lacks the linked reading, but (27b) has it.11

(27) a. *Non pretendo che nessuno sia arrestato.
    NEG (I) require that anyone be arrested

b. Non pretendo che sia arrestato nessuno.
    NEG (I) require that be arrested anyone
    ‘I didn’t require anyone to be arrested.’

Jaeggli (1981, 130) points out that exactly parallel facts hold for the following related examples in Spanish, involving the no ... ninguno construction:

(28) a. *No quiero que ninguno venga.
    NEG (I) want that anyone come

b. No quiero que venga ninguno.
    NEG (I) want that come anyone
    ‘I don’t want anyone to come.’

None of these phenomena require us to distinguish types of government of arguments at LF via the operation of the ECP, as in Kayne’s analysis.

### 3.4.3 Extractable Subjects in English

The above observations suggest an explanation for a number of further exceptions to the Fixed Subject Constraint, including the fact that English subjects can be extracted from bare complements.

(29) a. a man who(m) I think likes Keats
    b. a man who(m) I think Keats likes

We saw earlier that such sentences cannot be captured by introducing a rule of crossing forward composition, no matter how restricted. Such a mechanism would immediately cause overgeneralizations parallel to (19). The only degree of freedom that remains within the present theory is to assume that this phenomenon arises in the lexicon. One alternative
is to assume that verbs like \textit{think} bear, in addition to obvious categories like \textit{VP/S} and \textit{VP/S}, a special subject-extracting category. We will assume here that this category takes the following form:

\[(30) \text{think} := (\text{VP/}NP_{-\text{LEX,agr}})/(S/\text{NP}_{\text{agr}}) : \lambda p.p.x.\text{think}(px)\]

The translation of this category embodies a "reanalysis" at predicate-argument structure of a surface-syntactic object of the verb \textit{think} as the subject of its complement. In essence, this category embodies the GPSG analysis of extractable subjects proposed by Gazdar (1981) and Gazdar et al. (1985), as modified by Hepple (1990, 58) within a different categorial framework, and by Pollard and Sag (1994). (The advantage of the present proposal lies in the way most subject extraction is excluded.)\(^{12}\)

The \textit{NP} argument of this category bears a feature \textit{LEX}, which like Hepple’s corresponding “modality” \(\Delta\), the SLASH feature of GPSG, and the related device of Oehrle1991, prevents this argument from being saturated by a complement of any kind realized with lexical materials. The feature is in every respect like the agreement features discussed earlier. Indeed, the argument in question includes an (underspecified) number agreement feature \textit{agr}, which works in the usual way to exclude the following:\(^{13}\)

\[(31) \begin{align*}
&\text{a. *a man who(m) I think like marmalade} \\
&\text{b. *some men who(m) I think likes marmalade}
\end{align*}\]

The relative pronouns themselves (cf. (1) and (4b)) do not restrict the NP argument in their complement on the feature \(\pm \text{LEX}\). For example, the argument \(S/\text{NP}_{\text{agr}}\) of the object relative pronoun (1b), repeated here, can unify with any argument term in a functor whether or not it is specified for agreement, and whether or not it is specified via the value minus on the feature \textit{LEX}.\(^{14}\)

\[(32) \text{who(m),that,which} := (N_{\text{agr}}\backslash N_{\text{agr}})/(S/\text{NP}_{\text{agr}})\]

The derivation of (29a) is therefore allowed as follows:\(^{15}\)

\[(33) \begin{align*}
\text{man} &\quad \text{who(m)} & \text{I think} & \text{likes Keats} \\
N_{3SM} &\quad (N_{\text{agr}}\backslash N_{\text{agr}})/(S/\text{NP}_{\text{agr}}) & (S/\text{NP}_{-\text{LEX,agr}})/(S/\text{NP}_{\text{agr}}) & S/\text{NP}_{35} \\
&\quad (N_{\text{agr}}\backslash N_{\text{agr}})/(S/\text{NP}_{\text{agr}}) & C & \quad S/\text{NP}_{35} \rightarrow \text{b} \\
&\quad (N_{\text{agr}}\backslash N_{\text{agr}})/(S/\text{NP}_{\text{agr}}) & & \quad (N_{\text{agr}}\backslash N_{\text{agr}})/(S/\text{NP}_{\text{agr}}) \\
&\quad N_{35M} & & \quad \rightarrow \\
&\quad N_{35M} & & \quad <
\end{align*}\]

Among verb arguments, only extractable subjects are marked in this way. Verbs leave normal arguments unspecified on the attribute \textit{LEX}. In GB terms, what we have done is to distinguish the extracting subject, via the lexical entry for the verb, as an argument that can only be "antecedent-governed." In HPUG terms, we have defined a verb with a SLASH argument in the absence of any verb with a corresponding SUBCAT argument. However, we have again accomplished this effect entirely in terms of the lexicon, without invoking an empty category or attendant ECP, and without complicating the notion of case or distinguishing between types or qualities of government, or types of argument position, and without distinguishing subjects from other arguments, thereby maintaining the Principle of Categorial Government.

As a consequence, the relative pronoun category (32) is free to combine with functions whose argument is entirely unspecified on this feature. Since most nonsubject verb arguments in English are unspecified on both LEX and agr attributes, most relative clause residues are of this type, \(S/\text{NP}\). An example is the following unchanged derivation for (29b), which depends on the ordinary bare complement category \textit{VP/S} for the verb \textit{think}:

\[(34) \begin{align*}
&\quad \ldots[\text{who(m)}]_{(N_{\text{agr}}\backslash N_{\text{agr}})/(S/\text{NP}_{\text{agr}})} [\text{I think Keats likes}]_{S/\text{NP}} \\
&\quad \text{Similarly, such underspecified functors can combine with normal NPs, as in the right-node-raised construction (35), even on the further assumption that these are distinguished by the value } + \text{LEX} \text{ on this feature. (Like most such minor features, it will be omitted from the notation by convention whenever it is not directly relevant to the discussion. Nevertheless it is assumed to be present on all nonrelativized nominal categories.)}\(^{16}\)
\end{align*}\]

\[(35) \begin{align*}
&\quad [\text{I think Keats likes, but you say he detests,}]_{S/\text{NP}} [\text{the man in the grey flannel suit,}]_{N_{35M}} \quad [\text{NP}_{+\text{LEX}}]
\end{align*}\]

However, the subscript \(-\text{LEX}\) prevents the subject-extracting category (30) from combining with NPs realized with lexical material, which, as noted, are always implicitly \(+\text{LEX}\). The following derivation is therefore blocked:\(^{17}\)
The lexical reflexivizing rules such as (22) and (39) of chapter 2 must not be allowed to apply to subject-extracting verbs to reflexivize the extractable subject. Neither of the following (the exclusion of the first of which has also been thought to require the ECP) is allowed.

(37) a. *Keats and Chapman think each other stole the tarts.
   b. *Keats and Chapman think the tarts each other.

This restriction presumably reflects the derived or otherwise special status of the subject-extracting verb category (30) in the lexicon.

In contrast, (38) is allowed, on the slightly unorthodox assumption that “exceptional case-marking” verbs like consider and believe are, like auxiliaries, yet another case of object control categories (VP/VP_{70}/NP, to which rule (39) of chapter 2 can apply.

(38) Keats and Chapman believe each other to have stolen the tarts.

3.4.4 Some Other Idiosyncratically Extracting Subjects

It is assumed in the above analysis that sentences including bare complements with the subject NP in situ and those with the subject extracted arise from distinct lexical categories for the verb. It follows that we must predict the occurrence of verbs that bear only the extracting category and forbid a subject in canonical position in the complement.

Kayne (1983, 5, 111), points out that French infinitival complement verbs like croire and the English verb assure permit only extracted subjects, and forbid a lexical complement NP in canonical position, citing examples like the following:

(39) a. un enfant que je crois être intelligent
    a child that I believe to be intelligent
   b. *Je crois Chapman être intelligent.
      I believe Chapman to be intelligent.

(40) a. a man who(m) I assure you to be a genius
   b. *I assure you Keats to be a genius.

The present theory requires the lexical entries for such verbs and verb-classes to include only the extracting category, and to lack any corresponding category subcategorizing for S_{INF} or NP VP_{INF}.

The possibility of having verbs that overcome the unavailability of subject extraction in configurational SVO languages suggests the possibility that such languages might also have complementizers that overcome it in the same way. The French quel qui complementizer alternation discussed by Kayne (1983, 94–95), appears to be an example:

(41) la femme que je crois qui est venue
     the woman whom I believe that is come
     ‘the woman who(m) I believe (*that) has come’

(42) la femme que je crois que tu connais
     the woman whom I believe that you know
     ‘the woman who(m) I believe (that) you know’

If complementizers can bear such categories, then why not adverbials? These same degrees of freedom can be used to capture the possibility of certain subject extractions under an “adjunct effect” whose acceptability is entertained (with reservations) by Bresnan (1977, 173, 194 n. 6), and which have recently been discussed by Culicover (1993) and Browning (1996) (who also has some reservations; see 237 n. 1).

These authors agree that examples like (43a), in which a preposed adverbial intervenes between the complementizer and the extraction site are much better than the corresponding *that-t examples, like (43b).

(43) a. a man who(m) Harry said that in his opinion won the game
   b. *a man who(m) Harry said that won the game

Culicover points out that an important subset of the adverbials facilitating subject extraction of this kind, as in (44a), are the negative adverbials that precipitate inversion, as in (44b). (In fact, such adverbials seem to produce some of the most convincing examples of the extraction.)

(44) a. a person who(m) I said that under no circumstances would run for any public office
   b. I said that under no circumstances would this person run for any public office.

However, as Browning notes, not all modal and auxiliary verbs that license inversion license this extraction, the exception being do.
(45) a. I said that under no circumstances did this person run for any public office.
   b. *a person who(m) I said that under no circumstances did run for any public office

Moreover, ordinary tensed main verbs that do not normally support inversion do support the extraction.

(46) a. *I said that under no circumstances ran this person for any public office.
   b. a person who(m) I said that under no circumstances ran for any public office

We must therefore conclude that the class of adverbials that license the extraction bear a category reminiscent of subject-extracting verbs, complete with the feature $-LEX$.

$$ (S_{tense}/NP_{-LEX})/(S_{tense}\backslash NP) $$

Since the do of do-support seems to be $(S_{INV}/VP)/NP$, rather than $(S\backslash NP)/VP$, the above pattern is captured.

(47) 3.4.5 Tough-movement Revisited

Certain further details of subject extraction follow on the assumption that the category of easy in the earlier examples of tough-movement, (63) in chapter 2, is as follows, where the constant one' represents an arbitrary agent whose nature need not concern us here:

$$ easy := (S_{ADJ}/NP_{XPL})/(VP_{TO} : \lambda p. easy'(p\ one')) $$

$$ easy := (S_{ADJ}/NP_{agr})/(VP_{TO}/NP_{+LEX}) $$

$$ \lambda v. \lambda y. easy'(v ... y\ one') $$

(As usual, the category $VP_{TO}$ abbreviates $S_{TO}\backslash NP$.)

This analysis in essence follows those of Carpenter (1992) and Jacobson (1992a), who point out that functional composition allows the infinitival transitive verb to be an unboundedly large fragment such as to imagine that we could please, accounting for the unbounded character of the dependency involved, while maintaining the Principle of Categorial Government.21 The first of the categories in (48) (in which $XPL$ is assumed to be a value of the $AGR$ feature that can combine only with expletives) is involved in sentences like (49a), and the second in those like (49b).22

(49) a. It is easy to (imagine that we could) please John.
   b. John is easy to (imagine that we could) please.

Note that in category (48b), although agreement is included to bring out the parallel with the expletive subject-seeking category (48a), agreement plays no part in the long-range dependency.

We may therefore assume that the copula has the raising category shown in (50), in which $S_{ADJ}\backslash NP_{agr}$ is abbreviated as $AP_{agr}$. (There is a similarity to Postal 1974 here, and to the related HPSG analysis of the copula.)

$$ (S\backslash NP_{agr})/AP_{agr} : \lambda p. \lambda y. py $$

Example (49b) is then derived as follows (since agreement plays no part, it is omitted):

$$ \begin{array}{c}
S/(S\backslash NP) (S\backslash NP)/AP AP/(VP_{TO}/NP_{+LEX}) VP_{TO}/NP \\
\frac{}{S/VP_{TO} \rightarrow B} \frac{AP}{\rightarrow} \frac{VP_{TO}/NP}{\rightarrow} \\
\frac{}{S} \\
\end{array} $$

The object of the infinitival verb $VP_{TO}/NP_{+LEX}$ that is subcategorized for by category (48b) for easy is specified for verbal arguments that are compatible with the feature $+LEX$. Since extractable subjects are $-LEX$, this stipulation allows us to capture the contrast between (52a) and (52b), originally noticed by Schachter (1981), and discussed by Gazdar et al. (1985) and Jacobson (1992a), on the assumption that imagine has a subject-extracting category parallel to that of think ($VP/NP_{-LEX,agr}$) in (30).

(52) a. Keats is lovely [to look at.]
   b. *Keats is lovely [to look at.]
   c. *Keats is easy [to imagine might like Chapman.]
   d. Keats is a man who is easy [to imagine might like Chapman.]

These authors do not discuss the contrast between (52c) and (52d), but it is predicted by the categories in (48).
The restriction of tough-movement via the feature +LEX is reminiscent of similar proposals by Gazdar et al. (1985, 151) and Jacobson (1992b, 278), who suggest that the adjective subcategorizes for an accusative (or nonnominative) NP. It also resembles a GB analysis in which it is assumed that extractable subjects must be antecedent-governed. Like those related accounts, the one proposed here leaves unanswered the question of why -LEX arguments should be excluded from this particular cluster of constructions.\(^{23}\)

This analysis also predicts the following asymmetry in multiple long-range dependencies induced by the interaction of tough-movement and relativization, noted by Fodor (1978). The categories in (53b) cannot combine to give the same predicate-argument structure as (53a). They can only combine to yield a different, and anomalous, predicate-argument structure.

(53) a. a violin which [this sonata is]_{S/AP} [hard to play]_{AP/PP} [upon]_{PP/NP}.

b. #a sonata which [this violin is]_{S/AP} [hard to play]_{AP/PP} [upon]_{PP/NP}.

We thereby avoid any need to stipulate wh-island status for tough complements (Chomsky (1977, 105–106)), together with the attendant complications. As Hukari and Levine (1991, 223) note, this asymmetry continues to present problems both for GB approaches following Chomsky (1981), and for phrase-structure-based approaches following Gazdar et al. (1985). In the former case it has led to unconstrained operations of reanalyses, and in the latter to proliferating distinctions between types of slash (Hukari and Levine 1991; also advocated in categorial frameworks by Moortgat (1988) Jacobson (1990, 1992b), and Morrill, (1994, 1995; Morrill and Solias 1993)), or to the invocation of supposedly performance-related nesting constraints (Fodor 1978; Pollard and Sag 1994, 159).

3.5 Asymmetric Islands

The unboundedness of the dependencies involved in relativization is notoriously limited by “island constraints,” which have been related to the principle of Subjacency and the notion of barriers to movement. These have been discussed in categorial terms by Hepple (1990) and Morrill

(1988, 1994). The following remarks are confined to the question of asymmetries in island effects.

3.5.1 Adjunct Islands

The fact that both adjuncts and relative clauses are in general islands in English would follow from the assumption that the only category they bear is that of a (backward) modifier, as can be seen from the categories in the following unacceptible examples:\(^{24}\)

(54) a. ?a book [which](\(N\backslash N\))/(\(S\backslash N\)) [I will]_{S/VPP} [walk]_{VPP} [without reading]_{(VPP\backslash VPP)/NP}

b. ?a book [which](\(N\backslash N\))/(\(S\backslash N\)) [I met]_{S/NP}[a]_{NP/N} [woman]_{N} [who wrote]_{(N\backslash N)/NP}

However, such examples are only blocked if we make the further assumption that verbs like walk cannot type-raise over VP adjuncts, to acquire the category VPP/(VPP\backslash VPP), and that nouns like woman cannot raise over N adjuncts, to become N/(\(N\backslash N\)). If they can acquire these categories, either by active syntactic raising or by lexicalization, then they can compose into the adjunct, allowing the extraction. The fact that adjunct islands exist might therefore seem to suggest that the process of type-raising may be somewhat more restricted than we have so far assumed.\(^{25}\) However, the weakness of these constraints, and their sensitivity to lexical content (including the verb itself and such properties as definiteness in the argument itself) suggests that the origin of constraints on long-range dependencies ultimately lies in semantic coherence properties of the nonstandard constituents that combination into islands creates, as is to some extent implicit in the analyses of islands by Oehrle (1974), Rodman (1976), and Cooper (1982), and explicit in Steedman 1987 (see Hepple 1990 for a dissenting view).

Similarly, although examples like (55a) might make us want to restrict the rule of forward composition somewhat more than we have so far, examples like (55b) show that NPs are not in general islands.

(55) a. #I want a, and you want a, biscuit.

b. I read a novel by, and wrote a play about, the man in the Brooks Brothers shirt.
38. Infinitival and gerundive predicate categories are abbreviated as VP and VP_{arg}, and the raised NP object as NP^{i}, for ease of reading.
39. This restriction is different from the corresponding one in earlier papers, and I will say more about its motivation in chapter 3.
40. Similar examples are discussed by Frank (1991). He contrasts them with examples like the following, which seem much better:
   (i) ?a building which the mayor denounced the landlord's
   [neglecting]VP_{arg}/NP [after promising to repair.]VP_{arg}/NP
   The latter will be allowed by the rule on the assumption that gerunds are S_{arg} \rightarrow NP—here abbreviated VP_{arg}—and that possessives are functions of type NP/VP_{arg}, a assumption which is implicit in the analysis proposed by Abney (1987).
41. The corresponding relatives, to which we come below, such as the table on which I placed the book before carefully positioning the glass, seem impeccable.
42. If so, these two principles are essentially corollaries of the Principle of Combinatory Transparency. That is, a rule like (104), which is semantically function composition, but combines X/Y and Y/Z to yield X/Z, is not transparent, any more than would be a rule that combined the same two functions to yield X/W, where W \neq Z. This interpretation of directional slash as an attribute of the argument specification in functor types distinguishes the present approach from Lambek-based or type-logical versions of categorial grammar.
43. This again is a point that distinguishes the present approach from Lambek-based or type-logical versions of categorial grammar.
44. The way in which the principles impose this restriction, at least in configurational languages, is discussed at length in Steedman 1991b. CCG grammars for Turkish, a nonconfigurational language, are discussed by Hoffman (1995a, b) and von Heusinger (1991).
45. See Hoffman 1993 for a discussion of consequences for worst-case parsing complexity if \( n \) is allowed to be unbounded in composition rules, and \( T \) is a true variable in type-raised categories. Hoffman conjectures that the recognition problem for such grammars may still be polynomial.
46. Not least among those attractions is that lexical wrap is low in automata-theoretic power, amounting to a trivial finite state transduction.
47. The categories and rules that have so far been assumed here similarly allow the fragment I think that Keats to be assembled into a constituent of type S/S/\( \text{NP} \), thereby permitting right node raising of the tensed VP, as in (ia), in an manner identical to subject coordination, as in (ib):
   (i) a. ?[You doubt that Keats,]_S/(S\text{NP}) but [I wonder whether Chapman]_S/(S\text{NP}) is a genius.
   b. [Keats]_S/(S\text{NP}) and [Chapman]_S/(S\text{NP}) are geniuses.

Chapter 3
1. The reason for marking S/NP_{arg} for agreement in the nonnominative relative pronoun, b, is discussed below. It will be recalled that both S/NP_{arg} and S/NP_{arg} are also functions whose NP_{arg} arguments are by convention implicitly marked for \(-\text{ANA}\), as noted in chapter 2.
2. Schematicization over functions S/S/NP all of whose arguments are rightward, rather than using the notation of note 14 to schematicize over functions S/S/NP only the first of whose arguments is necessarily rightward, is necessary to prevent the following from meaning a dog that he likes:
   (i) a dog_{V} he_{NP} that_{N/\text{NP}}/S/S/NP \textit{likes}_{S/NP}/NP
   In some earlier papers the category was given in the more general form, and such overgeneralizations were inadvertently allowed. The present restriction is related to the exclusion of the forward crossed composition rule from the present fragment, discussed in section 3.4.1. The latter restriction independently excludes ECP violations like the following:
   (ii) a man who [I wonder]_{S/\text{SQ}} [what \text{likes}_{S/\text{NP}}/NP
3. A lexicalist solution of this kind is supported by the fact that the relative pronoun that lacks pied-piping categories, and that pied-piping only delivers specifiers of relatives, and not those of \( \text{wh} \)-questions, as in \text{whom}/**pictures of whom did you see?\, or indirect questions such as I wonder whom/**pictures of whom he saw.
4. I omit details of agreement. Again, presumably such category sets can be schematicized.
5. Because the present proposal remains uncommitted on a representation for quantifiers, it makes no specific proposal about weak crossover, the con-
ition that is sometimes invoked in connection with the asymmetry between pairs of sentences like the following:
(i) a. Who does his mother love?
   b. *Who(m) does his mother love?
This phenomenon has been used to argue for the distinction between A-positions and A-positions, and hence for the distinction between D-Structure and S-Structure. For similar reasons, it must in present terms be handled at predicate-argument structure. It is in keeping with this suggestion that, as has often been noted (e.g., by Jackendoff 1972), the unacceptability of (ii) seems to be of the same type as the unacceptability of the following with the bound variable reading:
(ii) *His mother loves every boy.
It therefore seems likely that weak crossover arises from the same mechanism as quantifier scoping. Specifically, it seems to reflect the requirement for quantifiers to c-command the pronouns they bind at predicate-argument structure—essentially as proposed in Williams 1986. See Park 1995, 1996 for an account of quantification, that is compatible with the present proposals.
7. The fact that subjects can in English extract from bare complements, as in a man who(m) I think likes Keats, is discussed in section 3.4.1.
8. See Maling and Zaanen 1978, 479–480. Although I will not explore the question here, Heaple’s (1990) analysis of Germanic V2 main clause order in terms of lexical VSO order suggests that the Icelandic verb lexicon specifies VSO order in main and subordinate clauses, and that V2 order arises from extraction, a proposal that can be seen as a lexicalized version of den Besten 1983.
9. Kayne notes that some informants have trouble with the sentence, and the support of a context-setting question seems to be important.
10. I have assumed that the complementizer and negation are clitics, combining in the lexicon, prior to syntactic derivation. They could be included in syntactic derivation by assigning them the obvious categories S′/S and (S\NEG\NP)/(S\NP), respectively.
11. However, there is another reading for (27a), equivalent to ‘I did not require that no-one be arrested.’
12. More precisely, the relation that such categories bear to the basic VP/S categories is a first cousin to the Slash Termination Metarule 2 proposed by Gazdar et al. (1985; for relevant discussion see Hukari & Levine 1987 and Heaple 1990, 59). The present analysis differs from that presented in Steedman 1987, which in its published form (as opposed to a widely circulated draft), used a category of the form (VP/(S\NP))/NP. See discussion by Bouma (1987), Heaple (1990, 60, n. 18), and Oehrle and Shi (1989).

13. Although I have not given a morpholexical rule for passive, I noted earlier that such a rule must apply to first arguments of verbs. It cannot therefore apply to the extracting category (30). (ia) is therefore ruled out for reasons similar to those that rule out *The bone was given the dog, unlike (ib), where the verb is (VP/VP_10)/NP.
(i) a. *Keats is believed likes marmalade.
   b. Keats is believed to like marmalade.
14. Formally, the property of being unmarked or unspecified on the feature LEX can be regarded simply as having an underspecified value on this feature that may unify with either + or −. In this case we must regard the feature with the underspecified value as being suppressed by convention in the present notation. Alternatively, we can represent the unmarked property as the complete absence of this feature-value pair from the syntactic category. In the latter case, we must use a generalization of term unification, to allow categories that do bear a given feature-value pair to unify with categories that lack the corresponding feature-value pair entirely (see Sieber 1986).
15. In many dialects of English that recognize the who/whom distinction (including my own), whom is acceptable with extracted subjects but never with root subjects. This observation is consistent with the analysis of extractable subjects as rightward (i.e nonnominative) arguments. See Steedman 1987, 425 for further discussion.
16. Sentences with multiple wh-elements, like Who thinks Keats likes whom?, are not discussed here. But it is clear that the in situ wh-elements that they include also have the category NP_1 Lex (or the order-preserving type-raised equivalent), just like full NPs. Otherwise, they would permit multiple wh-questions like the following:
(i) *Who thinks likes Keats who?
   Similarly, although topicalization is not discussed here, the treatment in Steedman 1987 remains valid on the assumption that topics acquire the relative pronoun–like category STOPTC/(S/NP) by virtue of their unique sentence-initial position.
17. Related categories such as (i) for “bridge” verbs like think might provide escape hatches for other exceptional extractions, such as that of adjuncts (cf. Hukari and Levine 1995).
(i) think := ((S/NP)/ADV)/S : λs.λa.λx. think′(a s)x
Such a category would allow symmetrical rightward and leftward extraction of adjuncts over bridge verbs.
   (ii) a. How do you think (that) he mended the truck?
       b. I think (that) he mended the truck, and you say (that) he ruined it, with a screwdriver.
18. Ivan Sag has pointed out to me that examples like ?Keats and Chapman always seem to know what each other is/are thinking seem better than they
should be on this and almost any other account. The fact that in some dialects (including my own) these sentences are better with singular agreement (and that there are no equivalent sentences with themselves) suggests that we are dealing with a nonanaphor related to the other.

19. I am assuming that the extracting argument is in addition in both cases marked for a ~LEX argument, so that neither construction permits heavy NP shift, as in ?I assure you to be as sane as the next man the person who stands accused of this horrible crime. If either croire or assure (or both) can in fact support this construction, then the analysis is still valid on the assumption that the extracting argument, like most arguments, is unmarked on the feature LEX. It seems difficult to get clear judgments on the question, and dialects may vary. In any case, the existence of such unrestricted verbs in SVO languages is predicted, and as we saw it offers an explanation for the conspiracy among subject extraction, subject inversion, and linking of subject negative polarity items in Italian and Spanish.

20. The problems that this construction raises for theories involving D-Structure, because of its combination of lexical predication and unboundedness, are discussed by Chomsky (1981, 309–310, 1995, 188).

21. Jacobson points out that the analysis has antecedents in unpublished work by Gazdar, and in Chomsky 1977.

22. Further categories for easy (which could as usual be combined in the parser with those in (48)) are needed to capture the related sentences It is easy for us to ... please John and John is easy for us to ... please. See Jacobson 1992b for discussion.

23. If the possibility mentioned in footnote 19 concerning examples like (ia) is correct, and we therefore assume the extractable NP complement in (40) to be unmarked on the feature LEX, then we predict that sentences like (ib) would be no worse. Again, the judgments are unclear.

(i) a. ?I assure you to be well formed every example in this footnote.
   b. ?This example is impossible to confidently assure you to be well formed.

(ii) The low acceptability of extraction out of preposed adjuncts in English—which are presumably forward adjuncts—in examples like (ii) *an article which without reading I will go to bed, seems to arise because such preposing marks the resulting clause as topicalized, and therefore incompatible with any further extraction, as shown in (ib). (See note 16.)

(i) a. *a book which {3S(5S/5P) [without reading]}{5TOPIC(5S)/5P} [I will go to bed]
   b. *a book which John, I gave

25. We might for example be tempted to further restrict the polymorphic type T in the raised category.

26. It follows once again that infinitival VPs in sentences like the following must be arguments of "exceptional case-marking" verbs like consider.

(i) a. I consider this novel to be poorly written.
   b. I consider to be well written the novel about the man in the grey flannel suit.

That is to say that a "small clause" analysis of these phenomena at the level of syntax appears to be incompatible with the present theory. See Stowell 1983 and Hoeksema 1991 for arguments against such analyses.

27. The restriction differs from the corresponding one given in earlier papers.

28. It follows that we predict that other languages with related lexicons may allow noun phrases on this pattern.

29. Oehrle 1991. offers a different categorial analysis. Ivan Sag, in an invited address to the Sixth Conference of the European Chapter of the Association for Computational Linguistics, Utrecht, April 1993, and at the LSA/ASL workshop held in conjunction with the 1993 LSA summer school in Columbus, Ohio, included this problem in a list of similar extraction asymmetries that he described as lacking solutions within CCG. Although a version of the account of subject extraction offered here was already in circulation in a number of places, including Hepple 1990, Ross's phenomenon had not then been satisfactorily treated. The present section is therefore offered in response to Oehrle's and Sag's claims.

30. Although in present terms the device of associating a shiftable argument with the attribute SHIFT is a stipulation, it is likely ultimately to turn out to be grounded in discourse-information-structural distinctions, an idea that is implicit in the related HPSG analysis, which calls a similar attribute ±TOPIC. In view of the tendency of heavy-shifted items to be accompanied by H* pitch accents, and assuming the account of the association of intonation and discourse information proposed in Steedman 1991a, Prevost and Steedman 1994, and Prevost 1995, RHEME might be another appropriate name for this attribute.

31. This is again reminiscent of Hepple's 1990, 32 proposal (following Barry et al. 1991) to restrict rules using "modalities" like Δ. A feature-based account of the restriction was proposed for HPSG by Ivan Sag in 1993 public lectures in Utrecht and Columbus, Ohio.

32. The fact that two standing categories have been stipulated in order to capture the facts of English suggests that some other language might include either one alone and exhibit only leftward or rightward preposition stranding. I am grateful to Mark Hepple for help with this analysis.

33. I have changed Blevins's example to eliminate an irrelevant effect of proper names inhibiting rightward extraction noted by Abbott (1976). Blevins does not comment on the increased acceptability of (73b,c), or the relation to the well-known idiosyncrasy of this particular class of verbs shown in (71).

34. The fact that verbs like promise, which also take "dative" bare NPs, seem according to some speakers to be reluctant to allow heavy NP shift (Bach