RESUMPTION AS RESOURCE MANAGEMENT

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Ash Asudeh
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I certify that I have read this dissertation and that, in my opinion, it is fully adequate in scope and quality as a dissertation for the degree of Doctor of Philosophy.

Peter Sells
(Principal Co-Adviser)

I certify that I have read this dissertation and that, in my opinion, it is fully adequate in scope and quality as a dissertation for the degree of Doctor of Philosophy.

Mary Dalrymple
(Principal Co-Adviser)

I certify that I have read this dissertation and that, in my opinion, it is fully adequate in scope and quality as a dissertation for the degree of Doctor of Philosophy.

David Beaver

I certify that I have read this dissertation and that, in my opinion, it is fully adequate in scope and quality as a dissertation for the degree of Doctor of Philosophy.

James McCloskey

Approved for the University Committee on Graduate Studies.

Abstract

This dissertation presents a theory of resumption based on semantic composition. The theory achieves a unified explanation of resumptive pronouns and copy raising. The basis is two key claims: 1) the pronouns in resumption are ordinary pronouns, 2) natural language is resource-sensitive. The latter is the guiding hypothesis of the dissertation: Resource Sensitivity. It is the claim that elements of semantic combination cannot be reused or discarded and is derived from the resource logical approach to the syntax–semantics interface and semantic composition, in particular Glue Semantics. The hypothesis is general, but with respect to semantics it is the claim that elements of semantic combinatorics cannot be reused or discarded. Resource logics yield a useful perspective on linguistic combinatorics in general (phonology, syntax, semantics), but must be constrained by linguistic theory in order to maintain a linguistically useful notion of Resource Sensitivity. It is argued that a number of proposals in the literature can be reduced to Resource Sensitivity while maintaining their insights.

The hypothesis is investigated empirically with respect to resumptive pronouns. A detailed descriptive overview of resumptive pronouns is presented. I argue that resumptives are ordinary pronouns based on their morphological exponence, their interpretation, and their behaviour in a number of syntactic tests. Resumptive pronouns challenge Resource Sensitivity, since they seem to constitute surplus resources for semantic composition. A resource management theory of resumption is presented, which introduces the licensing mechanism of manager resources. Manager resources remove a pronoun from composition through lexical specifications associated with complementizers. Cross-linguistic variation for grammaticized resumptives is explained as lexical variation. The resource management theory of resumption is integrated in a Lexical Functional Grammar syntax and architecture.

The theory is applied to analyses of resumptive pronouns in Irish, Swedish and Hebrew. The analysis of Irish treats both resumptive dependencies and filler-gap dependencies, including difficult mixed patterns. The analysis of Swedish achieves a novel unification of the Swedish resumptive

system with those of Irish and Hebrew. In each case, a manager resource that is specified as part of a complementizer's lexical entry licenses the resumptive pronoun. The key difference between Swedish on the one hand and Irish and Hebrew on the other is not the licensing mechanism, but whether the mechanism is local to the top of the unbounded resumptive dependency (Irish, Hebrew) or to the bottom (Swedish). Apparently problematic Swedish weak crossover, reconstruction, parasitic gap, and across-the-board extraction data are shown to in fact support the resource management theory.

A processing model for production and parsing is proposed that explains certain resumptive-like pronouns in English and Swedish which are not fully grammaticized. The production component explains how non-grammaticized resumptives are produced, both in positions that are inaccessible to fillers and in positions where fillers may freely occur. The explanation rests on the LFG treatments of fragments, unbounded dependencies, and island constraints. The parsing model explains a number of effects observed for English and Swedish resumptive-like pronouns. It provides a model of incremental, partial interpretation that explains why the English pronouns cannot be bound pronouns. It also provides a notion of complexity that explains certain amelioration effects for English and Swedish resumptives.

The resource management theory is extended to copy raising in English. Copy raising pronouns are argued to constitute a problem for composition, like resumptive pronouns. Copy raising pronouns are licensed by manager resources like those that license resumptive pronouns, but manager resources for copy raising are specified in the lexical entries for the raising verbs involved, rather than in entries for complementizers. This explains why a language like English can have resumption in copy raising, but lack it in unbounded dependencies. A unified theory of resumption which covers both resumptive pronouns and copy raising is thus achieved.

I also consider a class of perception verbs that apparently pattern like copy raising verbs. I argue that the crucial difference is that the perception verbs do not require pronominal copies in their complements and therefore do not constitute true copy raising verbs. The striking similarities between the two verb classes are explained by their having syntactically identical complementation possibilities, despite their differences in semantic composition with respect to copy pronouns. The syntax of the copy raising and perception verbs is investigated in detail. Their behaviour with respect to expletives is shown to be particularly challenging for linguistic theory.

Acknowledgements

It's fitting that I'm wrapping things up in Oscars week, because it reminds me that the best acknowledgements are short and sweet. I'm not sure how sweet I can be, but I'll try to be short.

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I owe a lifetime of debts and thanks to my parents, Isa Asudeh and Behin Safavi, and my sister Alli. I dedicate this thesis to them.

Lastly, I'd just like to say that I enjoy a good non sequitur.

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Chapter 1

Introduction

1.1 Resource logic and linguistic theory

This dissertation explores the consequences of a rather simple hypothesis about natural languages that has been alluded to or implicitly assumed in much work in theoretical linguistics yet has rarely received explicit attention:

(1.1) Natural language is universally *resource-sensitive*.

I investigate the hypothesis with respect to the syntax–semantics interface and semantic composition. I will also briefly discuss it in relation to phonology and syntax.

As a claim about semantic composition, the hypothesis is that the meaning of an expression is produced by consuming the meaning of each part of the expression *exactly once*. For example, consider the following sentence:

(1.2) Kim fooled Sandy.

The meanings of the words *Kim*, *Sandy*, and *fooled* can each be used to produce the meaning in (1.3) for sentence (1.2), but it is not possible to disregard the meaning of *Sandy* and to use the meaning of *Kim* twice to derive the meaning in (1.4).

(1.3) $fool(kim,\ sandy)$

(1.4) $fool(kim,\ kim)$

Or consider the following example of adverbial modification:

(1.5) This innocent man is allegedly guilty, according to some.

We cannot use the single occurrence of the adverb *allegedly* twice to give (1.5) a meaning equivalent to that of (1.6).

(1.6) This allegedly innocent man is allegedly guilty, according to some.

The two sentences are truth-conditionally distinct, since (1.5) entails that the man is innocent, whereas (1.6) does not.

The hypothesis (1.1) is called *Resource Sensitivity*. I derive it here from Glue Semantics (among others, Dalrymple et al. 1993, Dalrymple 1999, 2001), a theory that formalizes the syntax–semantics interface and semantic composition using the resource logic *linear logic* (Girard 1987). Linear logic is a substructural logic of great importance to proof theory, a subfield of theoretical computer science and formal logic. Although a resource accounting perspective on semantic composition has been implicit in certain proposals, and even occasionally explicit (e.g., van Benthem 1991/1995, Dalrymple et al. 1993, 1999b, Moortgat 1997, Bouma et al. 1999, Kruijff and Oehrle 2004b), it has not previously served as the basis for a research hypothesis. The simplicity of resource sensitivity belies its power to yield substantial empirical, theoretical, and formal gains for linguistic theory.

In Glue Semantics (Glue), lexical items (and possibly constructions, depending on auxiliary assumptions) contribute *meaning constructors*. Each meaning constructor consists of a term from a meaning language paired with a term of linear logic. Semantic composition is handled by linear logic proofs on the lexically-contributed meaning constructors, which serve as premises in the proof. Since linear logic is a resource logic, every meaning constructor must be used in the semantic derivation and no meaning constructor may be used more than once. A successful Glue derivation converges on a linear logic term. This will be a t-type atom for sentential semantics, but possibly a more complex term for proofs of subsentential constituents (e.g., relative clauses). Each premise that contributes to the proof must be used exactly once. Semantic ambiguity corresponds to multiple proofs from the same set of premises.

Resource Sensitivity is best tested by empirical phenomena that exhibit either *resource deficit*, where there are apparently too few meanings to go around, or *resource surplus*, where there are apparently more meanings than required. Coordination is an example of resource deficit. For example, in the following sentence there is a single resource contributed by the subject *Kim* and two consumers of this resource, contributed by *sang* and *danced*:

(1.7) Kim sang and danced.

Asudeh and Crouch (2002a) provide a generalized Glue Semantics for coordination that allows coordinators like *and* to handle the resource needs of the coordinated constituents in a manner that is analogous to, but ultimately different from, polymorphic coordination in Categorial Grammar (Steedman 1985, Emms 1990, Carpenter 1997). Other Glue work on resource deficit issues includes Kehler et al. (1999) on right-node raising, and Asudeh (2000, 2002a, 2003b) and Asudeh and Crouch (2002c) on control.

The focus of this dissertation is the opposite problem of *resource surplus*. The empirical focus is the phenomenon of *resumption*. The term resumption is standardly associated with resumptive pronouns, like the underlined pronoun *í* ('her') in the following Irish relative clause example (McCloskey 2002:189, (9b)):

(1.8) an ghirseach ar ghoid na síogaí <u>í</u>
the girl COMP.PAST stole the fairies her
the girl that the fairies stole away

One of the principal theoretical goals of this dissertation is to extend resumption to include *copy raising* (Postal 1974, Horn 1981, Rogers 1973, Joseph 1976, Perlmutter and Soames 1979). Copy raising occurs when a raising verb takes a complement that is syntactically complete, typically finite, and contains a pronoun that is obligatorily bound by the raising verb's subject, as in (1.9).

(1.9) No runner seems like <u>she</u> just ran a marathon.

Copy raising is somewhat limited in English, but it is not typologically uncommon and is the standard mechanism for raising in languages that lack clausal infinitives (e.g., Farsi (Persian); Greek and other Balkan languages). Intuitively, both resumptive pronouns and copy raising pronouns occupy a position that needs to be left open for semantic composition. If the resumptive pronoun were interpreted just like a normal pronoun, saturating some argument position, then the scope of the unbounded dependency would be sealed off and there would be no way to compose in the head of the unbounded dependency. Similarly, the copy raising verb's subject must saturate the position in the semantics corresponding to the copy pronoun, since the raising verb does not take its matrix subject as an argument. Despite the similarities between them, the two phenomena have resisted a unified analysis, because resumptive pronouns have standardly been analyzed purely in terms of unbounded dependencies. This is problematic for raising, a process that is lexically governed and considerably more local than an unbounded dependency analysis would predict. There is a substantial literature on resumptive pronouns, but it has been quite difficult to give a satisfactory theoretical definition of the term, let alone to extend it to copy raising.

Resource Sensitivity gives a new theoretical perspective on resumption: resumption is the apparent surplus of a resource contributed by a pronoun. Thus, the hypothesis approaches resumption as a problem at the syntax–semantics interface and in particular a problem about the relationship between syntax and semantic composition. This allows the formalization of the intuition that the phenomena of resumptive pronouns and copy raising are related, while maintaining the theoretical insights that have previously blocked a unified analysis. Importantly, the theory presented here treats the pronouns involved in resumption as just ordinary pronouns. Resource sensitivity predicts that there must be a special licenser for the pronoun that consumes the pronoun's resource.

In the rest of this introduction I consider the problem of defining the term *resumptive pronoun* and consider in a little more detail the resource logic perspective (section 1.2). I go on to discuss at a fairly intuitive level the empirical predictions and theoretical implications of this theory with respect to resumptive pronouns and copy raising (section 1.3). The chapter concludes with an outline of the dissertation (section 1.4).

1.2 A new perspective on resumption

Consider the following two sentences:

(1.10) Every girl thinks that the fairies stole <u>her</u> away.

(1.11) *Every girl who the fairies stole <u>her</u> away wept.

The pronoun in the second sentence is a resumptive pronoun. The sentence is ungrammatical because the grammar of English does not license this use of pronouns (Chao and Sells 1983, Sells 1984). But why is the pronoun in (1.11) a resumptive pronoun, while the pronoun in (1.10) is not? What is the definition of a resumptive pronoun? Despite the substantial literature on resumptive pronouns, it has been quite difficult to define *resumptive pronoun* in a theoretically sound manner and the term is typically defined only ostensively. In this section I discuss why this is so and in the following section I show how the resource logic perspective sheds new light on resumptive pronouns and yields a satisfactory theoretical definition.

1.2.1 What *is* a resumptive pronoun?

The intuitive difference between the pronouns in (1.10) and (1.11) is that the latter pronoun occurs where a gap might otherwise occur. Removal of the pronoun in (1.11) results in a well-formed sentence of English in which a gap occurs in place of the ungrammatical pronoun. Based on this difference, we might define resumptive pronouns as follows:

(1.12) **Resumptive pronoun (definition 1)**
A resumptive pronoun is a pronoun that occurs where a gap might otherwise occur.

This definition may satisfy our intuition, but it is theoretically problematic. First, the notion of "occurring where a gap might otherwise occur" is inherently transderivational. According to (1.12) we can only identify a sentence S1 as containing a resumptive pronoun if we look at a second sentence S2 that is identical in every way to S1 except that the pronoun has been removed. Transderivational rules and constraints have been argued against extensively in the literature on both empirical and theoretical grounds (recent work includes Jacobson 1998, Johnson and Lappin 1997, 1999, Potts 2001, 2002b, Pullum and Scholz 2001).

Second, even if we grant the transderivationality of (1.12), it is insufficient for well-known resumptive pronoun languages. For example, gaps and resumptive pronouns are in near-complementary distribution in Welsh (Sells 1984, Willis 2000). Another example comes from Swedish, where resumptives typically occur after a complementizer (Engdahl 1985). Removal of the resumptive pronoun would lead to an ungrammatical *that*-trace violation (in the dialect of Swedish that is most widely reported). Palestinian Arabic provides a yet stronger case: gaps and resumptive pronouns are in complete complementary distribution (Shlonsky 1992). It is therefore not true that a resumptive pronoun in Welsh or Swedish or Palestinian Arabic occurs where a gap might otherwise occur, because gaps cannot occur in the relevant positions. In fact, all resumptive pronoun languages have at least some environments in which resumptives can occur but in which gaps cannot (Sells 1984). Thus, a tranderivational reading of (1.12) is not sufficient. What is required is a *translinguistic* reading: "where a gap might otherwise occur" must be interpreted as where a gap might occur in *the corresponding sentence in another language*. This might capture the intuition that linguists have about resumptive pronouns, but it is nonsense as a theoretical postulate: no grammatical theory can even state a translinguistic constraint. Definition 1 must therefore be rejected.

Maintaining the intuition that the difference between (1.10) and (1.11) has to do with the unbounded dependency (relativization) in the latter, a second descriptive definition might be attempted:

(1.13) **Resumptive pronoun (definition 2)**
A resumptive pronoun is a pronoun that occurs at the foot of an unbounded dependency.[1]

[1] In different parlance, a resumptive pronoun is a pronoun that is the tail of an $\overline{\mathrm{A}}$-chain.

This is broadly speaking correct, but fails to get at the heart of the matter. In particular, resumptive pronouns by and large do not behave as if they are in typical unbounded dependencies, i.e. filler-gap dependencies. Resumptives are generally not island-sensitive (McCloskey 1979, 1990, 2002, Sells 1984), they do not show weak crossover effects (McCloskey 1990), and they can trigger different morphological effects from gaps (McCloskey 1979, Sells 1984). Although this definition captures a key pre-theoretical intuition about resumptive pronouns, it leads to several theoretical complications. We will also shortly see that it is not sufficiently general.

An early theoretical definition cast in Principles and Parameters theory (P&P) was offered by Sells (1984:16):

(1.14) **Resumptive pronoun (definition 3)**
A resumptive pronoun is a pronoun that is operator bound.

An operator is a *wh*-phrase or quantified NP in an $\overline{\text{A}}$-position (i.e., non-argument position).

This definition fails to distinguish between (1.10) and (1.11) though. Under the theoretical assumptions of P&P, the quantified subject in (1.10) moves to an $\overline{\text{A}}$-position and is an operator at the level of Logical Form (LF). The definition must be reworked to exclude LF operators. Sells (1984:26) realizes this and refines his definition as in (1.15) (also see Sells 1987:1).

(1.15) **Resumptive pronoun (definition 4)**
A resumptive pronoun is a pronoun that is operator bound at S-structure.

The revised definition distinguishes (1.10) from (1.11), but it is too narrow, both theoretically and empirically. The invocation of S-structure presumes a model of grammar that is derivational / transformational. The definition therefore fails to extend to monostratal / non-transformational syntactic theories, such as Categorial Grammar (Buszkowski et al. 1988, Oehrle et al. 1988, Morrill 1994, Steedman 2000), Head-Driven Phrase Structure Grammar (HPSG; Pollard and Sag 1994, Ginzburg and Sag 2001), and Lexical Functional Grammar (LFG; Kaplan and Bresnan 1982, Bresnan 2001, Dalrymple 2001).[2] Furthermore, S-structure is not even an accepted level in the latest version of transformational grammar (the Minimalist Program; Chomsky 1995). The definition in (1.15) is theoretically narrow and cannot be realized in current terms.

[2]Some further examples are: Arc Pair Grammar (Johnson and Postal 1980), Autolexical Syntax (Sadock 1991), Construction Grammar (Fillmore et al. 1988, Goldberg 1995), Dynamic Syntax (Kempson et al. 2001), Generalized Phrase Structure Grammar (Gazdar et al. 1985), Parallel Architecture (Jackendoff 1997), Relational Grammar (Perlmutter and Postal 1977, Perlmutter 1983), and Word Grammar (Hudson 1984, 1990).

These theoretical objections may be small beer, but the operator-binding definition (1.15) is also insufficiently general, a problem it shares with the unbounded dependency definition (1.13). These definitions fail to cover the intuitively resumptive-like use of pronouns in copy raising:

(1.16) Every baby seemed like she enjoys crackers.

(1.17) *Every baby seemed like I enjoy crackers.

The matrix subject in copy raising must be obligatorily "copied" by an appropriate pronoun in the complement clause. The raising verb does not take the matrix subject as a thematic argument. The subject must be interpreted as the argument of the complement clause. The obligatoriness of the copy pronoun indicates that the subject is interpreted in the position of the pronoun. Ura (1998) and Boeckx (2003) have noted that copy raising might be construed as the A-movement analog to $\overline{\text{A}}$-movement resumptives. There is a germ of descriptive truth to this observation, but we will shortly see reasons for it being unmaintainable as a theoretical position.

The operator-binding definition (1.15) fails to extend to copy raising because it cannot distinguish between copy raising and S-structure binding of a resumptive, as in (1.11). The copy pronoun's antecedent must be in an A-position at S-structure in order to satisfy the subject requirement of English clauses (i.e., the Extended Projection Principle). The pronoun is therefore not operator-bound at S-structure. In terms of operator-binding, copy raising is equivalent to the non-resumptive sentence (1.10) rather than the resumptive sentence (1.11).

The unbounded dependency definition of resumptive pronouns also fails to extend to copy raising. First, copy raising, like infinitival and predicative raising, is a lexically governed property of certain verbs. For example, in English only *seem* and *appear* are true copy raising verbs. Other verbs that display superficially similar behaviour (e.g., *look*, *smell* and other *perceptual resemblance* verbs) in fact do not require a copied pronoun in their complement:

(1.18) Thora smells like someone has been baking bread.

Second, copy raising (like other forms of raising), is a local dependency between syntactic arguments of a particular verb. This is emphasized by the ungrammaticality of attempting to copy-raise across an intervening subject:

(1.19) *Thora thought that I seemed like she enjoyed crackers.

Copy raising should therefore not be analyzed in terms of unbounded dependencies, like resumptive pronouns have been, and should instead be analyzed in terms of raising-type dependencies.

Raising in Principles and Parameters is an instance of A-movement (i.e., “NP-movement”). An A-movement analysis of copy raising as subject-to-subject raising has been proposed by Ura (1998) for Igbo, but it has been criticized on both theory-internal and theory-external grounds (Potsdam and Runner 2002, Asudeh 2004). A central problem that a movement analysis of at least English copy raising would face is that it flies in the face of a key generalization about English, and possibly language in general: A-movement out of a tensed clause is impossible (the Tensed S Condition; Chomsky 1973).[3] Under more recent Minimalist assumptions, the central problem is why an element X would move from a position P when 1) P satisfies all of X’s feature-checking requirements and 2) X satisfies all of P’s feature-checking requirements.

Boeckx (2001, 2003) proposes a Minimalist analysis of resumptive pronouns and briefly mentions that it could possibly be extended to copy raising (Boeckx 2001:76–77,165–166, fn.1), although he explicitly sets this phenomenon aside. His analysis involves Merging a constituent consisting of a resumptive pronoun and its antecedent and subsequent $\overline{\mathrm{A}}$-movement of the antecedent, stranding the resumptive pronoun in the base position. The straightforward extension of this analysis to copy raising — Merge of pronoun and antecedent plus subsequent *A-movement* and stranding — would encounter the same problem as Ura’s analysis: why is A-movement possible out of a tensed clause?

In sum, it is difficult to give a theoretically acceptable definition of resumptive pronouns that:

1. Relates resumptive pronouns to gaps.
2. Properly distinguishes resumptive unbounded dependencies from unbounded dependencies with gaps.
3. Relates resumptive pronouns to copy raising pronouns.
4. Properly distinguishes the relationship between the antecedent and the resumptive in an unbounded dependency from the relationship between the antecedent and the pronoun in copy raising.

Given just the first two problems, it is unsurprising that despite the reasonably large literature on resumptive pronouns very few explicit definitions of *resumptive pronoun* have been offered, with

[3] Potsdam and Runner (2002) note that although the Tensed S Condition is theoretically outdated, it effectively continues to be part of transformational theory in the Minimalist Program and holds under Chomsky’s recent theory of *phases* (Chomsky 2000, 2001). Phases include tensed clauses (CPs). In order for an element to undergo A-movement out of a phase it must first move to the edge of the phase. However, there is no motivation for A-movement to the edge of CP, since no features of the moved element or landing site need checking. In other words, the problem identified using the descriptive term “Tensed S Condition” can be characterized in current transformational theory in terms of phases.

the term typically defined purely ostensively.

1.2.2 The resource logic perspective

The use of a resource logic for semantic composition in Glue Semantics gives a fresh perspective on resumption that allows resumptive pronouns and copy raising pronouns to be treated uniformly while capturing the differences between the two through the interplay of lexical specifications and the usual mechanisms for anaphoric binding and unbounded dependencies.

Like other lexical items, a pronoun contributes a *meaning constructor* that pairs a meaning term with a linear logic term. The linear logic term is a resource that must be properly accounted for in the semantic derivation. For example, consider the following sentence:

(1.20) Thora said Pelle scratched her.

The transitive verb *scratched* contributes a resource that consumes two other resources, which are contributed by the arguments of the verb, *Pelle* and *her*.

A resumptive pronoun is just like a non-resumptive pronoun in contributing a resource. However, in this case the pronominal resource is not consumed by the verb in semantic composition. The spot in the semantics that corresponds to the resumptive pronoun must be left open in order for the displaced head of the unbounded dependency to compose with its scope. Similarly, a copy raising pronoun contributes an extra resource, because it is the copy raising verb's subject that fills the corresponding spot in the semantics. Without getting into formal details, the generalized theoretical definition of resumption from the resource logic perspective is:

(1.21) **Resumption (informal definition)**
Resumption is the presence of a surplus pronominal resource.

The resumptive pronoun's resource is surplus to the basic compositional requirements of the sentence that it appears in, but it must be consumed by something in order for there to be a successful derivation of the semantics in which all resources are properly accounted for.

Therefore, a resumptive pronoun is only licensed in the presence of a special licenser that consumes the pronominal resource. These licensers are *manager resources*. Resumptive pronouns and copy raising are unified as cases of an excess pronoun that is consumed by a manager resource. However, the way in which the manager resource is contributed differs between the kinds of resumption. In the case of resumptive pronouns, the manager resource is contributed through the complementizer system. This is theoretically desirable, since resumptive pronouns are involved in unbounded dependencies and it has been well-established that complementizers and their surrounding syntactic material are intimately involved in such dependencies. For example, in the Irish resumptive pronoun sentence in (1.8) above, it is the resumptive-sensitive complementizer *ar* that contributes the manager resource. By contrast, the manager resource in copy raising is contributed by the copy raising verb. This too is theoretically desirable, since raising is a lexically governed, local relation between a verb and its arguments. The possibility of resumption is in general governed *lexically*.

The formalization of resumption is described in the body of the thesis, but it does not hurt to dip in an anticipatory toe. A pronoun contributes the sort of linear logic resource shown schematically in (1.22). The linear logic term is paired with a meaning term, which I leave aside for now. The connectives are linear implication ($\multimap$) and (multiplicative) linear conjunction ($\otimes$).

(1.22) $A \multimap (A \otimes P)$

A represents the antecedent of the pronoun and P represents the pronoun. This treatment of anaphora is variable-free (Jacobson 1999): the pronoun is a function on its antecedent. As a function, the pronoun consumes its antecedent's resource (i.e., its argument's resource) to yield its own resource, taking on the antecedent's meaning.[4] However, the pronoun must not consume the only occurrence of the antecedent's resource. If it were to do so, then the antecedent could not serve any further role in composition, be it as an argument, as part of a functor, or even as the antecedent of another pronoun. The pronoun must therefore ensure that the antecedent resource that is consumed is also replicated, to be used elsewhere.

A manager resource contributes a resource that consumes a pronominal resource:

(1.23) $[A \multimap (A \otimes P)] \quad \multimap \quad (A \multimap A)$

The pronoun's resource is consumed to produce a function on its antecedent.[5]

A pronoun, its antecedent, and a manager resource together yield just the antecedent: the pronoun is removed from composition. This is sketched in the simple linear logic proof in Figure 1.1 on page 11. The proof uses only two instances of implication elimination (*modus ponens*). Corresponding meanings are derived in the associated meaning logic, which is not shown here.

[4]I am being purposefully vague for the moment. The final result of "taking on the antecedent's meaning" depends on how the pronoun is bound or takes its reference.

[5]Notice that consuming the pronoun to produce just the antecedent A, rather than the implication $A \multimap A$, would *replicate* the antecedent resource, illicitly adding an additional copy of the antecedent to the resource pool.

Antecedent   *Pronoun*   *Manager resource*   ***Lexical contributions***[6]

$$\cfrac{A \qquad \cfrac{A \multimap (A \otimes P) \qquad [A \multimap (A \otimes P)] \multimap (A \multimap A)}{A \multimap A}\multimap_{\mathcal{E}}}{A}\multimap_{\mathcal{E}}$$

Manager resource removes pronoun

Result of pronoun removal combines with antecedent; final result is just antecedent

Figure 1.1: A manager resource removes a pronominal resource

A note on terminology

I will reserve the terms *resumptive* and *resumptive pronouns* for the unbounded dependency pronouns that have traditionally received these names. To diverge from common usage at this point would be confusing and it is in any case useful to have terms specifically for this kind of resumption. I will also continue to use the terms *copy raising pronoun* and *copy pronoun*, even though there is no copying in the analysis I propose, just anaphoric binding. I introduce the new term *resumption pronoun* to refer to both resumptives and copy pronouns. I will refer to unbounded dependencies that terminate in a gap as *filler-gap dependencies* and ones that terminate in a resumptive as *binder-resumptive dependencies*.

1.3 Theoretical implications and empirical predictions

The resource management theory is a unified theory of resumption that accounts for both resumptive pronouns and copy raising in resource logical terms, while maintaining key differences between the two phenomena that have blocked unified analyses. The analysis treats resumptive pronouns and copy raising pronouns just like ordinary pronouns in terms of both their syntax and their semantics. This means that the terms *resumptive pronoun* and *copy raising pronoun* are not theoretical constructs, but rather just descriptive labels. Resumption pronouns as such have been eliminated from the theory — ordinary pronouns are all there is.

The first two predictions of the analysis are therefore:

1. Resumption pronouns are morphologically identical to non-resumptive pronouns with the

[6]The antecedent resource contributed here is appropriate for a type e nominal, such as a name. A higher-type binder, such as a quantifier, introduces a dependency on such a resource instead. I leave this issue aside for the time being.

same case and agreement features (McCloskey 2002).

2. Resumption pronouns inherit any general restrictions on pronominal interpretation (Doron 1982, Sells 1984, Sharvit 1999).

Both of these predictions are borne out by the data.

The third prediction of the analysis has to do specifically with resumptive pronouns. The analysis treats binder-resumptive dependencies in terms of anaphoric binding and resource management. Filler-gap dependencies are instead treated as involving structure-sharing at functional structure, using the usual LFG mechanisms of functional equality (Kaplan and Bresnan 1982) and functional uncertainty (Kaplan and Zaenen 1989). Binder-resumptive unbounded dependencies are therefore not reducible to filler-gap dependencies. The analysis predicts that:

3. Binder-resumptive dependencies are not island-sensitive.

The analysis predicts this because resumptives are analyzed in terms of anaphoric binding, a mechanism that is not affected by islands. Although some recent work has challenged this generalization (Boeckx 2003), it is generally quite robust and other current work in the same framework seeks to maintain it (McCloskey 2002).

Resumption pronouns are licensed by manager resources. These are lexically contributed meaning constructors and are therefore specified in particular lexical entries. The analysis is thus solidly lexicalist:

4. Resumption is licensed through the presence of lexically-specified licensers in lexical inventories.

Theories as otherwise disparate as Lexical Functional Grammar, Head-driven Phrase Structure Grammar (Pollard and Sag 1994), Categorial Grammar (Buszkowski et al. 1988, Oehrle et al. 1988), and the Minimalist Program (Chomsky 1995) have converged on the desirability of locating language variation in the lexicon.

Given the uncontroversial premise that lexical specification affects morphological exponence, the analysis makes the following further prediction:

(1.24) Resumptive licensers may be distinguished by morphology or lexical class.

Irish and Welsh have resumptive-sensitive complementizers that show distinct morphological marking from non-resumptive complementizers and which have distinct morphophonological effects (mutations) on subsequent material (Awbery 1977, McCloskey 1979, Sells 1984, Willis 2000). English copy raising verb are distinguished by lexical class: only a very limited subset of raising verbs allow copy raising (*seem* and *appear*).

Finally, the theory offers an answer to what must be one of the central questions about resumption:

(1.25) Why are only pronouns used for resumption?[7]
Pronouns are the only items used for resumption because they lack inherent meaning.

The Glue Semantics specification of the linear logic term for a pronoun and the way in which pronouns take their antecedents are such that pronouns are the only lexical items that can be consumed by manager resources. Only pronouns can be used in resumption because they are the only things that have the correct form to be consumed by manager resources. But why do pronouns have this form? They have this form because on a variable-free theory of anaphora, such as the one presented here, a pronoun is a function on its antecedent. However, the pronoun must also replicate the antecedent resource. The answer thus becomes that pronouns are used in resumption because of how they receive their meanings. But why do pronouns receive their meanings in this manner? Pronouns receive their meanings in the specific manner that they do because they lack inherent meaning and must take on the meaning of their antecedent, through saturation, coreference, or binding. In other words, pronouns are the only items used for resumption because they lack inherent meaning. Pronominal elements can be consumed by manager resources because it is precisely these elements whose removal is recoverable from elsewhere in the semantics.

1.4 Outline of the dissertation

Part I • Resource Sensitivity: The Formal Theory

Chapter 2 · An overview of LFG and Glue Semantics

Chapter 2 begins the main part of the dissertation with a review of Lexical Functional Grammar, the theory of syntax that is assumed throughout, and Glue Semantics, the theory of the syntax–semantics interface and semantic composition which captures the hypothesis of Resource Sensitivity through the use of linear logic for semantic composition.

[7]Epithets in Lebanese Arabic can be used resumptively, but the crucial property that allows this is the presence of pronominal information in the epithet (Aoun and Choueiri 2000, Aoun et al. 2001).

In the LFG overview, I first review the grammatical architecture, since this will help make clearer the syntax–semantics interface in LFG with Glue Semantics. I then present the syntactic levels of c(onstituent)-structure and f(unctional)-structure in some detail. In the section on constituent structure, I present Toivonen's theory of phrase structure (Toivonen 2001, 2003), which I assume throughout the thesis. The section on functional structure presents the c-structure to f-structure mapping and the key well-formedness conditions on functional structures. The c-structure and f-structure sections are followed by a review of the level of semantic structure, which is relevant to Glue Semantics. In addition to the fundamentals of the theory, I present reasonably standard LFG treatments of unbounded dependencies and raising, since these will be of key importance in Parts II and III.

The overview of Glue Semantics will be a little more detailed, both because the theory is less familiar than LFG and because it lies at the heart of the theoretical proposals that are made throughout the dissertation. I first present Glue in terms of the resource logic that underpins it, linear logic. I discuss the various linear logic proof rules which are responsible for composition and explore the Curry-Howard isomorphism (Curry and Feys 1958, Howard 1980), which relates linear logic terms to terms in the meaning language that represents the truth-conditional semantics. The next section presents the variable-free treatment of anaphora, since the theory of anaphoric binding is a crucial component of the resource management theory of resumption. The following section presents the analysis of quantifiers and the proof-theoretic treatment of quantifier scope. Scope ambiguity is realized as multiple proofs from the same set of premises; there is no syntactic ambiguity posited and no need for type shifting. Finally, I sketch the combinatorics for unbounded dependencies in Glue. Example Glue proofs are given throughout the section.

Chapter 3 · **The resource-sensitivity of natural language**

Chapter 3 lays out the hypothesis of the dissertation, that natural language is *resource-sensitive*. I first discuss the contribution that substructural logics can make to linguistic theory. I present three key structural rules of *weakening*, *contraction*, and *commutativity* and discuss how these rules define a hierarchy of logics, some of which are resource logics.

In the second part of the chapter I examine two notions of resource sensitivity: Logical and Linguistic Resource Sensitivity. The former is a notion of resource sensitivity that comes from resource logics as characterized by structural rules. The latter is the substantive hypothesis about language introduced in (1.1) above. I demonstrate that the relationship between Logical and Linguistic Resource Sensitivity is real but potentially complex. In particular, the connectives that are present in the resource logic affect the relationship between the two. Although, Logical Resource Sensitivity forms the basis for Linguistic Resource Sensitivity, the latter requires further constraints from a substantive theory of language in the form of a proof goal.

The third and final part of the chapter considers various proposals in the theoretical linguistics literature which I argue to be implicit appeals to Resource Sensitivity. The proposals I consider are Bounded Closure in type-driven translation (Klein and Sag 1985), completeness and coherence (Kaplan and Bresnan 1982), the Theta Criterion (Chomsky 1981), the Projection Principle (Chomsky 1981, 1982, 1986), the ban on vacuous quantification (Chomsky 1982, 1995, Kratzer 1995, Kennedy 1997, Heim and Kratzer 1998, Fox 2000), the Principle of Full Interpretation (Chomsky 1986, 1995), and numerations and the Inclusiveness Condition (Chomsky 1995). I show that Resource Sensitivity not only captures the important insights behind these proposals, but also solves certain empirical and theoretical problems with them. Resource Sensitivity thus paves the way to a new understanding of these proposals and their potential elimination.

Part II • Resumptive Pronouns

Chapter 4 · A descriptive overview

Chapter 3 identifies and discusses seven core characteristics of resumptive pronouns from a crosslinguistic perspective:

A. Resumptive pronouns occur in unbounded dependencies.

B. Resumptive pronouns are interpreted as bound pronouns.

C. Resumptive pronouns are the ordinary pronouns of the language.

D. Resumptive pronouns and gaps have distinct syntactic distributions.

E. Resumptive pronouns display restrictions on their interpretation which gaps do not and which correlate with restrictions on the interpretation of non-resumptive pronouns.

F. Resumptive pronouns do not display certain key characteristics of gaps.

G. Resumptive pronouns resemble gaps in their interaction with certain grammatical phenomena.

Data is considered from a number of resumptive pronoun languages, but primarily Irish, Hebrew, and Swedish. Property G initially seems to be problematic for the theory, but I show in chapter 7 that it is not.

I discuss two possible kinds of theories of resumptive pronouns. The first kind of theory holds that resumptive pronouns are essentially like gaps, that binder-resumptive dependencies involve similar mechanisms to filler-gap dependencies, or that resumptives themselves are alternative realizations of gaps (i.e., “spelled out traces”). Crucially, this kind of theory entails that resumptives are somehow different from non-resumptive pronouns, since normal pronouns and pronominal binding are not gap-like. I call this kind of theory a *special pronoun* theory of resumptive pronouns. The second kind of theory holds that resumptive pronouns are not like gaps and that they are instead exactly like non-resumptive pronouns. I call this kind of theory an *ordinary pronoun* theory. The resource management theory of resumption is an ordinary pronoun theory. I argue based on the properties of resumptives and data examined in this chapter that an ordinary pronoun theory is preferable to a special pronoun theory on empirical and theoretical grounds. The debate is pursued further in chapter 7, where certain challenges to ordinary pronoun theories are met.

Chapter 5 · Resumptive pronouns as resource surplus

Chapter 5 presents the Glue theory of resumption that stems from Resource Sensitivity and the use of a resource logic for semantic composition. The logic behind the proposal is this: if a resumptive pronoun is an ordinary pronoun that constitutes a surplus resource and if Resource Sensitivity is to be maintained, then there must be an additional consumer of the pronominal resource present. These are the manager resources discussed in section 1.2.2 above. The problem of resumptives as resource surplus is explored in detail. I begin by quickly reviewing the variable-free Glue theory of anaphora. Next the resource surplus problem is identified by looking at how a resumptive pronoun results in ungrammaticality for English relativization. I then introduce manager resources at a fairly abstract level.

The second part of the chapter deals with incorporating the resource management theory into Lexical Functional Grammar. It addresses how manager resources are lexically specified and how the theory of resumptives interacts with the LFG theory of unbounded dependencies. I show that manager resources can be specified completely locally, except for the part that deals with anaphoric binding, which is independently known to be a non-local process. I also address a potential alternative LFG analysis and argue that it is problematic.

The third and final part of the chapter considers the theoretical implications and empirical predictions of the analysis, as sketched in section 1.3 above. The chapter closes with a consideration of how the characteristics of resumptive pronouns that were identified in chapter 4 are explained on the resource management theory.

Chapter 6 · Resumptives in Irish

Chapter 6 is the first of two chapters that apply the resource management theory of resumptive pronouns in empirical analyses. This chapter applies the theory to the analysis of Irish unbounded dependencies. The central mechanism of manager resources is embedded in a lexicalist analysis of the Irish complementizers, which register filler-gap dependencies (*aL*), binder-resumptive dependencies (*aN*), or simple embedding with no unbounded dependency (*go*) (McCloskey 1979, 1990, 2002). I begin by looking at the core patterns of unbounded dependencies, which are as follows:

(1.26) $[_{\mathrm{CP}}\ aL \ldots [_{\mathrm{CP}}\ aL \ldots [_{\mathrm{CP}}\ aL \ldots \_\_ \ldots]]]$

(1.27) $[_{\mathrm{CP}}\ aN \ldots [_{\mathrm{CP}}\ go \ldots [_{\mathrm{CP}}\ go \ldots\ pro \ldots]]]$

The filler-gap complementizer *aL* typically marks the dependency from the top to the bottom. The binder-resumptive complementizer *aN* typically marks the top of the dependency, with the neutral complementizer *go* marking lower positions.

LFG's Extended Coherence Condition (ECC) requires that unbounded dependencies be properly integrated into the grammatical representation (Zaenen 1980, Bresnan and Mchombo 1987, Fassi-Fehri 1988). This can be done either by functional equality, i.e. structure-sharing of a value between two grammatical functions at the level of functional structure, or by anaphoric binding (Bresnan and Mchombo 1987). Both of these mechanisms are independently motivated aspects of LFG theory. I argue that the Irish complementizers *aL* and *aN* play a crucial role in satisfying this well-formedness condition.

The role of the filler-gap complementizer *aL* is to *ground* the unbounded dependency in the structure containing the gap and to *pass* the dependency between successive complement clauses until the filler is reached. The complementizer performs this role through functional equality. The effect is analogous to that of successive-cyclic movement, but without any movement transformations. The result is proper integration of the unbounded dependency into the grammatical representation and satisfaction of the ECC. The successive passing of the filler-gap dependency results in marking of each intervening clause with *aL*. I show that the island-sensitive nature of filler-gap dependencies in Irish follows directly.

The binder-resumptive complementizer *aN* also grounds an unbounded dependency, but it does so by anaphoric binding of a resumptive pronoun. It contributes a manager resource and permits construction of a valid linear logic proof with no left-over pronominal resource. The anaphoric dependency between the binder and the resumptive occurs without successive passing, which accounts for the marking pattern of a single *aN* at the top of the dependency and for the lack of island sensitivity of Irish resumptives, since anaphoric binding is not island-sensitive.

The analysis is extended to deal with the "mixed chains" discussed by McCloskey (2002). These constitute a challenge to analyses of Irish, because there is mixed marking of unbounded dependencies, as follows:

(1.28) Pattern 1
$[_{\mathrm{CP}}\ \mathit{aN} \ldots [_{\mathrm{CP}}\ \mathit{aL} \ldots \_\_ \ldots]]$

(1.29) Pattern 2
$[_{\mathrm{CP}}\ \mathit{aL} \ldots [_{\mathrm{CP}}\ \mathit{aN} \ldots \mathit{pro} \ldots]]$

(1.30) Pattern 3
$[_{\mathrm{CP}}\ \mathit{aN} \ldots [_{\mathrm{CP}}\ \mathit{aN} \ldots \mathit{pro} \ldots]]$

Pattern 1 has an occurrence of *aN* but no resumptive pronoun. Pattern 2 has an occurrence of *aL* but no gap. Pattern 3 has multiple occurrences of *aN*, but only one resumptive pronoun. I show that Pattern 2 falls out of the analysis of the core patterns. The complementizer *aN* grounds the unbounded dependency by binding a resumptive, and the complementizer *aL* passes up the dependency and integrates it with the filler.

Patterns 1 and 3 pose a challenge to the resource logic approach to resumptives, because there are more occurrences of *aN* than there are pronominal resources. The manager resource of the single *aN* in Pattern 1 and one of the two *aN*s in Pattern 3 will therefore not find a resumptive pronoun to consume and there will be proof failure due to a left-over manager resource. The solution is to add the capacity to pass an unbounded dependency to *aN*'s lexical entry. When *aN* is passing an unbounded dependency, it must actually find one to pass in a lower clause. The passing *aN* does not consume a resumptive pronoun, because this is a concomitant of grounding the dependency. Patterns 1 and 3 now follow: a higher *aN* picks up an unbounded dependency that has either been grounded or passed by a lower *aL* or *aN*. However, the dependency passing, like the dependency grounding, is accomplished via anaphoric binding, not functional equality.

The resulting theoretical picture is shown in Table 1.1 on page 19. Both complementizers act to satisfy the Extended Coherence Condition by integrating an unbounded dependency into the grammatical representation. The two complementizers satisfy the ECC in each of the two ways that have been independently proposed in the literature. The complementizer *aL* uses functional equality and *aN* uses anaphoric binding. There is further symmetry between the complementizers, in that each performs a passing and a grounding function with respect to its unbounded dependency.

The acyclic nature of resumptive dependencies follows from the mechanism of anaphoric binding, which is always acyclic.

	Role Relative to Position			
	Not bottom	**Bottom**	**Method**	**Cyclic?**
aL	Passing	Grounding	Functional equality	Yes
aN	Passing	Grounding Resumptive licensing	Anaphoric binding	No

Table 1.1: The role of Irish complementizers in unbounded dependencies

The third section closes with a discussion of the predictions of the theory for Irish, directions for future work and a detailed comparison to the recent Minimalist analysis of McCloskey (2002). A key difference between this theory and that of McCloskey (2002) is that the resumptive licensing mechanism is derived from semantic composition and therefore itself properly accounts for the semantic composition of binder-resumptive dependencies. By contrast, ensuring proper semantic composition presents various complications for McCloskey's analysis.

Chapter 7 · Resumptives in Swedish and Hebrew

Chapter 7 presents the second empirical application of the theory to analyses of resumptive pronouns in Swedish and Hebrew. Swedish resumptives have proven especially difficult to assimilate to other kinds of resumptives (McCloskey 1990). The theory presented here is shown to essentially dictate such an assimilation, though. I present new data on Swedish and show how the theory can bring Swedish resumptives in line with Irish and Hebrew resumptives, with the result that they do not constitute a different class of resumptive. The theory thus guides us to a unification of previously heterogeneous facts.

The chapter begins with the analysis of resumptives in Swedish. I first review various environments that have been identified as hosting resumptive pronouns and set all but one aside, following Engdahl (1982). I return to the three other kinds of resumptive pronouns in chapter 8, where I argue that they are processing effects due to complexity factors. The true resumptives in Swedish are identified as occurring after lexical material in the left-periphery of CP, i.e. after a *wh*-phrase in SpecCP or after an overt complementizer in C^0. I first present a structural account of Swedish resumptives, but ultimately reject this in favour of a lexical analysis. The lexical analysis upholds a recent conjecture by McCloskey (2002) that the sole difference between languages with grammaticized resumptive pronouns and those that lack resumptives is a matter of lexical inventories. This proposal is appealing because it attempts to reduce variation with respect to resumptive pronoun licensing to lexical variation, which is independently necessary and which builds on the increasing lexical bent of most modern linguistic theories.

I also present dialect data from the Swedish spoken on the Åland Islands (*Ålandssvenska*). This data shows two things. First, there are speakers of *Ålandssvenska* who do not require resumptives after overt complementizers in C^0 but do require them after material in SpecCP. This motivates an analysis involving two related lexical items that independently pick out these cases, rather than a single lexical item that refers to a generalization over lexical material in SpecCP and C^0, such as one refering to COMP. This dialect data therefore lends further support to the splitting of COMP into SpecCP and C^0. Second, certain *Ålandssvenska* dialects do not have *that*-trace violations. Speakers thus allow resumptive pronouns in the same environments as gaps. Based on the *Ålandssvenska* dialects, I construct an argument against Last Resort theories of resumption (among others, Shlonsky 1992, Aoun et al. 2001).

I next turn to various challenges that Swedish poses for an ordinary pronoun analysis of resumption. These have to do with certain apparently gap-like properties of resumptives in weak crossover, reconstruction, across-the-board extractions from coordinate structures, and parasitic gap constructions. I argue that the weak crossover facts in Swedish have been misanalyzed due to artefacts of the theory used for the original analysis (Engdahl 1985). The weak crossover patterns for Swedish are in fact exactly what an ordinary pronoun theory would predict and match those which have been reported for other languages.

I then look at reconstruction, parastic gaps, and across-the-board extraction. I argue that the original reconstruction arguments for Swedish were based on non-grammaticized resumptives. I then present new data from scope reconstruction that shows that Swedish resumptives block reconstruction, as one would expect on an ordinary pronoun theory. I next point out that although the resource management theory of resumption treats resumptive pronouns as ordinary pronouns in the syntax, resumptives resemble gaps at the proof-theoretic level (i.e., in the linear logic proofs that perform semantic composition) and at the model-theoretic level (i.e., in the meaning language side of Glue meaning constructors). This means that the theory can in fact handle the behaviour of Swedish resumptives with respect to parastic gaps and ATB if these are shown to crucially involve semantic composition or truth-conditional semantics. I show that both cases in fact do involve semantic composition (i.e., the proof level) and therefore support the theory. The case for ATB is based on previous work by Asudeh and Crouch (2002a). I also sketch a new Glue analysis of parasitic gaps that builds on previous work by Steedman (1987) and Nissenbaum (2000).

Having presented the application of the theory to Swedish and met certain apparent challenges, I give a brief analysis of Hebrew that nevertheless handles resumptive pronouns in both fronted and unfronted positions. I also sketch how the analysis can provide an explanation of dialectal variation in Hebrew for resumptive pronouns in *wh*-questions. I show that the analyses of Irish, Swedish, and Hebrew reveal a much more coherent picture of their resumptive pronouns than has previously been achieved. All three languages involve local licensing by manager resources. The key difference between the three languages is that Irish and Hebrew manager resources are local to the binder at the top of the binder-resumptive dependency, whereas Swedish manager resources are local to the resumptive pronoun at the bottom of the dependency.

I end the chapter with a final argument against special pronoun theories of resumption. The form of the argument is simple. If resumptive pronouns are underlyingly gaps (or distinct from pronouns in some other way), then their morphological form is perhaps predictable given assumptions about morphological realization in certain theories. However, it can be shown that the putatively underlying gaps are also interpreted like pronouns and not like gaps. This would be completely unpredicted if resumptives are underlyingly gaps. If this were true, then resumptive pronouns should be interpreted like gaps, whatever their surface form, because this kind of interpretation is not affected by surface form, late lexical insertion, or PF effects. I show that Swedish resumptives, which have formed a paradigm case for the underlying gap view, are also interpreted like ordinary pronouns.

Chapter 8 · A processing model

Chapter 8 presents a processing model for *processing-resumptives* — i.e., resumptive-like uses of pronouns (and other nominals) that are not licensed by the grammar. I argue that processing-resumptives arise through normal constraints on production and can be accommodated under certain circumstances in parsing. They contrast with *syntactic resumptives*, which are fully grammaticized resumptive pronouns that are grammatically licensed according to the resource management theory of resumption.

The processing model includes both production and parsing components and is based on the following assumptions:

(1.31)
1. Production and parsing are incremental.
2. Incremental production and parsing construct *locally* well-formed structures.
3. Global well-formedness applies only to the output of production and parsing.
4. Production and parsing are constrained by memory limitations.

These are all assumptions that are supported by the psycholinguistic literature, although the model itself has not yet been tested experimentally.

The chapter begins by considering how resumptive pronouns in English (*intrusive pronouns*; Sells 1984), are produced in the first place (section 8.1.1). It is argued that they are not licensed by the grammar at all, but arise from incremental production. The production model is based on the notion of fragments in LFG (Bresnan 2001:79–81), which allow a definition of locally well-formed structures. I argue that in producing locally well-formed structures that are consistent with the production plan speakers have two options. The first option is to integrate the filler, resulting in fully locally and globally well-formed structures. The second option is to insert pronouns and other nominals in positions where a filler ought to be integrated. This leads to local well-formedness, even though the overall result is global ill-formedness. However, since production is incremental, such productions can nevertheless be uttered.

If the filler integration site is inside an island, integration of the filler is blocked. This means that the only choice for constructing locally well-formed structure is to insert in the gap position in the island a pronoun or other nominal that is consistent with the production plan and local well-formedness. This structure is nevertheless globally ill-formed according to the grammar. The model thus explains recent observations in the experimental literature that despite producing processing-resumptives both in island environments and in non-island environments, speakers judge the examples to be ill-formed.

The parsing model explains how processing-resumptives are parsed despite their ungrammaticality. Three major subclasses of processing-resumptives are identified: island-resumptives, ECP-resumptives, and complexity-resumptives. The notion of complexity-resumptive covers the distance amelioration effects for processing-resumptives observed by Erteschik-Shir (1992) but is a more general notion that includes other measures of processing complexity. Island-resumptives are processing-resumptives inside islands and ECP-resumptives are processing-resumptives that are used to avoid *that*-trace filter violations. Island- and ECP-resumptives are underlyingly ungrammatical on the model, which is supported by the recent experimental findings alluded to above. However, parsing of the relevant sentences leads to partial interpretation that can nevertheless be informative. Whether the partial interpretation is informative depends on properties of the resumptive's binder or antecedent. If the processing-resumptive is bound by an operator, e.g. a quantifier or *wh*-word, the resulting partial interpretation is uninformative. By contrast, if the processing-resumptive is bound by a type e binder, such as a name, indefinite, or definite, partial interpretation is informative. This explains Sells's (1984) observation that intrusive pronouns cannot be operator-bound.

The memory limitations that I assume for parsing are instrumental in the model's explanation of complexity-resumptives. I also assume the Active Filler Strategy (Frazier 1987, Frazier and Flores d'Arcais 1989), whereby the integration of an unbounded dependency is driven by the filler rather than by the gap. Complexity-resumptives occur when a pronoun is encountered after the active filler has dropped out of working memory. When the pronoun finds its antecedent, the filler-gap dependency is reanalyzed and the pronoun is removed. Complexity-resumptives are therefore reanalyzed as gaps. Whether the reanalysis results in well-formedness depends on whether the underlying structure is well-formed. In the typical distance resumptive cases discussed by Erteschik-Shir (1992), the underlying structure is grammatical. The theory of complexity resumptives is then applied to an explanation of the non-grammaticized Swedish resumptives that were set aside at the beginning of chapter 7.

I close the chapter with a detailed overview of the predictions of the overall theory of resumptive pronouns constituted by the resource management theory of grammaticized, syntactic resumptives and the processing theory of processing-resumptives.

Part III • Extending Resumption

Chapter 9 · Copy raising in English

Chapter 9 extends the resource management theory, demonstrating that it is a general, unified theory of resumption that covers not just resumptive pronouns but also the related case of copy raising:

(1.32) a. Thora seemed like <u>she</u> was mad at Pelle.

b. Thora appeared as though Pelle had annoyed <u>her</u>.

It has been previously observed that the two phenomena are related (McCloskey and Sells 1988, Boeckx 2003), but they have resisted a unified, formal analysis.

Copy raising involves the raising verb *seem* or *appear* with a complement introduced by *like*, *as though*, or *as if*. The complement to the copy raising verb must obligatorily contain a pronoun:

(1.33) *Thora seemed like the raisins were delicious.

However, the pronoun is not necessarily a subject, as shown in (1.32).

The first part of the chapter concerns copy raising verbs and the superficially similar case of perceptual resemblance verbs:

(1.34) a. Thora sounded like she was over her cold.

b. Thora smelled like she had gotten hold of some chocolate.

There are perceptual resemblance verbs for each of the five senses. In addition to *sound* and *smell* there are *look*, *feel*, and *taste*.

There are a number of similarities between perceptual resemblance verbs and copy raising verbs. These similarities are traced to the two verb classes sharing the same syntax, particularly with respect to their complements. The complements of these verbs are analyzed as predicative prepositional phrases headed by *like* or *as* (Heycock 1994, Maling 1983, Potsdam and Runner 2002, Asudeh 2004). The instances of these verbs with *like*-complements are thus assimilated to instances of the same verbs with open, predicative complements:

(1.35) Thora seems happy.

(1.36) Pelle smells funny.

I present several arguments for the categorial status of *like* and *as* as prepositions and for the status of the predicate PP complement as an argument rather than an adjunct. The gist of the analysis is that copy raising verbs and perceptual resemblance verbs share a subject with their predicative PP complements.

The behaviour of copy raising and perceptual resemblance verbs with respect to expletives is also examined in detail. Both verb classes can license expletive subjects:

(1.37) It seemed like Thora had a good time.

(1.38) It sounds like Thora enjoys crackers.

Curiously, both verb classes have the ability to raise an expletive subject that they cannot otherwise license:

(1.39) a. There seemed like there was a problem.

b. *There seemed like Thora was upset.

c. It seemed like Thora was upset.

(1.40) a. There sounded / smelled like there was a problem with the fan belt.

b. *There sounded / smelled like the fan belt caught fire.

c. It sounded / smelled like the fan belt caught fire.

There is dialectal variation on this point, which I discuss. I argue that the closed complement raising is handled by the predicative preposition, *like* or *as*, which alternates between a raising and non-raising version. The analysis is that a single expletive subject is exceptionally raised by the head of the *like*-complement from its finite complement to its subject position and then raised further by the matrix verb, which always has the option of raising the subject of the *like*-complement.

In its schematic form, the analysis is as follows:

(1.41)
$$\left[\begin{array}{ll} \text{“seem / sound / \ldots”} & \\ \mathrm{SUBJ} & \left[\mathrm{EXPLETIVE}\right] \\ \mathrm{XCOMP} & \left[\begin{array}{ll} \text{“like / as”} & \\ \mathrm{SUBJ} & \\ \mathrm{COMP} & \left[\begin{array}{ll} \text{“\ldots”} & \\ \mathrm{SUBJ} & \end{array}\right] \end{array}\right] \end{array}\right]$$

The expletive thus simultaneously occupies three subject positions. I discuss the consequences that this has for LFG's theory of open complements (XCOMP). I also discuss how the theory predicts that although the expletive is realized in three f-structural positions it is only realized in two c-structural positions. I briefly explore some consequences of the analysis for LFG's Subject Condition and the EPP feature of the Minimalist Program.

Despite the similarities between copy raising verbs and perceptual resemblance verbs, there is crucial difference between them. The perception verbs do not require pronouns in their complements:

(1.42) Thora sounded like the raisins were delicious.

(1.43) Thora felt as if the fever wasn't completely gone.

The ability of perceptual resemblance verbs to occur without pronominal copies in their complements, which has been observed before by Heycock (1994:292), indicates that they are not true copy raising verbs. To my knowledge this asymmetry between the two verb classes has not been noticed before. The difference is traced to lexical specifications: unlike the perception verbs, copy raising verbs contribute a manager resource and therefore set up an environment for resumption. As a result the two verb classes have distinguished methods of semantic composition, despite their syntactic similarities.

Resumption is thus extended from resumptive pronouns to copy raising using a single theoretical mechanism. However, the dependency between the matrix subject and the pronoun in copy raising is not an unbounded dependency. Rather, it is a local dependency between the copy raising verb's syntactic arguments: the matrix subject and the PP complement. I provide a critical review of previous approaches to copy raising. For example, as mentioned earlier in this chapter, the alternative proposals by Ura (1998) and Boeckx (2003) are problematic because the mechanisms they propose to handle copy raising should not be able to cross a finite clause boundary. The resource logic approach does not share this problem. The pronominal copy is licensed by a process of anaphoric binding and this kind of process may freely reach into finite clauses.

The compositional semantics proposed for copy raising verbs also predicts Lappin's (1984) observation that copy raising subjects cannot take narrow scope with respect to the copy raising verb:

(1.44) No chef seemed like <u>she</u> enjoyed the contest.
$no > seem$
*$seem > no$

This contrasts with infinitival raising constructions, which allow both scope possibilities:

(1.45) No chef seemed to enjoy the contest.
$no > seem$
$seem > no$

I show that a treatment of the compositional semantics of perceptual resemblance verbs that builds on previous work on control (Asudeh 2000, 2003b) correctly predicts that their subjects must also take wide scope.

I close the chapter with a discussion of the prospects for extending the analysis of copy raising to other languages. I show that the analysis illuminates a puzzling fact about Irish. Namely, in Irish copy raising the neutral complementizer *go* is used rather than the resumptive-sensitive complementizer *aN*.

Chapter 10 · Conclusion

The dissertation ends with a review of the main results, a brief discussion of previous approaches, and a discussion of directions for future work.

Appendices

There are three appendices. The first appendix consists of a compact presentation of the Glue logic and the fragment of linear logic that is adopted in this work. Proof rules and Curry-Howard terms are provided for the linear logic fragment. The second and third appendices provide small fragments of the grammars of Irish and Swedish resumptive pronouns. The fragments are not meant to rigorously control for under- and overgeneration, but are rather meant to compactly present lexical entries, rules and structures for the analyses developed in the body of the dissertation.

A note on conventions used in this work

I have for the most part left glosses from cited examples as in the source. I have however made a few minor standardizations. Cited examples are always followed by a citation of the source, including the page number (except for certain examples from unpublished work) and the example number. If a cited example has been changed in any substantial way, it is indicated by use of the mark $\sim$ before the example number, indicating that the present example is “similar” to the cited example. I adopt the convention of underlining resumptive pronouns to assist the reader. In many cases this is not found in the original of a cited example. English translations are as usual a rough guide only. Certain translations are marked with the ungrammaticality mark ‘*’ to indicate that the English equivalent is also ill-formed. In other cases, an impossible English equivalent is given in parentheses. In some cases, resumptive pronouns are included in the English translation in parentheses, since this is often the closest translation that can be given. This is not meant to indicate that resumptives are considered grammatical in English. Several cited works are reprints. Page numbers from these refers to the pagination of the reprint. In some cases, the original page numbers are also indicated in square brackets.

Part I

Resource Sensitivity: The Formal Theory

Chapter 2

An overview of LFG and Glue Semantics

Introduction

This chapter serves as a brief introduction to the linguistic theory that I use in the rest of the dissertation: Glue Semantics with a Lexical Functional Grammar (LFG) syntax situated in an LFG grammatical architecture. I cannot hope to give thorough introductions to Glue and LFG in one chapter. Rather, I concentrate on aspects of the theory that are particularly relevant to the analyses and arguments in the following chapters. The goal is to provide enough background so that readers who are uninitiated in LFG and Glue can gain a deeper understanding of the theory of resumption developed here than might otherwise be possible. Readers who are familiar with Glue and LFG can quite safely skip this chapter. Those who are familiar with either LFG or Glue but not the other may wish to read only the relevant section. In any case, the chapter can hopefully serve as a handy reference to turn back to while reading the rest of the dissertation.

There are several options in the literature for readers who wish to have a fuller introduction to LFG and/or Glue. Among the key foundational papers in LFG are Bresnan (1982a,c) and especially Kaplan and Bresnan (1982), which is the initial presentation and formalization of the theory. Bresnan (1978) provides much of the theory's foundational linguistic motivation and argumentation, but is not cast in LFG per se. Kaplan (1987, 1989) are two excellent shorter introductions to the general architecture of LFG which also provide plenty of formal detail. Bresnan (1982b) and Dalrymple et al. (1995) collect these papers and others together. Dalrymple (2001) is an up-to-date reference work, while Bresnan (2001) and Falk (2001) are recent textbook introductions, the latter providing numerous comparisons between LFG and Government and Binding Theory. The theory of phrase structure that I adopt here is presented in detail in Toivonen (2001, 2003). The best sources at this point for details of Glue Semantics are Dalrymple (2001) and the papers in Dalrymple (1999), especially Dalrymple et al. (1999a,b,c), Crouch and van Genabith (1999), and van Genabith and Crouch (1999a). Crouch and van Genabith (2000) is an excellent but unfortunately as of yet unpublished introduction to linear logic for linguists and also features a good technical introduction to Glue. For less linguistically-oriented references on linear logic, see appendix A. Lastly, sketches of Glue Semantics for other formalisms are provided for Head-Driven Phrase Structure Grammar by Asudeh and Crouch (2002c) and for Tree-Adjoing Grammar by Frank and van Genabith (2001).

2.1 A brief introduction to Lexical Functional Grammar

2.1.1 Grammatical architecture

The original architecture of LFG (Kaplan and Bresnan 1982) consisted of two syntactic levels: constituent structure (c-structure) and functional structure (f-structure). C-structure is described by phrase structure rules and is represented as a tree. It represents syntactic information about precedence, dominance, and constituency. F-structure is described by a regular expression language and is represented as a feature structure, also known as an attribute value matrix. It is is also a syntactic representation, but represents more abstract aspects of syntax, such as grammatical functions, predication, subcategorization, and local and non-local dependencies. C-structure and f-structure are projected from lexical items, which specify their c-structure category and f-structure feature contributions. The two syntactic representations are present in parallel, with the structural correspondence or projection function ϕ establishing the relationship between c-structure and f-structure by mapping c-structure nodes (i.e., tree nodes) to f-structure nodes (i.e., feature structures). The basic grammatical architecture can be schematized as in Figure 2.1. An LFG representation of a sentence on this view is a triple consisting of a c-structure, an f-structure and a ϕ projection function that maps the c-structure to the f-structure: $\langle c,\ f,\ \phi \rangle$. C-structures and f-structures are constructed by simultaneous constraint satisfaction. LFG is therefore a declarative, non-transformational theory. The fact that c-structure and f-structure are represented using distinct data structures (trees and feature structures) distinguishes LFG from both transformational theories such as Principles and Parameters Theory, which represents all syntactic information in a tree, and non-transformational theories such as HPSG, which represents all grammatical information, whether syntactic or not, in a directed acyclic graph. LFG uses mixed data structures related by structural correspondence, rather than a single monolithic data structure.

The LFG architecture was subsequently further generalized to a *parallel projection architecture*

$$\text{constituent structure} \xrightarrow{\phi} \text{functional structure}$$

Figure 2.1: The original LFG architecture

(Kaplan 1987, 1989, Halvorsen and Kaplan 1988). There are now various levels of linguistic representation, called *projections*, which are present in parallel, and these projections are related by structural correspondences (i.e., projection functions) which map elements of one projection onto elements of another. C-structure and f-structure are still the best understood projections, but they are now two among several levels of representation and the projection function ϕ is now one of many. For example, f-structures are mapped onto s(emantic)-structures by the σ-function (Dalrymple 1993, Dalrymple et al. 1999b, Dalrymple 2001).

Kaplan (1987, 1989) gives Figure 2.2 as an example of the projection architecture, representing the decomposition of a mapping Γ from form to meaning. Two of the projections proposed in Figure 2.2 — anaphoric structure and discourse structure — have never really been pursued. Anaphora have been handled at semantic structure (Dalrymple 1993, 2001), as we will see in further detail below, and discourse structure has been pursued instead as information structure (Butt and King 2000), which encodes notions like discourse topic and focus and old and new information.

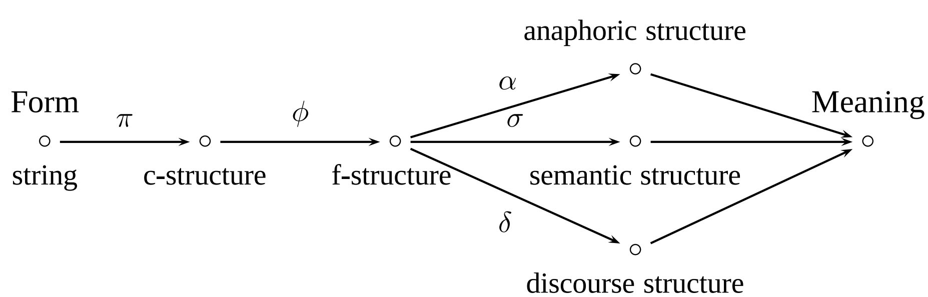


Figure 2.2: An early version of LFG's projection architecture

Information structure is just one of several recent proposals for new projections. Three other recent proposals are argument structure (Butt et al. 1997), morphological structure (Butt et al. 1996, 1999, Frank and Zaenen 2002) and phonological structure (Butt and King 1998), the latter of which should perhaps be called prosodic structure, since it is concerned almost entirely with phrasal phonology and prosodics. Butt et al. (1997) propose that argument structure should be interpolated between c-structure and f-structure with the ϕ projection function broken up into the α function from c-structure to a-structure and the λ function from a-structure to f-structure. The ϕ function is then the composition of these two new functions: $\phi = \alpha \circ \lambda$. Information structure and phonological structure have both been proposed as projections from c-structure. There has been some debate over the proper location for morphological structure in the architecture. Butt et al. (1996, 1999) treat it as a projection from c-structure. Frank and Zaenen (2002) argue that although this is adequate for the phenomena that Butt et al. (1996, 1999) use morphological structure for (auxiliaries), there are reasons to prefer morphological structure as a projection from f-structure. Adding these proposals to the architecture proposed in Figure 2.2 (and having taken away anaphoric structure and discourse structure), we get the revised projection architecture in Figure 2.3.

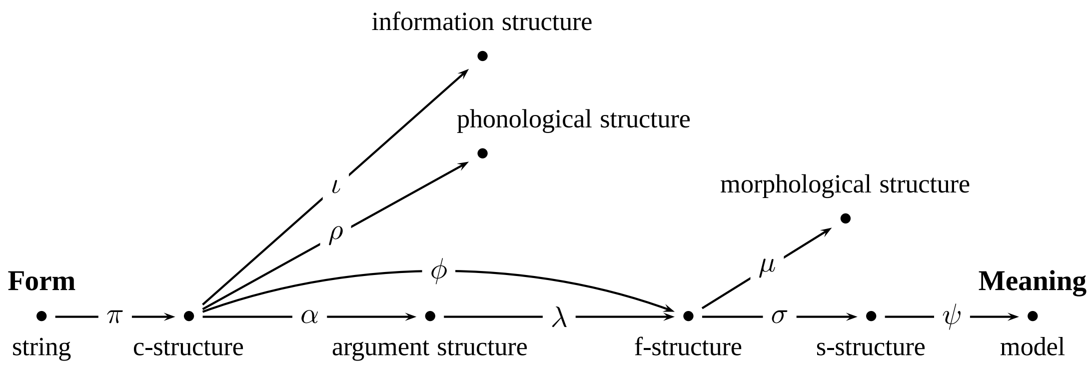


Figure 2.3: A version of LFG's projection architecture incorporating certain recent proposals

It is worth reiterating that the various levels of grammatical representation in the projection architecture are simultaneously present, but each level is governed by its own rules and representations. This separation of levels allows one to make simple theoretical statements about the aspects of grammar that the level in question models. It is even possible to split up correspondences in novel ways. Since the projection functions are functions in the mathematical sense, we can always regain the original function through composition of the new functions. This is exemplified by the Butt et al. (1997) proposal for argument structure, which was discussed above. Another important feature of this architecture is that there can be systematic mismatches between grammatical levels. For example, null pronoun subjects in pro-drop languages are not present at c-structure, because they are unmotivated by the syntactic phenomena represented at that level. Rather, null pronouns are present at f-structure, where they can participate in agreement, binding, and other syntactic processes represented at that level. Similarly, there can be systematic mismatches between f-structure and s-structure. Resumption is an example of this. More generally, any case of apparent resource deficit or surplus is in some way a mismatch between f-structure and s-structure.

The projection architecture also allows one to concentrate on properties of one level without disturbing other aspects of linguistic representation. This dissertation is an investigation in Glue Semantics of the hypothesis of Resource Sensitivity. Glue is a theory of the syntax-semantics inteface and semantic composition. As such the parts of the architecture that I am primarly concerned with are c-structure, f-structure, s-structure, and the ϕ and σ projection functions. The last projection function, ψ, is one that I have added to the architecture to represent the structural correspondence from semantic structure to model-theoretic meaning, i.e., the linear logic proofs for semantic composition. The ψ-projection parallels Kaplan's (1987, 1989) π-projection from the string (i.e., form) to c-structure.

2.1.2 Constituent structure

Constituent structure is modelled using non-tangled phrase structure trees. It represents precedence, dominance, and constituency. Since the nodes in the tree are syntactic categories, c-structure also encodes categorially detemined syntactic distribution. C-structures are described by phrase structure rules.

LFG commonly adopts an X-bar theoretic (Chomsky 1970, Jackendoff 1977) approach to phrase structure (Bresnan 2001, Falk 2001, Toivonen 2001, 2003). In this work I adopt Toivonen's (2001, 2003) theory of c-structure, which is motivated by extensive data from Swedish and other Germanic languages. Toivonen proposes a theory of non-projecting words within a general X-bar theory of phrase structure. Terminal categories in this theory of phrase structure can either be of the projecting category X^0 ("X-zero") or of the non-projecting category $\hat{\mathrm{X}}$ ("X-roof"). In Toivonen's theory, X^0 categories must project a medial X' category which in turn must project a maximal XP category. By contrast, $\hat{\mathrm{X}}$ categories are non-projecting and cannot be immediately dominated by an X'. Toivonen (2003) argues that Swedish particles are non-projecting words and that they can in principle be of any lexical category ($\hat{\mathrm{N}}$, $\hat{\mathrm{P}}$, $\hat{\mathrm{V}}$, $\hat{\mathrm{A}}$). Toivonen (2003:63–65) takes the strong position that a non-projecting word must be head-adjoined; i.e., a non-projecting $\hat{\mathrm{X}}$ not only cannot be inserted under X', a medial category of the same kind, it also cannot be inserted under Y', a medial category of a different kind, or any maximal category (XP or YP). Non-projecting words will be used in the analyses of the complementizer systems of Irish, Swedish and Hebrew in chapters 6 and 7.

Toivonen (2003:62), following Bresnan (2001:100), proposes that the following syntactic categories are universally available, although a given language may use only a subset:

(2.1)	F(unctional):	C, I, D
	L(exical):	V, A, P, N

The functional categories C(omplementizer), I(nflection), and D(eterminer) are the only functional categories commonly used in LFG, although the functional category K (Case) proposed by Bittner and Hale (1996) has been used in some unpublished work (Falk 1997, Butt and King 2002b). Falk (2001:37ff.) argues that the only functional categories admitted by the theory should be ones that exhibit head-like properties and that are realized as independent words.

In addition to these endocentric categories, Bresnan (2001) and Toivonen (2001, 2003) allow the exocentric category S, which dominates a nominal category and a predicative XP:

(2.2) $\quad$ S $\longrightarrow$ NomP, XP

I use NomP as a generalization over DP and NP, based on the idea that the functional category D shares features of the lexical category N (Grimshaw 1998). Bresnan and Toivonen just specify the nominal as an NP, but given their adoption of the category D, presumably a DP should be allowed in this position, too.

Given the distinction between non-projecting and projecting categories, the full set of categories is (Toivonen 2003:63):

(2.3)			
	X^0:	V^0, P^0, A^0, N^0, C^0, I^0, D^0	**Projecting categories**
	$\hat{X}$:	$\hat{V}$, $\hat{P}$, $\hat{A}$, $\hat{N}$, $\hat{C}$, $\hat{I}$, $\hat{D}$	**Non-projecting categories**
		S	**Exocentric category**

Toivonen (2003:22) generalizes over non-projecting $\hat{X}$ categories and projecting X^0 categories with a plain X category. The category X is theoretically justified based on the fact that both projecting and non-projecting categories are terminal nodes that dominate lexical material (Toivonen 2003:64). It is empirically justified based on lexical items that behave like both projecting and non-projecting words (Toivonen 2003:22ff.). One such lexical item is Swedish *dit* (‘there.DIRECTIONAL’), which is either of the projecting category P^0, in which case it projects a full PP and occurs at the end of the verb phrase, or of the non-projecting category $\hat{P}$, in which case it is a verbal particle adjoined to V^0 (Toivonen 2003:90–91).

Basic X-bar structures in Toivonen’s theory are described by the following constraints (Toivonen 2003:61):

(2.4) $\quad$ a. $\quad$ $\mathrm{XP} \longrightarrow \mathrm{X}', \mathrm{YP}^*, \quad \mathrm{X} \neq \mathrm{S}$

$\quad\quad\quad$ b. $\quad$ $\mathrm{X}' \longrightarrow \mathrm{X}^0, \mathrm{YP}^*, \quad \mathrm{X} \neq \mathrm{S}$

There are a couple of points about these constraints that bear comment. First, notice the use of Kleene star on specifiers and complements. Multiple specifiers and non-binary complementation structures are thus permitted by these constraints, although they may be ruled out by independent constraints. Second, notice that the constraints explicitly state that the exocentric category S cannot serve as X.

In addition to the X-bar structures in (2.4), Toivonen (2003:63) assumes that adjunction structures described by the following constraints are allowed:

(2.5) a. $\mathrm{XP} \longrightarrow \mathrm{XP}, \mathrm{YP}^*$

b. $\mathrm{X}^0 \longrightarrow \mathrm{X}^0, \hat{\mathrm{Y}}^*$

Toivonen (2003:62) proposes that adjunction to X' is not permitted and that the following generalization holds:

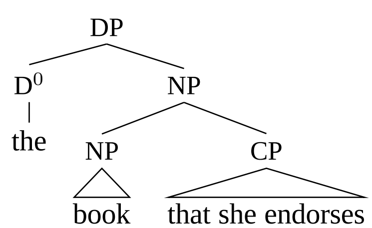
(2.6) **Adjunction Identity**:

Same adjoins to same.

X^0 and $\hat{\mathrm{X}}$ categories count as the same for adjunction identity, for the reasons that justify the generalized category X (see above).

The key aspect of Toivonen's theory for my purposes is the notion of a non-projecting head. As I mentioned above, non-projecting complementizers are part of the empirical analyses in chapters 6 and 7. Adjunction identity is another aspect of the theory that affects my analysis, but only in a peripheral way. In particular, it means that restrictive relative clauses are adjoined to NP within a DP:

(2.7)



I adopt this structure for relative clauses simply to be consistent with Toivonen's overall theory.

I make no deep theoretical commitment to either the DP analysis of nominals (Brame 1982, Abney 1987) or to adjunction identity, though. Such a commitment is unnecessary given the overall theory I am working with. We will see below that the determiner is a co-head of the NP. The nodes DP, NP, and N' therefore all map to the same f-structure. Since Glue Semantics works with semantic structure, which is projected from f-structure, the attachment site of the relative clause in c-structure does not affect compositional semantics, providing it is attached to a reasonable place in DP or NP. The semantics just sees the f-structure that all the head material in the nominal projects to. This means that the semantic considerations that have been key to deciding relative clause attachment (Partee 1975, Bach and Cooper 1978) do not arise. In particular, if the DP hypothesis is not pursued and nominals receive the traditional category NP, it would be possible to adjoin the relative to NP. However, this would not require the addition of an additional relative clause variable as in Bach and Cooper (1978). Alternatively, if both the DP hypothesis and adjunction identity are given up, then the relative clause could adjoin at the N′ level (this is effectively the modern update of Partee 1975). On this theory, relative clause attachment is not decided by semantic composition, but rather by syntactic facts about constituency. This seems to me to be a desirable result. This discussion has been rather abstract and it would be profitable to pursue these matters further in the future. However, I will leave the matter here and simply adopt the structure in (2.7). Since semantic composition is not affected by this choice, it is not an integral part of the analysis and could easily be given up.

There is one aspect of the c-structure theories of Bresnan (2001) and Toivonen (2001, 2003) that I explicitly reject. This is the principle known as Economy of Expression, which removes excess c-structure material. The main effect of Economy of Expression for Bresnan (2001:91ff.) is to tightly circumscribe the distribution of traces in c-structure. I am adopting a trace-less version of LFG, so this motivation for Economy does not apply. Toivonen (2001, 2003) has a more narrowly empirical motivation for Economy, which is used to derive certain aspects of the distribution of Swedish particles (Toivonen 2003:101ff.). However, Potts (2002a) gives an alternative analysis of the Swedish data that does not use Economy. The motivation behind Economy of Expression is thus in doubt and I do not adopt it here, since it is a transderivational constraint (as shown by Potts 2002a) and is therefore inherently problematic (Jacobson 1998, Johnson and Lappin 1997, 1999, Potts 2001, 2002a, Pullum and Scholz 2001).

Finally, I should note that I assume like much LFG work that all constituent structure positions are optional (Kroeger 1993, King 1995, Bresnan 2001, Dalrymple 2001, Toivonen 2003). Nothing much hinges on this decision, but it will allow less clutter in rules and trees. In some cases this will lead to non-endocentric structure, but LFG adopts a theory of extended projection in which various c-structure positions project as a single f-structure head (Bresnan 2001). Thus, a notion of endocentric head is definable by referring to c-structures and f-structures together, using the ϕ projection function (Bresnan 2001:131–134).

2.1.3 Functional structure

Functional structure is a level of syntactic representation that encodes more abstract syntactic information — essentially everything apart from categorial status, linearization, and dominance. Among the information encoded at f-structure are the following:

1. Grammatical functions

2. Subcategorization

3. Predication

4. Case and agreement

5. Tense, mood, and aspect

6. Syntactic restrictions on anaphoric binding

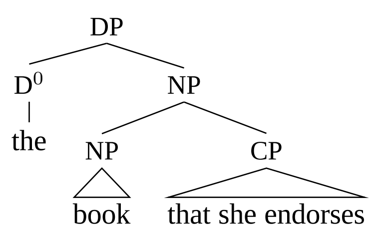
7. Local dependencies, e.g. control, raising

8. Unbounded dependencies, e.g. topicalization, relativization, interrogatives

Much of the information encoded in f-structure corresponds to information that in the Minimalist Program is encoded in VP and vP (subcategorization, grammatical functions) and in the functional projections above VP (case, agreement, tense, aspect).

An f-structure is a finite tabular function whose domain are elements from a set of symbols, i.e. features. Possible values in its range are features, semantic forms (i.e., PRED features), f-structures, and sets (Kaplan 1989:11). F-structures are represented as feature structures, also known as attribute value matrices. For example, the relative clause example in (2.7), which I repeat below, maps to the f-structure in (2.9), leaving aside for the moment the unbounded dependency.

(2.8)



(2.9)
$$\begin{bmatrix} \textsc{pred} & \text{`book'} \\ \textsc{num} & \text{sg} \\ \textsc{spec} & \begin{bmatrix} \textsc{pred} & \text{`the'} \\ \textsc{def} & + \end{bmatrix} \\ \textsc{adj} & \left\{ \begin{bmatrix} \textsc{pred} & \text{`endorse}\langle\textsc{subj}, \textsc{obj}\rangle\text{'} \\ \textsc{subj} & \begin{bmatrix} \textsc{pred} & \text{`pro'} \\ \textsc{pers} & 3 \\ \textsc{num} & \text{sg} \\ \textsc{gend} & \text{fem} \end{bmatrix} \\ \textsc{tense} & \text{pres} \end{bmatrix} \right\} \end{bmatrix}$$

The mapping from c-structure to f-structure (the ϕ projection function) and how the f-structure in (2.9) is constructed from the c-structure will be discussed shortly.

The f-structure above illustrates all four possible attribute values mentioned above. The features DEF(INITE), PERS(ON), NUM(BER), and GEND(ER) all have features as their values. The features SPEC(IFIER) and SUBJ(ECT) have f-structures as their values. The feature ADJ(UNCT), where the relative clause makes its contribution, takes a set as a value. Modifiers are typically represented in sets, since there can be indefinitely many of them. Another typical use for sets is in coordination, where there can be indefinitely many conjuncts or disjuncts. Lastly, there are several instances of the feature PRED, which has a special value called a *semantic form*, indicated by single quotes. The term "semantic form" is no longer an accurate description of the role of PRED, since the semantic contributions it made in the original treatment by Kaplan and Bresnan (1982) have largely been taken over by other aspects of the theory, such as Lexical Mapping Theory (Bresnan and Kanerva 1989) and Glue Semantics (for discussion, see Dalrymple 2001:219–221). The usage has stuck, however.

2.1.3.1 The c-structure to f-structure mapping

C-structures are mapped to f-structures via the projection function ϕ. F-structures are constructed through specifications called *functional equations* or *functional descriptions* — *f-descriptions* for short. F-descriptions are specified in lexical entries and annotate phrase structure rules.

F-descriptions are constructed out of two key ingredients: the f-structure metavariables $\uparrow$ and

$\downarrow$ and regular expressions that describe f-structure paths. For example, ($\uparrow$ SUBJ NUM) refers to the value reached by following the path SUBJ NUM from the f-structure designated by $\uparrow$. The metavariables are constructed from two c-structure variables and the ϕ function. The c-structure variables in question are $*$, which refers to the c-structure node that it annotates, and $\hat{*}$ (sometimes represented as $\mathcal{M}(*)$), which refers to the c-structure node that immediately dominates the annotated node (i.e., its mother). The metavariables are thus defined as follows:

(2.10) $\downarrow := \phi(*)$ the annotated node's f-structure
$\uparrow := \phi(\hat{*})$ the annotated node's mother's f-structure

For example, the f-description ($\uparrow$ SUBJ) refers to the SUBJ of the f-structure corresponding to the mother of the c-structure node that bears the f-description.

The elements of the phrase structure rules that construct c-structures are annotated with f-descriptions that describe the f-structures that the elements map to. For example, leaving aside irrelevant X-bar theoretic details, the annotated rules in (2.11) could be used for the relative clause example (2.7). In (2.12) below I present a more detailed version of (2.7) in its annotated form together with the partial f-structure that the annotations describe and an explicit representation of the ϕ function.

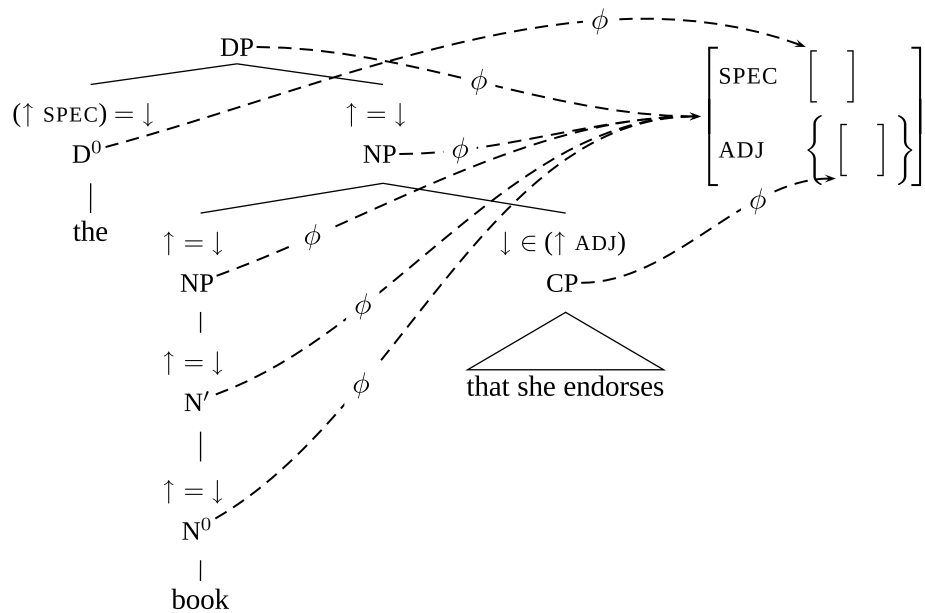
(2.11) a. $\text{DP} \longrightarrow \underset{(\uparrow \text{SPEC}) = \downarrow}{\text{D}^0} \quad \underset{\uparrow = \downarrow}{\text{NP}}$

b. $\text{NP} \longrightarrow \underset{\uparrow = \downarrow}{\text{NP}} \quad \underset{\downarrow \in (\uparrow \text{ADJ})}{\text{CP}}$

c. $\text{NP} \longrightarrow \underset{\uparrow = \downarrow}{\text{N}'}$

d. $\text{N}' \longrightarrow \underset{\uparrow = \downarrow}{\text{N}^0}$

(2.12)



The f-description $\uparrow = \downarrow$ indicates equality between two f-structures and is how LFG expresses the notion of headedness at f-structure: all of the c-structure nodes projecting from the head *book* map to the same f-structure. The f-description ($\downarrow \in (\uparrow$ ADJ$)$) indicates that the f-structure contributed by the CP is a member of ($\in$) the set that constitutes the NP's ADJUNCT.

The rest of the information shown in the fuller f-structure (2.9) above comes from the lexical entries in the structure, which also contribute f-descriptions:

(2.13) *the*: D^0 $(\uparrow \text{PRED}) = \text{`the'}$
$(\uparrow \text{DEF}) = +$

(2.14) *book*: N^0 $(\uparrow \text{PRED}) = \text{`book'}$
$(\uparrow \text{NUM}) = \text{sg}$

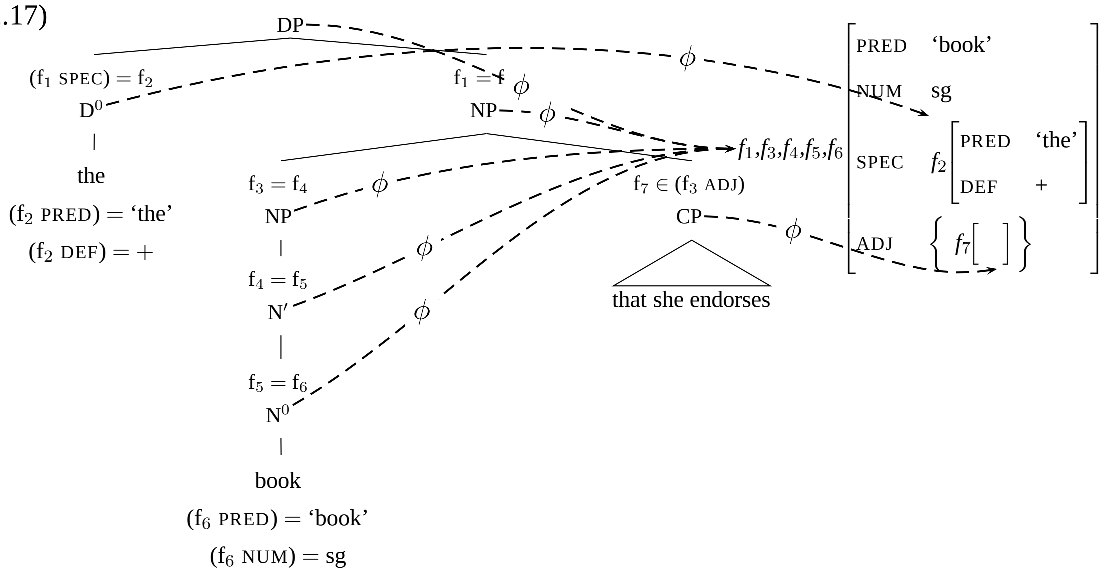
(2.15) *she*: D^0 $(\uparrow \text{PRED}) = \text{`pro'}$
$(\uparrow \text{PERS}) = 3$
$(\uparrow \text{NUM}) = \text{sg}$
$(\uparrow \text{GEND}) = \text{fem}$

(2.16) *endorses*: V^0 $(\uparrow \text{PRED}) = \text{`endorse}\langle\text{SUBJ, OBJ}\rangle\text{'}$
$(\uparrow \text{TENSE}) = \text{pres}$
$(\uparrow \text{SUBJ PERS}) = 3$
$(\uparrow \text{SUBJ NUM}) = \text{sg}$

Notice that I have assumed that the complementizer *that* makes no contribution to the f-structure. This illustrates that there can be elements at one level of structure that have no correspondent at another level. Another example of this is null pronouns. These are represented at f-structure, but there is no null pronominal in the c-structure.

F-structures are constructed by instantiating the f-description metavariables in the annotated tree to f-structure labels. The f-descriptions of the terminal nodes of the tree are also instantiated. The instantiated version of (2.11) is the following, where I have only provided the lexical information from *the* and *book*:

(2.17)



Details of the instantiation mechanism for the c-structure to f-structure mapping can be found in Bresnan (2001:56–60) and Dalrymple (2001:122–125).

Throughout this work I will skip the instantiation step and instead assume the convention that f-structures are labelled mnemonically with the first letter of their PRED. The f-structure in (2.9) would be labelled as follows:

(2.18)

$$b\left[\begin{array}{ll} \textsc{pred} & \text{`book'} \\ \textsc{num} & \text{sg} \\ \textsc{spec} & t\left[\begin{array}{ll}\textsc{pred} & \text{`the'}\\ \textsc{def} & +\end{array}\right] \\ \textsc{adj} & \left\{ e\left[\begin{array}{ll} \textsc{pred} & \text{`endorse}\langle\textsc{subj}, \textsc{obj}\rangle\text{'} \\ \textsc{subj} & p\left[\begin{array}{ll} \textsc{pred} & \text{`pro'} \\ \textsc{pers} & 3 \\ \textsc{num} & \text{sg} \\ \textsc{gend} & \text{fem}\end{array}\right] \\ \textsc{tense} & \text{pres}\end{array}\right]\right\}\end{array}\right]$$

F-structure labels are arbitrary up to identity. If more than one f-structure would get the same label, I either differentiate them using numerals (e.g., *p1* and *p2*) or assign one an arbitrary distinct label.

There are two main kinds of functional equations: *defining equations* and *constraining equations*. Defining equations, which are the sort we have seen so far, add information to an f-structure. For example, suppose a lexical entry for a verb has the following defining functional equation:

(2.19) $(\uparrow\ \textsc{subj num}) = \text{sg}$

Whether the subject of the verb adds this information or not, the f-structure will contain it, due to the verb's defining equation. This contrasts with a constraining equation, which checks the f-structure to make sure the equation holds, but does not itself add the information. For example, suppose the verb instead had the following constraining equation:

(2.20) $(\uparrow\ \textsc{subj num}) =_c \text{sg}$

Now the verb itself does not add the information. It checks to see if it is has been added by something else, though. The constraining equation cannot be satisfied if the f-structure does not contain the information. Another useful kind of constraining equation is an *existential equation* which checks that a certain attribute or path of attributes exists in the f-structure but does not state anything about its value (e.g., $(\uparrow\ \textsc{subj})$). Boolean connectives can also be used in functional equations and have the expected interpretations (for details, see Bresnan 2001:62).

F-descriptions are stated using regular expressions over f-structure paths. The regular language supports the usual operations, including Kleene star (*) and plus ($^+$) and disjunction ($|$). Kaplan and Zaenen (1989) use the regular language — in particular the notion of sets of strings defined by regular expressions — to provide *functional uncertainty* for f-descriptions with regular expressions over paths. Dalrymple (2001:143) gives the following definitions:

(2.21) $(f\ \ \alpha) = v$ holds if and only if f is an f-structure, α is a set of strings, and for some s in the set of strings α, $(f\ \ s) = v$.

(2.22) $(f\ \ as) \equiv ((f\ \ \alpha)\ s)$ for a symbol α and (possibly empty) string of symbols s.
$(\mathrm{f}\ \ \epsilon) \equiv f$, where ϵ is the empty string.

This kind of functional uncertainty is typically called *outside-in* functional uncertainty and is used in unbounded dependencies, as we will see below. Outside-in descriptions do not need to be unbounded, though. We have already seen examples like the following which are not:

(2.23) $(\uparrow\ \textsc{subj num}) = \mathrm{sg}$

Any f-description that starts with an f-structure and works its way in counts as an outside-in functional uncertainty.

The opposite case of *inside-out* functional uncertainty (Halvorsen and Kaplan 1988, Dalrymple 1993) is also defined. These are f-descriptions which have one or more attributes before the metavariable, e.g.:

(2.24) $(\textsc{subj}\ \uparrow)$

This is an inside-out existential equation that states that the $\uparrow$ is the SUBJ of some f-structure. Dalrymple (2001:145) gives the following definitions for inside-out functional uncertainty:

(2.25) $(\alpha\ \ f) \equiv g$ if and only if g is an f-structure, α is a set of strings, and for some s in the set of strings α, $(s\ \ f) \equiv g$.

(2.26) $(\epsilon\ \ f) \equiv f$, where ϵ is the empty string.
$(sa\ f) \equiv (s\ (\alpha\ f))$ for a symbol α and a (possibly empty) string of symbols s.

One last feature of the regular language for f-descriptions should be mentioned. The set membership symbol $\in$ can be used to state that a certain f-structure is in a certain set, as we have already seen above, but it can also be used as in attribute in a regular expression (Dalrymple 2001:154). For example, the following f-descriptions states that the f-structure $\uparrow$ is in some adjunct set:

(2.27) $(\textsc{adj}\ \in\ \uparrow)$

2.1.3.2 Well-formedness criteria

There are three principal well-formedness criteria for f-structures: *completeness*, *coherence*, and *uniqueness* (also known as *consistency*). Completeness requires that all subcategorized arguments represented in the PRED feature must be present in the f-structure. Coherence requires that all arguments that are present in the f-structure must be subcategorized by a PRED.

For example, consider the verb *endorse* in the following two f-structures:

(2.28)
$$\left[\begin{array}{ll} \textsc{pred} & \text{‘endorse}\langle\textsc{subj}, \textsc{obj}\rangle\text{’} \\ \textsc{subj} & \left[\;\;\right] \end{array}\right]$$

(2.29)
$$\left[\begin{array}{ll} \textsc{pred} & \text{‘endorse}\langle\textsc{subj}, \textsc{obj}\rangle\text{’} \\ \textsc{subj} & \left[\;\;\right] \\ \textsc{obj} & \left[\;\;\right] \\ \textsc{obl} & \left[\;\;\right] \end{array}\right]$$

The first f-structure is incomplete: it is missing a subcategorized OBJECT. The second f-structure is incoherent: it contains an unsubcategorized OBLIQUE. I adopt the convention of abbreviating PRED features without the subcategorized grammatical functions, on the assumption that the f-structure is complete and coherent unless otherwise indicated. For example, the PRED for *endorses* would just be ‘endorse’. I also adopt the further convention of abbreviating the information inside an f-structure using the word that contributes the f-structure. For example, the f-structure to which *endorses* contributes would be abbreviated as [“endorse”].

The uniqueness or consistency condition is the requirement that each f-structure attribute has at most one value. Recall that f-structures are functions from attributes to values. Each attribute must have a unique value if the f-structure is a function. PRED features are special in this regard as semantic forms. Semantic forms are always unique. This means that two f-structures cannot be unified if they each have a PRED, even if the PRED values are identical.

2.1.4 Semantic structure

Semantic structure is projected from functional structure via the σ projection function. Semantic structures are used as resources in linear logic proofs in Glue Semantics. This level of representation has not received nearly as much attention as constituent structure and functional structure

An exception to this is the LFG theory of anaphora, as initially put forward by Dalrymple (1993). She argues that binding relations should be represented as s-structure. Since s-structure is projected from f-structure, this allows a treatment of anaphora that takes both syntactic and semantic factors into account. This approach has been pursued in the Glue Semantics theory of anaphora, which I review in section 2.2.2 below, where binders are represented at s-structure using the feature ANTECEDENT. Two other s-structure features adopted in Glue Semantics are VARIABLE (VAR for short) and RESTRICTION (RESTR for short). These are used in providing common noun meanings and in the treatment of generalized quantifiers (see section 2.2.3 below).

2.1.5 Syntactic aspects of anaphora

Anaphoric binding in LFG is mediated by *binding equations* (Dalrymple 1993:120), which are used in LFG's binding theory (Dalrymple 1993, 2001, Bresnan 2001). Binding equations state syntactic constraints on binding and relate bound elements and their binders. The following is an example of a binding equation:

(2.30) $(\uparrow_\sigma \text{ ANTECEDENT}) = ((\text{GF}^* \text{ GF} \uparrow) \text{ GF})_\sigma$

Equation (2.30) identifies the binder of the pronominal in question using the semantic structure feature ANTECEDENT, following Dalrymple (2001). Note that ANTECEDENT is a value of the σ-projection of $\uparrow$.

The binding relation may be stated by co-indexation (see, for example, the expository, textbook binding theory of Bresnan 2001:212–235), as it is in much of the Principles and Parameters binding literature. Co-indexation is a symmetric relation: if A is co-indexed with B, then B is co-indexed with A. The binding relations employed here in terms of the s-structure feature ANTECEDENT are asymmetric: if A is the ANTECEDENT of B, then B is not the ANTECEDENT of A. Higginbotham's *linking* theory (Higginbotham 1983, 1985) is a similarly asymmetric binding theory.

The left side of the binding equation (2.30) is quite straightforward. It identifies the s-structure node that is found by following the path ANTECEDENT from the s-structure node $\uparrow_\sigma$, which is the σ-projection of the pronominal's f-structure node, $\uparrow$. Notice that there is a σ subscript that applies to the entire right side of the equation such that the result of resolving the right side is an s-structure node. We are therefore equating two s-structure nodes, the results of the left and right sides.

The right hand side of the equation is perhaps slightly harder to understand, but all it does is specify two things: where the binder of the anaphor may occur and that it bears a grammatical function at f-structure. One side of LFG binding equations, in this case the right one, always has the following general form (Dalrymple 1993:120):

(2.31) ((DomainPath $\uparrow$) AntecedentPath)

The sub-expression (DomainPath $\uparrow$) is an inside-out functional uncertainty equation. It specifies an f-structure, call it *f*, from which there is a path DomainPath to $\uparrow$. AntecedentPath is the path from *f* to the f-structure of $\uparrow$'s antecedent. AntecedentPath is usually the attribute GF or a more specific instance of GF, such as SUBJ (for example, if the anaphor is subject-oriented). The expression (DomainPath $\uparrow$) is also know as the binding domain (Dalrymple 2001:283–291). The binding domain is the specification of where the antecedent can occur.

The binding domain may be suitably restricted through off-path constraints (see the following section), such as $\neg$ ($\rightarrow$ SUBJ). The expression $\rightarrow$ is an f-structure variable (like $\uparrow$ and $\downarrow$); it refers to the value of the f-structure attribute which it annotates. For example, the f-structure equation in (2.32) is suitable for the binding domain of English reflexives (Dalrymple 2001:279–87).

(2.32) $\left(\underset{\neg (\rightarrow \text{SUBJ})}{\text{GF}^*} \quad \text{GF} \ \uparrow \right)$

The off-path constraint states that for each f-structure *f* identified by the regular expression GF*, *f* cannot contain a SUBJECT grammatical function. Notice that the off-path constraint does not apply to the f-structure in which the pronoun occurs, (GF $\uparrow$), which is embedded one level further than the first f-structure to which the off-path constraint applies. This restricts the binding domain of the reflexive to the smallest f-structure that contains the reflexive and a SUBJECT grammatical function, the "Minimal Complete Nucleus" of the reflexive (see, e.g. Dalrymple 2001:281). The binding domain in (2.32) with the off-path constraint given effectively captures Principle A.

Returning to the specific binding equation in (2.30), we see that the binding domain is (GF* GF $\uparrow$). This equation is unpacked as follows. The f-structure variable $\uparrow$ specifies the f-structure node of the anaphor. The equation (GF $\uparrow$) identifies the f-structure node, call it *g*, of the predicate that takes the anaphor as an argument. GF* uses the Kleene star to identify an f-structure node, call it *f*, that is found by moving zero or more GFs out from *g*. The f-structure node identified by (GF* GF $\uparrow$) is either *g*, the f-structure in which the anaphor occurs, or an f-structure that can be found by following a series of GF attributes outward from *g*. Thus, the binding domain (GF* GF $\uparrow$) specifies the possible f-structures within which the anaphor finds the f-structure node that maps to its antecedent at s-structure. The binding domain (GF* GF $\uparrow$), is completely unrestricted; i.e. it is the "Root Domain" (Dalrymple 2001:284).

The inside-out binding equation in (2.30) is appropriate as part of the lexical entry for an anaphor and suitably restricts the anaphor's relationship to its antecedent. For further details of such binding equations, see Dalrymple (1993, 2001) and Bresnan (2001). However, in this thesis I am more interested in the kind of binding that occurs in binder-resumptive dependencies. This kind of binding is stated at the top of the binder-resumptive dependency using an outside-in equation like the following:

(2.33) $(\uparrow \text{GF})_\sigma = ((\uparrow \text{GF}^+)_\sigma \ \text{ANTECEDENT})$

This particular equation states that one of the grammatical functions in the f-structure identified by $\uparrow$ is the ANTECEDENT of a grammatical function that is found in the same f-structure or in any embedded f-structure. The grammatical function that gets bound will have its own inside-out binding equation that further restricts the anaphoric binding. However, such equations will not affect the main points and will only be discussed where relevant.

2.1.6 Unbounded dependencies

Unbounded dependencies in LFG are represented using the grammaticized discourse functions TOPIC and FOCUS. For example, topicalization and relative clauses involve TOPIC, whereas *wh*-questions involve FOCUS. This distinction is not important for present purposes, but I maintain it for the sake of continuity. I generalize across the two unbounded dependency functions with the function UDF, defined as follows:

(2.34) $\text{UDF} := \text{TOPIC} \vee \text{FOCUS}$

Unbounded dependencies are integrated into syntactic representations according to the Extended Coherence Condition (ECC; among others, see Zaenen 1980, Bresnan and Mchombo 1987, Fassi-Fehri 1988). Bresnan and Mchombo (1987:746) formulate the condition as follows:

(2.35) **Extended Coherence Condition**

FOCUS and TOPIC must be linked to the semantic predicate argument structure of the sentence in which they occur, either by functionally or by anaphorically binding an argument.

Filler-gap unbounded dependencies satisfy the ECC through functional equality: the UDF is equated with some subcategorized grammatical function. Binder-resumptive unbounded dependencies satisfy the ECC through anaphoric binding. Binder-resumptive dependencies are discussed at length in part II of the dissertation. I will stick to filler-gap dependencies in the following discussion of the general LFG approach to unbounded dependencies

A filler is functionally equated with some argument in order to satisfy the ECC. I follow Kaplan and Zaenen (1989) in using an outside-in functional uncertainty to accomplish this. For example, the following functional uncertainty states that the UDF is equated to a GF embedded in zero or more COMP f-structures:

(2.36) $(\uparrow \text{UDF}) = (\uparrow \text{COMP}^{*}\ \ \text{GF})$

This would account for sentences like the following:

(2.37) Who did you see?

(2.38) Who did Mary say that you saw?

(2.39) Who did Mary claim that John alleged that you saw?

The UDF is the filler and the GF it is equated with is the gap. Notice that there is nothing in the gap position in this theory (e.g., a trace or a special gap object like the *gap-synsem* of Bouma et al. 2001). The filler-gap dependency is just a single f-structure occupying two grammatical functions.

The functional uncertainty path above is clearly inadequate. For example, it does not handle extraction from an adjunct, like in the following sentence:

(2.40) What do you play records on?

Dalrymple (2001:396,404,407) gives the following path for English filler-gap dependencies (adapted to the UDF convention):

(2.41) $(\uparrow \text{UDF}) \;=\; \{\text{XCOMP} \;|\; \underset{(\rightarrow\text{LDD}) \neq -}{\text{COMP}} \;|\; \underset{(\rightarrow\text{TENSE})}{\text{OBJ}}\}^{*}\ \ \{(\text{ADJ}\ \ \underset{\neg\,(\rightarrow\text{TENSE})}{\in}\ \ )\ \ (\text{GF}) \;|\; \text{GF}\,\}$

According to this functional uncertainty, the UDF is equated with grammatical function that is arbitrarily deeply embedded in any number of XCOMP, COMP or OBJ grammatical functions. Optionally, the UDF can be an argument of one these functions' (untensed) ADJUNCT or it can itself be an ADJUNCT (Dalrymple 2001:396). The expression illustrates that we can state complex functional uncertainties to capture a wide range of possible unbounded dependency paths.

The equation also illustrates the use of *off-path constraints* (Dalrymple 1993:128–131) to further restrict the unbounded dependency. The off-path metavariables refer to the f-structure that has the annotated attribute as its value (←) or the f-structure that is the value of the annotated attribute (→). For example, in the above expression, the off-path constraint $\neg\,(\rightarrow \text{TENSE})$ entails that there cannot be extraction from a tensed adjunct. The constraint blocks sentences such as the following:

(2.42) * John is the man who we laughed when we saw.

The specification of the grammatical functions in the functional uncertainty together with the off-path constraints constrain possible unbounded dependencies and extraction sites and are how island effects are derived in this theory.

I do not use complex functional uncertainties in much of what follows, although off-path constraints will become relevant in the discussion of islands in chapter 8. The following c-structure rule for introducing unbounded dependency functions suffices for my purposes:

(2.43)
$$\begin{array}{llccccc} \text{CP} & \longrightarrow & \{ & \text{XP} & | & \epsilon & \} & \text{C}' \\ & & & (\uparrow \textsc{udf}) = \downarrow & & (\uparrow \textsc{topic pred}) = \text{`pro'} & & \uparrow = \downarrow \end{array}$$

This rule allows a TOPIC or FOCUS XP to be generated in SpecCP. It also allows for the generation of a relative clause without a relative pronoun (e.g., *a guy I know*). This is accomplished by using the empty string to introduce material into f-structure without anything being present in c-structure. The material that is introduced is the specification that the TOPIC's PRED has the value PRO, which is appropriate for a missing relative pronoun. The rule is quite unconstrained, but rather than adding details that would distract attention from more relevant points, I just assume that the methods outlined by Dalrymple (2001:400ff.) can be applied appropriately.

2.1.7 Raising

Raising is handled as functional equality between a grammatical function of the raising verb and the subject of its open, predicative complement (Bresnan 1982a). The open complement is represented as the grammatical function XCOMP. The raising equation for subject raising would therefore be:

(2.44) $(\uparrow \textsc{subj}) = (\uparrow \textsc{xcomp subj})$

The matrix and subordinate subjects are thus identified at f-structure. They have a single, structure-shared value.

For example, the f-structure for the example in (2.45) is shown in (2.46)

(2.45) Thora seems happy.

(2.46)
$$\begin{bmatrix} \textsc{pred} & \text{`seem'} \\ \textsc{subj} & \begin{bmatrix} \textsc{pred} & \text{`Thora'} \end{bmatrix} \\ \textsc{xcomp} & \begin{bmatrix} \textsc{pred} & \text{`happy'} \\ \textsc{subj} & \rule{2em}{0.4pt} \end{bmatrix} \end{bmatrix}$$

An infinitival raising complement is handled similarly:

(2.47) Thora seems to like cookies.

(2.48)
$$\left[\begin{array}{ll}
\text{PRED} & \text{'seem'} \\
\text{SUBJ} & \left[\text{PRED} \quad \text{'Thora'}\right] \\
\text{XCOMP} & \left[\begin{array}{ll}
\text{PRED} & \text{'like'} \\
\text{SUBJ} & \rule{3cm}{0.4pt} \\
\text{OBJ} & \left[\text{PRED} \quad \text{'cookie'}\right]
\end{array}\right]
\end{array}\right]$$

Raising is thus a lexically controlled local dependency and involves simultaneous instantiation of two grammatical functions to a single f-structure value. There is no movement involved in raising and the target of raising in the complement is not represented in c-structure.

2.2 A brief introduction to Glue Semantics

2.2.1 Composition and interpretation

In Glue Semantics (Glue), *meaning constructors* for semantic composition are obtained from lexical items instantiated in particular syntactic structures. Each constructor has the following form:

(2.49) $\mathcal{M} : G$

$\mathcal{M}$ is a term from some representation of meaning, a *meaning language*, and G is a term of the Glue logic that sticks meanings together, i.e. performs composition. The colon is an uninterpreted pairing symbol. Linear logic (Girard 1987), or more precisely a fragment of linear logic, serves as the Glue logic (Dalrymple et al. 1993, 1999a,b). The meaning constructors are used as premises in a (linear logic) proof that consumes the lexical premises to produce a sentential meaning. A successful Glue proof of sentential semantics proves the following sequent (following Crouch and van Genabith 2000:117):

(2.50) $\Gamma \vdash \mathcal{M} : G_t$

Semantic ambiguity (e.g., scope ambiguity) results when there are alternative derivations from the same set of premises. The logics for $\mathcal{M}$ and G are presented in appendix A.1. Note that the linear logic is typed.

It is useful to view linear logic from the perspective of substructural logics, a field to which it has made a substantial contribution (Restall 2000). More familiar logics, such as classical logic (Hodges 2001, Gamut 1991:28–113) or intuitionistic logic (van Dalen 2001, Gamut 1991:140–141), have structural rules of *contraction* and *weakening*, which are shown in (2.51).[1]

(2.51) $$\frac{\Gamma, A, A \vdash B}{\Gamma, A \vdash B}\, contraction \qquad \frac{\Gamma \vdash B}{\Gamma, A \vdash B}\, weakening$$

Contraction allows us to arbitrarily drop a premise and weakening allows us to arbitrarily add a premise. The absence of these structural rules and the resulting interpretation of the sequent ($\vdash$) means that new, linear connectives must be defined, which is the source of much of the appeal of linear logic to logicians, since these connectives are quite interesting from a proof-theoretic perspective. From a linguistic perspective, what is more relevant is that the absence of these rules means that linear logic can serve as a logic of resources. We will return to this linguistically significant aspect of linear logic shortly.

Glue Semantics is related to Categorial Grammar in the Lambek tradition (what is sometimes called Type-Logical Grammar (Morrill 1994)), since linear logic is basically equivalent to **LP**, the commutative and associative logic on the Lambek hierarchy, whereas the Lambek calculus for simple Categorial Grammar in this tradition is the logic **L**, which is associative but non-commutative (Moortgat 1997). In structural terms, the fragment of linear logic used for Glue has the structural rule of *commutativity*, which **L** lacks:[2]

(2.52) $$\frac{\Gamma, A, B \vdash C}{\Gamma, B, A \vdash C}\, commutativity$$

Commutativity just says that the order of premises does not matter. The most crucial difference between Glue and Categorial Grammar is that the latter rejects a level of syntax that is separate from the syntax of semantic composition whereas the former accepts such a level. It is the acceptance of a separate level of syntax that allows the Glue logic to be commutative without wildly overgenerating.

As noted above, linear logic lacks the structural rules of contraction and weakening and is therefore a resource logic, unlike classical and intuitionistic logics (but like **L**). All premises must be used in reaching the conclusion (as in *relevance logic*; Anderson and Belnap 1975, Read 1988) and the premises are *resources* that are literally used up in producing conclusions. The following comparison to classical/intuitionistic logic serves as an illustration of this (note that '$\multimap$' is linear implication and '$\otimes$' is one form of linear conjunction, multiplicative conjunction):

[1] This is the presentation of Crouch and van Genabith (2000:13); for more precise discussion see Restall (2000:26ff.).

[2] This is again a simplified presentation, following Crouch and van Genabith (2000) (who use another common name for the rule: *exchange*); see Restall (2000) for further details and discussion.

(2.53)

Premise reuse Classical/Intuitionistic Logic	Linear Logic
$A,\ \ A \rightarrow B \vdash B$ $A,\ \ A \rightarrow B \vdash B \wedge A$ Premise A reused, conjoined with conclusion B	$A,\ \ A \multimap B \vdash B$ $A,\ \ A \multimap B \nvdash B \otimes A$ Premise A is consumed to produce conclusion B, no longer available for conjunction with B

(2.54)

Premise nonuse Classical/Intuitionistic Logic	Linear Logic
$A, B \vdash A$ Can ignore premise B	$A, B \nvdash A$ Cannot ignore premise B

This logical resource sensitivity tightly constrains the proof space of linear logic. More importantly from a linguistic perspective, the resource sensitivity of linear logic models the resource sensitivity of natural language semantics, whereby each meaningful element makes its meaning contribution exactly once. Thus, resource sensitivity also constrains derivations in linguistically desirable ways. Substructural logics and resource sensitivity are discussed further in chapter 3.

The fragment of linear logic I assume is the the modality-free, multiplicative fragment of intuitionistic linear logic, which I will refer to as MILL. It is not a strictly propositional logic, because it has universal quantification, but it is not fully higher order, since the quantification is strictly limited to universal quantification over t-type atoms of the linear logic (Crouch and van Genabith 2000:124).[3] The logic MILL lacks existential quantification and negation. It is therefore quite weak from a proof-theoretic perspective (there are many things it cannot prove), but it is strong enough for central concerns of linguistic semantics, such as basic composition of functors and arguments, anaphora, and scope. See appendix A for further details of MILL.

I principally use three proof rules of this fragment of linear logic. In a natural deduction presentation, these are conjunction elimination for $\otimes$ and implication introduction and elimination for $\multimap$ (a.k.a. 'abstraction' or 'hypothetical reasoning' for implication introduction and 'modus ponens' for elimination), as shown in (2.55).

(2.55) a. Implication Elimination

$$\dfrac{\begin{matrix}\vdots \\ A\end{matrix} \qquad \begin{matrix}\vdots \\ A \multimap B\end{matrix}}{B} \multimap_{\mathcal{E}}$$

[3] Kokkonidis (2003) defines a version of Glue Semantics that uses a strictly propositional linear logic; the treatment is extremely promising, but at this point not well-understood.

b. Implication Introduction

$$\dfrac{\begin{array}{c}[A]^1\\ \vdots\\ B\end{array}}{A \multimap B}\multimap_{\mathcal{I},1}$$

c. Conjunction Elimination

$$\dfrac{\begin{array}{c}\\ \vdots\\ A\otimes B\end{array}\qquad \begin{array}{c}[A]^1\ \ [B]^2\\ \vdots\\ C\end{array}}{C}\otimes_{\mathcal{E},1,2}$$

A premise in brackets with a numerical flag indicates an assumption; the flags keep track of which assumptions have been withdrawn and which are active. The rules for implication may be familiar from classical and intuitionistic logic and the rule for $\otimes$ might be too, except that it looks similar to the rule for discharging *disjunction*. The resource perspective on linear logic can make the intuition behind this apparently puzzling similarity clear. Recall that in classical or intuitionistic logic we can only be sure that a disjunction is true or provable if both disjuncts can be used to establish some conclusion (given that we do not know *which* disjunct confirms the disjunction). Likewise, in linear logic we can only be sure that we can use a multiplicative conjunction of two resources if we know that both resources can be used independently.

The proof rules for linear logic construct proof terms via the Curry-Howard isomorphism (a.k.a. 'formulas-as-types'; Curry and Feys 1958, 1995, Howard 1980), which establishes a formal correspondence between natural deduction and terms in the lambda calculus. One useful application of the terms is in stating identity criteria for proofs, so that we know when two proofs are equivalent and when they are not; thus, term reduction is related to proof normalization (Prawitz 1965; see Gallier 1995 on the relationship between term reduction and proof normalization). The basic insight behind the isomorphism is that implications correspond to functional types, so that implication elimination corresponds to *functional application* and implication introduction corresponds to *abstraction*. The basic isomorphism, discovered by Curry (Curry and Feys 1958; Curry and Feys 1995 contains the most relevant sections), was extended to deal with various other types by Howard (1980). The Curry-Howard term assignments for the three rules in (2.55) are:

(2.56) a. Application : Implication Elimination

$$\frac{\begin{array}{c}\vdots \\ a : A\end{array} \qquad \begin{array}{c}\vdots \\ f : A \multimap B\end{array}}{f(a) : B} \multimap_{\mathcal{E}}$$

b. Abstraction : Implication Introduction

$$\frac{\begin{array}{c}[x : A]^1 \\ \vdots \\ f : B\end{array}}{\lambda x.f : A \multimap B} \multimap_{\mathcal{I},1}$$

c. Pairwise substitution : Conjunction Elimination

$$\frac{\begin{array}{c}\vdots \\ a : A \otimes B\end{array} \qquad \begin{array}{c}[x : A]^1 \quad [y : B]^2 \\ \vdots \\ f : C\end{array}}{\mathsf{let}\ a\ \mathsf{be}\ x \times y\ \mathsf{in}\ f : C} \otimes_{\mathcal{E},1,2}$$

As noted above, implication elimination corresponds to functional application, and implication introduction corresponds to abstraction. The assumed premise in the introduction rule is associated with a variable that is abstracted over when the assumption is discharged. The term constructor let is possibly less familiar. A multiplicative conjunction $A \otimes B$ corresponds to a tensor product $a \times b$, where a is the proof term of A and b is the proof term of B (see the rule for conjunction introduction ($\otimes_{\mathcal{I}}$) in (2.62) below). However, let prevents projection into the individual elements of the tensor pair and therefore enforces pairwise substitution (Abramsky 1993, Benton et al. 1993, Crouch and van Genabith 2000:88), such that a let expression β-reduces as follows:

(2.57) $\mathsf{let}\ a \times b\ \mathsf{be}\ x \times y\ \mathsf{in}\ f \quad \Rightarrow_{\beta} \quad f[a/x, b/y]$

The substitution of the pair is simultaneous and does not involve projection into the members. So let is not forbidding and is just a slightly more structured form of functional application.

It is the Curry-Howard term assignments that determine operations in the meaning language. I use the locution "operations in the meaning language" purposefully. The term assignments constructed by rules of proof for linear logic result in *linear* lambdas (Abramsky 1993); these are lambda terms in which every lambda-bound variable occurs exactly once (i.e. no vacuous abstraction and no multiple abstraction). The proof terms therefore satisfy resource sensitivity. However, lexically contributed meanings need not contain only linear lambdas (for a similar point about the

Lambek Calculus, see Moortgat 1997:122ff.). This is *not* a violation of the isomorphism though, because the isomorphism says nothing about the internal structure of the functions that it constrains in correspondence to the rules of proof. In summary, the meaning language needs to support operations determined by the Curry-Howard for the three rules in (2.56).

The meaning language therefore needs to minimally support a notion of application and abstraction, as well as product pairs for the multiplicative conjunction. Work in Glue Semantics has traditionally assumed that the meaning language is a lambda calculus of some kind. The meaning language can be construed as simply being a convenient representation for what is in fact the model theory itself, as discussed by Jacobson (1999:122). The lambda calculus is one convenient way to describe the functions that are actually in the models, but it is not the only one. The notations in (2.58)–(2.61) are equivalent in terms of defining functions, where the left sides of the last two most clearly represent model-theoretic objects. The reduced forms of the first two notations would mask things too much for present purposes; they are therefore given in unreduced form:

(2.58) $\lambda x.comedian(x) : a \multimap b$

(2.59) $\lambda^* x.\mathbf{comedian}\, x : a \multimap b$

(2.60) The function f such that $f(x) = 1$ iff x is a comedian : $a \multimap b$

(2.61) $\begin{bmatrix} \text{julia} \rightarrow 1 \\ \text{jerry} \rightarrow 1 \\ \text{kofi} \rightarrow 0 \end{bmatrix} : a \multimap b$

The first notation just is the lambda calculus. The second notation is abstraction in combinatory logic (Curry and Feys 1958), where $\lambda^*.M$ is not part of the formal system of terms, but is rather part of the metatheory and is constructed from the combinators S and K and parts of M (Hindley and Seldin 1986:25–28). The possibility of using combinators underscores the fact that the meaning language for Glue is variable-free in the usual sense of variable-free semantics (Jacobson 1999): there is no *crucial* use of variables, since the variables are bound. Even implication introduction, with the apparently free variable in the assumed premise, does not pose a problem, because this rule just corresponds to abstraction and we have just seen that abstraction can be defined in terms of combinators. The last two notations are commonly used in pedagogical presentations as preliminaries to the lambda calculus (see, e.g., Dowty et al. 1981, Heim and Kratzer 1998), but do not readily support a notion of abstraction. We could define ad hoc abstraction systems for them, but then either the lambda calculus or combinatory logic is clearly preferable. However, combinatory logic is harder to read than the lambda calculus, and I therefore adopt the latter. It is common even in Combinatory Categorial Grammar to adopt the more easily readable lambda calculus for meaning representations (Jacobson 1999:122), even though the combinators form the heart of the theory. The meaning language is presented in appendix A.1. I assume a simple extensional semantics, as the main area of concern here is semantic composition, rather than truth conditions per se.

There are three further proof rules for MILL, conjunction introduction ($\otimes_{\mathcal{I}}$) and universal introduction and elimination ($\forall_{\mathcal{I}}$ and $\forall_{\mathcal{E}}$). The rule for conjunction introduction is straightforward and just corresponds to pair formation in the meaning language:

(2.62) Product : Conjunction Introduction

$$\frac{\begin{array}{c}\vdots\\ a : A\end{array} \qquad \begin{array}{c}\vdots\\ b : B\end{array}}{a \times b : A \otimes B}\otimes_{\mathcal{I}}$$

The rule for univeral introduction is not used here at all, but is given in appendix A for reasons of completeness. The rule for universal elimination is trivial and is used only implicitly; it is also provided in the appendix. Since the universal is used in the analysis of scope, as will become clear in section 2.2.3, the universal rules bear some comment, starting with the interpretation of the quantifier itself.

The universal quantifier representation $\forall$ occurs only in the linear logic side, G, of meaning constructors $\mathcal{M} : G$. It is important to realize that $\forall$ means *any* not *all* in linear logic (Crouch and van Genabith 2000:89). Consider this from the perspective of linear logic as a resource logic. If all the resources quantified over were selected, there could be massive resource failure, since they would all be consumed in one fell swoop. Rather, the way to reason about it is that if some property holds of all such resources, then you can pick any one and know that the property holds over that one. A contrast with the existential quantifier (which is absent in this fragment) serves to highlight the fact that despite the resource-sensitive intepretation of $\forall$, it is truly universal quantification. In the case of the existential quantifier, we know that the property holds of some resource, but we cannot arbitrarily pick *any* resource and be sure that the property hold of *that* resource. Thus, the universal quantifier in linear logic really is a universal and should be represented as such, despite its "any" interpretation and the possible danger of overloading the symbol $\forall$. The potential overload is not a real danger here, because $\forall$ will only be used in the linear logic. It will never appear in the terms of the meaning language, where all quantifiers are represented using a functional generalized quantifier notation that is discussed further below. That the linear logic universal is a true universal is further underscored by the fact that the universal introduction and elimination rules are identical to those of intuitionistic logic (see appendix A).

The introduction rule for the universal, which is the more problematic rule (in just the usual sense that we have to be careful in concluding a universal from an instance), will not be used at all. As mentioned above, the universal is used in constructing the scope of scope-taking lexical items (e.g. quantifiers). The universal quantifier is therefore part of the meaning constructors that are lexically specified by such lexical items and as such is not introduced in the proof. The term assignments for universals in fact have no effect on the meaning language (see appendix A.3); this means that the universals used here live entirely in the linear logic. The universal elimination rule will be used when scopal elements take their scope, but its use will be only implicit, since it is trivial. I will return to this point in section 2.2.3 below, when we have seen an example of the relevant sort of derivation.

I noted above that the Glue meaning constructors are instantiated relative to a particular syntactic parse and that it was the assumption of a syntax separate from the syntax of the proof theory that allows the logic of composition to be commutative. I am assuming an LFG syntax and the LFG projection architecture. The linear logic resources used for semantic composition in Glue-LFG are node labels in semantic structure, instantiated by the σ projection function. This means that the meaning constructors contributed by lexical items are instantiated by σ projections on f-structure equations. Since these f-structure equations are standardly called f-descriptions, I will call σ-mapped f-structure equations *s-descriptions*, since they describe semantic structures. Meaning constructors are instantiated by s-descriptions. For example, the proper name *Mary* provides the meaning constructor in (2.63a) and the intransitive verb *laughed* the one in (2.63b).

(2.63) a. $mary : \uparrow_{\sigma_e}$

b. $laugh : (\uparrow \text{SUBJ})_{\sigma_e} \multimap \uparrow_{\sigma_t}$

For example, if we had the f-structure (2.64), with node labels as indicated, then the f-descriptions in (2.63) would get instantiated as in (2.65):

(2.64) $$f\begin{bmatrix} \text{PRED} & \text{‘laugh’} \\ \text{SUBJ} & g\begin{bmatrix} \text{PRED} & \text{‘Mary’} \end{bmatrix} \end{bmatrix}$$

(2.65) a. $mary : g_{\sigma_e}$

b. $laugh : g_{\sigma_e} \multimap f_{\sigma_t}$

The lexical item *Mary* contributes the resource that is the σ-projection of its f-structure (indicated as usual by $\uparrow$); similarly, the lexical item *laughed* contributes a resource that is an implication from the

σ-projection of its subject to the σ-projection of the verb, where (f SUBJ) $= g$ in (2.64). However, it is standard practice in Glue work to name meaning constructors mnemonically and to suppress the σ-projection and type subscripts where convenient. Therefore, the normal abbreviation for the resources contributed by *Mary* and *laughed*, when the former is the subject of the latter, would be m and $m \multimap l$. This naming convention allows a schematic presentation of meaning constructors that abstracts away from how they are derived from the syntax, focusing instead on the compositional semantics. I will call meaning constructors written in terms of s-descriptions *generalized meaning constructors* and those written using the mnemonic convention *schematic meaning constructors*.

As an initial simple example, consider the sentence *Mary laughed*. The lexically contributed meaning constructors were shown above and are repeated here:

(2.66)
1. $mary : m$ — Lex. **Mary**
2. $laugh : m \multimap l$ — Lex. **laughed**

I adopt the general covention of providing the meaning constructors together with their contributors and a gloss if this is appropriate. To avoid clutter I often suppress the meaning terms in both premise lists and proofs, since the meanings follow pretty straightforwardly by the Curry-Howard isomorphism.

The premises above construct the following proof:

(2.67)
$$\frac{mary : m \qquad laugh : m \multimap l}{laugh(mary) : l} \multimap_{\mathcal{E}}$$

The proof tree is annotated with the proof rule that was used ($\multimap_{\mathcal{E}}$). I will usually suppress labelling of proof trees with implication elimination, since its application is so obvious. As noted above, I typically do not provide the meaning terms in proofs to avoid clutter. Sometimes the proof is given without the meaning terms and then again with the meaning terms. I find that this maximizes ease of readability, since on the first pass the reader sees just the structure of the proof, which determines the meanings in any case.

It should be kept in mind that there is nothing privileged about representing proofs as natural deduction proof trees. Proofs are abstract objects that can be written down in various ways. It makes no more sense to think of proof trees as special than it does to think of “1” as a special representation of the number one. The proof above could equivalently be provided in a list style:

(2.68)
1. $mary : m$ — Lex. **Mary**
2. $laugh : m \multimap l$ — Lex. **laughed**
3. $laugh(mary) : l$ — E $\multimap$, 1, 2

Despite the equivalence between the two representations, natural deduction trees are easier to read for larger proofs and I will therefore present proofs as trees.

2.2.2 Anaphora in Glue Semantics

Anaphora resolution in Glue Semantics has been variable-free from the start (Dalrymple et al. 1999c), and independently of the variable-free tradition in Categorial Grammar (see Jacobson 1999 and references therein). This can ultimately be traced to the commutativity of the Glue logic. In the CG tradition, the pronoun is a function on its antecedent but cannot combine with it directly, since the pronoun does not occur adjacent to its antecedent in the string and the non-commutative logic of CG does not allow arbitrary reordering of premises to permit direct application. This necessitates a series of function compositions such that a function that has composed with the pronoun applies to the antecedent. By contrast, since the Glue logic is commutative, the pronoun can directly apply to its antecedent. Given the possibility of such application, there is no temptation to use assignment functions for pronouns, since a cleaner alternative is immediately apparent.

A pronoun has a meaning constructor that makes crucial use of multiplicative conjunction ($\otimes$), as shown here:

(2.69) $\lambda z.z \times z : (\uparrow_\sigma \ \textsc{antecedent})_e \multimap ((\uparrow_\sigma \ \textsc{antecedent})_e \otimes \uparrow_{\sigma_e})$

Recall that ANTECEDENT is a feature at semantic structure, not functional structure.

A schematic representation of the pronoun's meaning constructor is as follows, where A is the antecedent's resource and P is the pronoun's resource:

(2.70) $A \multimap (A \otimes P)$

The pronoun's meaning constructor consumes its antecedent's resource to produce a conjunction of the antecedent resource and the pronoun's resource. The pronoun has a functional type from type e to the product type $e \times e$. The pronoun's type is therefore $\langle e, \langle e \times e \rangle \rangle$. The possible values of ANTECEDENT at s-structure are constrained by syntactic factors (Dalrymple et al. 1999c:58), including LFG's binding theory, which is stated using f-structural relations and the mapping from functional structure to semantic structure (Dalrymple 1993, Bresnan 2001; see section 2.1.5).

We can construct the proof in (2.72) for the simple example in (2.71), using the mnemonic convention for naming resources, where p indicates 'pronoun' ('$\Rightarrow_\beta$' indicates β-reduction of a lambda term).

(2.71) Joe said he bowls.

(2.72)

$$\dfrac{\dfrac{\dfrac{\begin{array}{l}joe:\\ j\end{array} \quad \begin{array}{l}\lambda z.z \times z:\\ j \multimap (j \otimes p)\end{array}}{joe \times joe : j \otimes p} \qquad \dfrac{\dfrac{[x:j]^1 \quad \begin{array}{l}\lambda u \lambda q.say(u,\ q):\\ j \multimap b \multimap s\end{array}}{\begin{array}{l}\lambda q.say(x,\ q):\\ b \multimap s\end{array}} \quad \dfrac{[y:p]^2 \quad \begin{array}{l}\lambda v.bowl(v):\\ p \multimap b\end{array}}{\begin{array}{l}bowl(y):\\ b\end{array}}}{say(x,\ bowl(y)) : s}}{\mathsf{let}\ joe \times joe\ \mathsf{be}\ x \times y\ \mathsf{in}\ say(x,\ bowl(y)) : s}\otimes_{\mathcal{E},1,2}}{say(joe,\ bowl(joe)) : s}\Rightarrow_\beta$$

Note that there is nothing special about the verb *bowl*. It has not undergone a type shift or been modified in any way to accommodate the pronoun. Note also that the resource corresponding to the pronoun is the right member of the conjunction pairing and that it is a type e atomic resource, just like that of a name. However, the proof rule for conjunction elimination requires simultaneous substitution of the products and does not permit separate projection into one or the other (see section 2.2). Finally, observe that the pronoun does not correspond to a free variable, since the corresponding variable is lambda-bound. Thus, we have a variable-free analysis of pronouns.

The pronoun in example (2.71) can also refer deictically or be discourse-bound and does not need to be bound by the intra-sentential antecedent. There are a number of options for handling such cases in Glue Semantics. First, it is possible to take Jacobson's (1999:134–135) approach and simply assume that free pronouns are left unresolved and that sentential semantics does not need to terminate in type t, but can instead terminate in a functional type from the type of a pronominal antecedent to a sentential type. As Jacobson (1999:135) notes, it is no worse for a sentential meaning to be dependent on a nominal meaning for saturation then it is for it to be dependent on an assignment function. In practice though, it will be somewhat difficult to ensure that the right proof conditions hold. In particular, it has to be ensured that the unused material corresponds to a pronoun and a method has to be established for generalizing to an unbounded number of free pronouns. These same complications equally apply to Jacobson's particular implementation of variable-free semantics.

Another option is to make the standard move to a dynamic semantics. There are two fundamental methods for making Glue Semantics dynamic. The most straightforward method is to use a dynamic meaning language that supports lambda abstraction, such as Lambda DRT (Bos et al. 1994), as suggested briefly by Dalrymple et al. (1999b) and pursued in detail by Kokkonidis (2003), or Compositional DRT (Muskens 1994), as developed by van Genabith and Crouch (1999a). A second method is to keep the meaning language static and to allow the linear logic that composes meanings to also handle contextual update, thus effectively moving the dynamics into the linear logic side. This approach was initially developed by Crouch and van Genabith (Crouch and van Genabith 1999, van Genabith and Crouch 1999b) and further developed by Dalrymple (2001:291ff.), but it is still to some extent work in progress.

In sum, there are at least three options for handling free pronouns: changing the goal of semantic proofs to allow unresolved pronouns in the conclusion, using a dynamic meaning language, or using context update to model dynamic semantics in the linear logic. Since resumptive pronouns are by definition intra-sententially bound pronouns, these matters do not directly impinge on most of this thesis. However, dynamic semantics becomes relevant again in chapter 8, where I consider the interpretation of resumptive-like pronouns in English (i.e., *intrusive pronouns*; Sells 1984).

2.2.3 Scope

I assume a generalized quantifier analysis of scope-taking elements, in particular quantifiers and *wh*-words. The following is an example of a lexical entry for a quantifier:

(2.73) *most*: D^0 $(\uparrow \textsc{pred}) = \text{`most'}$

$$\begin{array}{l}\lambda R \lambda S.most(x,\ R(x),\ S(x)) : \\ [((\textsc{spec}\ \uparrow)_\sigma\ \textsc{var})_e \multimap ((\textsc{spec}\ \uparrow)_\sigma\ \textsc{restr})_t] \multimap \\ \quad \forall X.[((\textsc{spec}\ \uparrow)_{\sigma_e} \multimap X_t) \multimap X_t]\end{array}$$

Recall that I am assuming that D^0 maps to a SPEC f-structure inside the larger nominal f-structure. There are a variety of ways to represent quantificational determiners on the left hand side of the meaning constructor, depending partly on the logic chosen for the meaning language. I opt for the three-place functional representation shown above. Notice that the type of the meaning constructor is the generalized quantifier type $\langle\langle e,t\rangle, \langle\langle e,t\rangle, t\rangle\rangle$.

The meaning constructor in (2.73) states that the quantifier will consume as its restriction an implication from its common noun's VAR(IABLE) to the noun's RESTR(ICTION). VAR and RESTR are features contributed by common nouns to semantic structure (see section 2.1.4). The generalized meaning constructor for an ordinary common noun is as follows:

(2.74) $president : (\uparrow_\sigma\ \textsc{var})_e \multimap (\uparrow_\sigma\ \textsc{restr})_t$

The common noun is type $\langle e,t\rangle$ as expected.

Having consumed its restriction, the quantifier looks for its scope. The scope-taking part of the quantifier is represented by the expression $\forall X.[((\textsc{spec}\ \uparrow)_{\sigma_e} \multimap X)_t \multimap X_t]$. The universal quantifiation means that the meaning constructor for a quantifier looks for *any* $\langle e,t\rangle$ implication that depends on the resource of the quantified DP. The fact that we universally quantify over X allows the quantifier to take higher scope by introducing a hypothesis on the resource instantiating X, discharging the dependency on this resource locally, and then reintroducing it at a later point in the derivation. Recall that all scope-taking words use $\forall$ in the linear logic expression for finding their nuclear scope; it says nothing about the semantics of the word in question, which is represented as a functional quantifier in the meaning language.

Using the mnemonic convention described above and suppressing σ and type subscripts, we get the lexically contributed premises in (2.76) for sentence (2.75). Notice that $president^*$ represents the denotation of the plural common noun.

(2.75) Most presidents speak.

(2.76)
1. $\lambda R \lambda S.most(x, R(x), S(x)) : (v \multimap r) \multimap \forall X.[(p \multimap X) \multimap X]$ Lex. **most**
2. $president^* : v \multimap r$ Lex. **presidents**
3. $speak : p \multimap s$ Lex. **speak**

From these premises we construct the proof in (2.77).

(2.77)
$$\dfrac{\dfrac{\begin{array}{l}\lambda R \lambda S.most(x, R(x), S(x)) : \\ (v \multimap r) \multimap \forall X.[(p \multimap X) \multimap X]\end{array} \quad \begin{array}{l}president^* : \\ v \multimap r\end{array}}{\begin{array}{l}\lambda S.most(x, president^*(x), S(x)) : \\ \forall X.[(p \multimap X) \multimap X]\end{array}} \quad \begin{array}{l}speak : \\ p \multimap s\end{array}}{most(x, president^*(x), speak(x)) : s} \multimap_{\mathcal{E}}, [s/X]$$

The quantifier takes its scope by finding an appropriate dependency and consuming it through implication elimination. Note that a step of universal elimination is implicit, but rather than carrying it out the elimination step is annotated with the appropriate substitution, since universal elimination is trivial.

The following example illustrates the Glue approach to scope ambiguity:

(2.78) Most presidents speak at least one language.

These premises are contributed:

(2.79)
1. $\lambda R \lambda S.most(x, R(x), S(x))$: $(v1 \multimap r1) \multimap \forall X.[(p \multimap X) \multimap X]$ — Lex. **most**
2. $president^*$: $v1 \multimap r1$ — Lex. **presidents**
3. $speak$: $p \multimap l \multimap s$ — Lex. **speak**
4. $\lambda P \lambda Q.at\text{-}least\text{-}one(y, P(y), Q(y))$: $(v2 \multimap r2) \multimap \forall Y.[(l \multimap Y) \multimap Y]$ — Lex. **at least one**
5. $language$: $v2 \multimap r2$ — Lex. **language**

This same set of premises leads to two Glue proofs, corresponding to the two readings. The surface scope reading is represented in (2.80) on page 66 and the inverse scope reading is represented in (2.81). Notice that the verb has been curried in (2.81).

In sum, scope in Glue Semantics is calculated on linear logic proofs. Scope ambiguity is represented as multiple possible proofs from the same set of premises. There is no need to posit any syntactic ambiguity. There is also no need for any type-shifting mechanism. For further details about scope in Glue Semantics, see Dalrymple et al. (1999c), Crouch and van Genabith (1999), and Dalrymple (2001).

(2.80)

$$
\dfrac{\dfrac{\begin{array}{l}\lambda R\lambda S.\mathit{most}(x,R(x),S(x)) :\\ (\mathit{v1} \multimap \mathit{r1}) \multimap \forall X.[(p \multimap X) \multimap X]\end{array} \quad \begin{array}{l}\mathit{president}^{*} :\\ \mathit{v1} \multimap \mathit{r1}\end{array}}{\begin{array}{l}\lambda S.\mathit{most}(x,\mathit{president}^{*}(x),S(x)) :\\ \forall X.[(p \multimap X) \multimap X]\end{array}} \quad \dfrac{\dfrac{\dfrac{\dfrac{\begin{array}{l}\lambda P\lambda Q.\mathit{a\text{-}l\text{-}o}(y,P(y),Q(y)) :\\ (\mathit{v2} \multimap \mathit{r2}) \multimap \forall Y.[(l \multimap Y) \multimap Y]\end{array} \quad \begin{array}{l}\mathit{lang} :\\ \mathit{v2} \multimap \mathit{r2}\end{array}}{\begin{array}{l}\lambda Q.\mathit{a\text{-}l\text{-}o}(y,\mathit{lang}(y),Q(y)) :\\ \forall Y.[(l \multimap Y) \multimap Y]\end{array}} \quad \dfrac{\begin{array}{l}\lambda u\lambda v.\mathit{speak}(u,v) :\\ p \multimap l \multimap s\end{array} \quad [z : p]^1}{\begin{array}{l}\lambda v.\mathit{speak}(z,v) :\\ l \multimap s\end{array}}}{\mathit{a\text{-}l\text{-}o}(y,\mathit{lang}(y),\mathit{speak}(z,y)) : s}\,[s/Y]}{\lambda z.\mathit{a\text{-}l\text{-}o}(y,\mathit{lang}(y),\mathit{speak}(z,y)) : p \multimap s}\,\multimap_{\mathcal{I},1}}{\mathit{most}(x,\mathit{president}^{*}(x),\mathit{a\text{-}l\text{-}o}(y,\mathit{lang}(y),\mathit{speak}(x,y))) : s}\,[s/X]
$$

(2.81)

$$
\dfrac{\dfrac{\begin{array}{l}\lambda P\lambda Q.\mathit{a\text{-}l\text{-}o}(y,P(y),Q(y)) :\\ (\mathit{v2} \multimap \mathit{r2}) \multimap \forall Y.[(l \multimap Y) \multimap Y]\end{array} \quad \begin{array}{l}\mathit{lang} :\\ \mathit{v2} \multimap \mathit{r2}\end{array}}{\begin{array}{l}\lambda Q.\mathit{a\text{-}l\text{-}o}(y,\mathit{lang}(y),Q(y)) :\\ \forall Y.[(l \multimap Y) \multimap Y]\end{array}} \quad \dfrac{\dfrac{\dfrac{\dfrac{\begin{array}{l}\lambda R\lambda S.\mathit{most}(x,R(x),S(x)) :\\ (\mathit{v1} \multimap \mathit{r1}) \multimap \forall X.[(p \multimap X) \multimap X]\end{array} \quad \begin{array}{l}\mathit{president}^{*} :\\ \mathit{v1} \multimap \mathit{r1}\end{array}}{\begin{array}{l}\lambda S.\mathit{most}(x,\mathit{president}^{*}(x),S(x)) :\\ \forall X.[(p \multimap X) \multimap X]\end{array}} \quad \dfrac{\begin{array}{l}\lambda v\lambda u.\mathit{speak}(u,v) :\\ l \multimap p \multimap s\end{array} \quad [z : l]^1}{\begin{array}{l}\lambda u.\mathit{speak}(u,z) :\\ p \multimap s\end{array}}}{\mathit{most}(x,\mathit{president}^{*}(x),\mathit{speak}(x,z)) : s}\,[s/X]}{\lambda z.\mathit{most}(x,\mathit{president}^{*}(x),\mathit{speak}(x,z)) : l \multimap s}\,\multimap_{\mathcal{I},1}}{\mathit{a\text{-}l\text{-}o}(y,\mathit{lang}(y),\mathit{most}(x,\mathit{president}^{*}(x),\mathit{speak}(x,y))) : s}\,[s/Y]
$$

2.2.4 Unbounded dependencies: relative clauses and questions

The unbounded dependencies that come up the most in the literature on resumptive pronouns are restrictive relative clauses and questions. I give a sketch of a Glue Semantics treatment of these unbounded dependencies here.

Restrictive relative clauses are handled by the following kind of meaning constructor:

(2.82)
$$\begin{array}{l}\lambda P \lambda Q \lambda x. Q(x) \wedge P(x) : \\ \quad [(\uparrow \text{TOPIC})_{\sigma_e} \multimap \uparrow_{\sigma_t}] \multimap \\ \quad\quad [[((\text{ADJ} \in \ \uparrow)_\sigma \text{ VAR})_e \multimap ((\text{ADJ} \in \ \uparrow)_\sigma \text{ RESTR})_t] \multimap \\ \quad\quad\quad [((\text{ADJ} \in \ \uparrow)_\sigma \text{ VAR})_e \multimap ((\text{ADJ} \in \ \uparrow)_\sigma \text{ RESTR})_t]]\end{array}$$

Recall from section 2.1 that restrictive relative clauses are inside a set-valued ADJUNCT grammatical function at f-structure. This meaning constructor states that the scope of the relative clause is a $\langle e, t\rangle$ dependency on the relative head and that the relative clause restricts the relative head by modifying its common noun meaning constructor.

The schematic form of the relative clause meaning constructor is as follows, where $rel\text{-}head$ is the s-structure of the relative head, $pred$ is the s-structure of the predicate that takes the relative head as an argument, and v and r are the VAR and RESTR of the relative head:

(2.83) $$\lambda P \lambda Q \lambda x. Q(x) \wedge P(x) : (rel\text{-}head \multimap pred) \multimap (v \multimap r) \multimap (v \multimap r)$$

The relative clause meaning constructor is a common noun modifier of type $\langle\langle e, t\rangle, \langle\langle e, t\rangle, \langle e, t\rangle\rangle\rangle$.

The relative clause meaning constructor can be contributed by the relative pronoun, but it can also be associated directly with the appropriate c-structure rule element in the case of relative clauses that lack overt pronouns:

(2.84)
$$\begin{array}{lcc}\text{CP} \longrightarrow & \epsilon & \text{C}' \\ & (\uparrow \text{TOPIC PRED}) = \text{`pro'} & \uparrow = \downarrow \\ & REL_\sigma & \end{array}$$

I have abbreviated the meaning constructor as REL_σ.

As an example of relative clause composition, consider example (2.85) and the premises it contributes, shown in (2.86).

(2.85) every book that Lee endorses

(2.86)

1. $\lambda R \lambda S.every(y, R(y), S(y)) : (v \multimap r) \multimap \forall Y.[(b \multimap Y) \multimap Y]$ Lex. **every**
2. $book : v \multimap r$ Lex. **book**
3. $\lambda P \lambda Q \lambda x.Q(x) \wedge P(x) : (b \multimap e) \multimap (v \multimap r) \multimap (v \multimap r)$ Lex. **that**
4. $lee : l$ Lex. **Lee**
5. $endorse : l \multimap b \multimap e$ Lex. **endorses**

These premises construct the following proof for the relativized DP:

(2.87)

$$\dfrac{\begin{array}{c}\lambda R \lambda S.every(y, R(y), S(y)) : \\ (v \multimap r) \multimap \forall Y.[(b \multimap Y) \multimap Y]\end{array} \quad \dfrac{\begin{array}{c}book : \\ v \multimap r\end{array} \quad \dfrac{\begin{array}{c}\lambda P \lambda Q \lambda x.Q(x) \wedge P(x) : \\ (b \multimap e) \multimap (v \multimap r) \multimap (v \multimap r)\end{array} \quad \dfrac{\begin{array}{c}lee : \\ l\end{array} \quad \begin{array}{c}endorse : \\ l \multimap b \multimap e\end{array}}{\begin{array}{c}endorse(lee) : \\ b \multimap e\end{array}}}{\begin{array}{c}\lambda Q \lambda x.Q(x) \wedge endorse(lee, x) : \\ (v \multimap r) \multimap (v \multimap r)\end{array}}}{\begin{array}{c}\lambda x.book(x) \wedge endorse(lee, x) : \\ (v \multimap r)\end{array}}}{\lambda S.every(y, book(y) \wedge endorse(lee, y), S(y)) : \forall Y.[(b \multimap Y) \multimap Y]}$$

Notice that the proof terminates in a nominal type, since it is a proof of DP semantics.

If we embed (2.85) in a sentence, as in (2.88), we get the additional premise in (2.89) from the matrix verb *stinks*.

(2.88) Every book that Lee endorses stinks.

(2.89) 6. $stink : b \multimap s$ Lex. **stinks**

Now we can put this premise together with the conclusion of (2.87) to get the proper sentential semantics:

(2.90)

$$\dfrac{\begin{array}{c}\vdots \\ \lambda S.every(y, book(y) \wedge endorse(lee, y),\ S(y)) : \forall Y.[(b \multimap Y) \multimap Y]\end{array} \qquad stink : b \multimap s}{every(y, book(y) \wedge endorse(lee, y),\ stink(y)) : s}\ [s/Y]$$

Further details of relative clause semantics in Glue Semantics can be found in Dalrymple (2001:415–422).

For questions I make the simplifying assumption that the *wh*-word acts like a generalized quantifier and that the question's semantics are represented by a place-holder operator Qu. The treatment is illustrated by the following example:

(2.91) What did Lee endorse?

The f-structure for the example is shown here:

(2.92)
$$e\left[\begin{array}{ll}\textsc{pred} & \text{`endorse'}\\ \textsc{focus} & w\left[\begin{array}{ll}\textsc{pred} & \text{`what'}\end{array}\right]\\ \textsc{subj} & l\left[\begin{array}{ll}\textsc{pred} & \text{`Lee'}\end{array}\right]\\ \textsc{obj} & \rule{6em}{0.4pt}\end{array}\right]$$

The contributed premises and proof for the example are as follows:

(2.93)
1. $\lambda S.Qu(x,\ thing(x),\ S(x)) : \forall X.[(w \multimap X) \multimap X]$ Lex. **what**
2. $lee : l$ Lex. **Lee**
3. $endorse : l \multimap w \multimap e$ Lex. **endorse**

(2.94)
$$\frac{\lambda S.Qu(x,\ thing(x),\ S(x)) : \forall X.[(w \multimap X) \multimap X] \qquad \dfrac{lee : l \qquad endorse : l \multimap w \multimap e}{endorse(lee) : w \multimap e}}{Qu(x,\ thing(x),\ endorse(lee,\ x)) : e}\ [e/X]$$

There are several more examples of unbounded dependency derivations throughout part II of the thesis.

Conclusion

This overview of LFG and Glue Semantics has been presented in a rather compact form. For further details, the reader is referred to the references listed in the introduction to the chapter. Nevertheless, the aspects of LFG and Glue Semantics that I use in the rest of the thesis can be found here, although they are also reviewed in subsequent chapters when required. The material in section 2.2.1 is especially relevant to the next chapter, where I delve into resource logics and the hypothesis of Resource Sensitivity.

Chapter 3

The resource-sensitivity of natural language

Introduction

This dissertation is an investigation of resumption phenomena in light of the hypothesis of Resource Sensitivity:

(3.1) Natural language is universally *resource-sensitive*.

The overview of Glue Semantics in the previous chapter, particularly section 2.2.1, began the presentation of the formal theory behind Resource Sensitivity. This chapter continues the investigation and focuses on resource logics, in particular *linear logic*, and their relationship to the hypothesis. Having completed the presentation of Resource Sensitivity, I consider several theoretical proposals in linguistic theory which can either be reduced to Resource Sensitivity or can at least be understood in new terms based on the hypothesis.

In section 3.1, I present the notions of Logical Resource Sensitivity and Linguistic Resource Sensitivity, the latter of which is what is presented in (3.1). I present a hierarchy of substructural logics and illustrate their linguistic relevance with respect to the combinatorics of three principal grammatical subsystems: phonology, syntax, and semantics. I will motivate linear logic as the appropriate logic for the syntax–semantics interface and semantic composition and discuss the consequences of its adoption for grammatical architecture. I discuss how the choice of logic affects the relationship between Logical and Linguistic Resource Sensitivity. This underscores the necessity of understanding Resource Sensitivity as a property of linguistic theories (and by extension languages), rather than just a purely logical property.

I begin section 3.2 with a discussion of certain explicit discussions of resource accounting in the literature (van Benthem 1991/1995, Dalrymple et al. 1993, Moortgat 1997, Dalrymple et al. 1999b, Dalrymple 2001, Bouma et al. 1999, Kruijff and Oehrle 2004b). I then proceed to a detailed examination of the relationship between Logical and Linguistic Resource Sensitivity. I argue that, despite initial appearances, Logical Resource Sensitivity is generally insufficient on its own to guarantee a useful notion of Linguistic Resource Sensitivity, although Logical Resource Sensitivity does form the foundation for Linguistic Resource Sensitivity. A linguistically useful notion of Resource Sensitivity is demonstrated to require coupling of Logical Resource Sensitivity to a theory of natural language.

In section 3.3, I go on to consider various proposals in the theoretical linguistics literature which I argue to be implicit appeals to Resource Sensitivity. The proposals I consider are Bounded Closure in type-driven translation (Klein and Sag 1985), completeness and coherence (Kaplan and Bresnan 1982), the Theta Criterion (Chomsky 1981), the Projection Principle (Chomsky 1981, 1982, 1986), the ban on vacuous quantification (Chomsky 1982, 1995, Kratzer 1995, Kennedy 1997, Heim and Kratzer 1998, Fox 2000), the Principle of Full Interpretation (Chomsky 1986, 1995), and numerations and the Inclusiveness Condition (Chomsky 1995). I show that Resource Sensitivity not only captures the important insights behind these proposals, but also solves certain empirical and theoretical problems with them. Resource Sensitivity thus paves the way to a new understanding of these proposals and their potential elimination.

3.1 Substructural logics and linguistic theory

Characterizing the syntax–semantics interface and semantic composition in logical terms is by now well-established in linguistic theory and this is in fact the predominant view, stemming from the work of Montague (1970, 1973). Similar logical approaches to syntax and phonology have not been as influential, although such approaches have been available at least as long as generative approaches (Bar-Hillel 1953, Lambek 1958).[1] Work in Categorial Grammar has contributed greatly to understanding the logical underpinnings of syntax (see Moortgat 1997 and Steedman 2000 for recent overviews and references and Wood 1993 for a general introduction) and, to a lesser degree, phonology (Wheeler 1988). Categorial Grammar investigations in the type-logical or Lambek

[1] There are even earlier precursors, such as Ajdukiewicz (1935), but we could also isolate similarly early precursors to generative approaches. This is in essence a historical question.

Calculus traditions (van Benthem 1991/1995, Morrill 1994, Carpenter 1997, Moortgat 1997) are instances of the logical approach based on *substructural logics*, which I apply in this section to the combinatorics of phonology, syntax, and semantics, but based on a different theoretical perspective.

Restall (2000:1–2) offers the following characterization of substructural logics:

> Substructural logics focus on the behaviour and presence — or more suggestively, the *absence* — of *structural rules*. These are particular rules in a logic which govern the behaviour of collections of information. (emphasis in original)

The basic insight behind substructural logics is that by carefully manipulating the structural rules that characterize a logic we can home in on a logic that precisely characterizes the informational system under consideration. A unifying guiding principle of modern linguistics has been the characterization of language as information, whether from a logical perspective (see, e.g., the linguistic work of van Benthem and Moortgat and their students) or from a cognitive perspective ("knowledge of language"; Chomsky 1986).

There are many structural rules that have been identified in the field of subtructural logic (see Restall 2000). The three that are particularly relevant here — weakening, contraction, and commutativity — were initially discussed in the previous chapter and will be discussed in more detail here. They are shown in Figure 3.1. The intuitions behind these rules can be summarized as follows:

1. **Weakening:**
   Premises can be *freely added*.

2. **Contraction:**
   Additional occurrences of a premise can be *freely discarded*.

3. **Commutativity:**
   Premises can be *freely reordered*.

Restall (2000) names these rules in terms of the associated combinators from *Combinatory Logic* (Curry and Feys 1958): K, W, and C.

$$\begin{array}{ccc} \textit{Weakening} & \textit{Contraction} & \textit{Commutativity} \\ \dfrac{\Gamma \vdash B}{\Gamma, A \vdash B}\,\mathsf{K} & \dfrac{\Gamma, A, A \vdash B}{\Gamma, A \vdash B}\,\mathsf{W} & \dfrac{\Gamma, A, B \vdash C}{\Gamma, B, A \vdash C}\,\mathsf{C} \end{array}$$

Figure 3.1: Three key structural rules

Weakening and contraction are of particular interest here, because a substructural logic that lacks these rules is a *resource logic*. Lack of these structural rules means that premises *cannot* be freely added or discarded. This has the effect that premises in a proof in the logic in question are *resources* that must be strictly accounted for (since they cannot be freely reused or ignored). Weakening and contraction therefore form the basis for what I will call Logical Resource Sensitivity, which is a property of logics as opposed to Linguistic Resource Sensitivity, which is a hypothesized property of natural language:

(3.2) **Logical Resource Sensitivity**:
In a resource logic, premises in proofs cannot be freely *reused* or *discarded*.

(3.3) **Linguistic Resource Sensitivity**:
Natural language is universally *resource-sensitive*. Elements of combination in grammars cannot be freely *reused* or *discarded*.

Throughout this thesis, unless I specifically talk about Logical versus Linguistic Resource Sensitivity, I mean the term Resource Sensitivity to name the latter substantive hypothesis about language.

This is already enough background on substructural logics to see how they yield a useful perspective on phonology, syntax, and semantics. There are two points that I want to make about these grammatical subsystems. They are simple points, but ones that are nevertheless fundamental. The first point is that phonology, syntax, and semantics vary as to how important the order of the elements to be combined is. Order is very important in phonology and not important at all in semantics, with syntax falling somewhere in between. The second point is that all of these grammatical subsystems require tight control of their combinatorics. In particular, in all three cases elements of combination cannot be freely discarded or reused: the three grammatical systems are equally resource-sensitive. Let us see how these two points play out for each grammatical subsystem, with a little exemplification added for further clarification, beginning with phonology:

(3.4) **Phonology**

1. Order very important:

   XY $\not\equiv$ YX

2. Elements of phonological combination cannot be freely discarded or reused:

   XY $\not\equiv$ X
   XY $\not\equiv$ XXY

Phonological sequences cannot be freely reordered: a sequence XY of phonemes X and Y is (generally) not equivalent to a sequence YX. For example, no language allows a three-phoneme word to be represented in any of the six possible orderings. Metathesis may at first seem like an exception to the generalization, but no language allows free metathesis of any two phonemes. Rather, metathesis is a phonological rule or constraint that applies under certain specific conditions. The second point is that no language allows free dropping or adding of just any phoneme. There may be specific rules of deletion or epenthesis, but again these will apply to particular phonemes in particular environments. The fundamental combinatorics of phonology is therefore highly order-sensitive and also resource-sensitive.

The combinatorics of syntax with respect to these two points can be summarized as follows:

(3.5) **Syntax**

1. Order important in some languages, less important in others:

   WORD1 WORD2 $\Diamond\equiv$ WORD2 WORD1

2. Elements of syntactic combination cannot be freely discarded or reused:

   WORD1 WORD2 $\not\equiv$ WORD1
   WORD1 WORD2 $\not\equiv$ WORD1 WORD1 WORD2

Word order is less universally strict than phoneme order. In many languages, two alternative word orders may be equivalently allowed.[2] This is indicated in (3.5), where it is noted that the order WORD1 WORD2 is possibly equivalent ($\Diamond\equiv$) to the order WORD2 WORD1. Certain languages, such as English or French, have quite strict word order. Nevertheless, under certain circumstances even such strictly ordered languages may allow some freedom:

(3.6) a. i. Thora looked the number up.
ii. Thora looked up the number.

b. i. In the room stood a smiling baby.
ii. A smiling baby stood in the room.

[2]Notice that we are discussing syntactic order alone, leaving semantics aside. The alternative orders may have different semantic or information-theoretic content. The point is just that they both occur.

(3.7) a. i. Cette sculpture énorme est belle.
this enormous sculpture is beautiful
This enormous sculpture is beautiful.

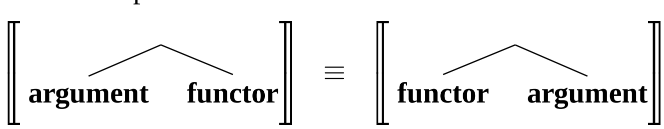
ii. Cette énorme sculpture est belle.
this enormous sculpture is beautiful
This enormous sculpture is beautiful.

Other languages, such as German, Dutch, and Persian, allow fairly free word order due to scrambling (for some recent work, see Karimi 2003). Still other languages, such as Warlpiri, allow even more free word order, with even elements of the same noun phrase being separable and reorderable. Yet even extremely free word order languages make certain word order requirements. For example, Warlpiri roughly requires that the second position in the clause is occupied by the auxiliary (Hale 1980, 1983, Austin and Bresnan 1996, Donohue and Sag 1999). Although freedom of word order is a major locus of variation among languages (and hence a major focus of syntactic research), no language allows free deletion or addition of syntactic material. Once again, as in phonology, there may be specific processes that meet this characterization; perhaps pro-drop is a candidate, for example. However, no language allows completely indiscriminate addition or deletion of syntactic material. The fundamental combinatorics of syntax is therefore order-sensitive to varying degrees across languages but is universally resource-sensitive.

Semantic combinatorics with respect to order and resource sensitivity can be characterized as follows:

(3.8) **Semantics**

1. Order unimportant:



2. Elements of semantic combination cannot be freely discarded or reused.

Semantic composition has long been understood in terms of functor-argument composition (Frege 1891/1952); indeed this is one of the fundamental insights that enabled a formal semantics. Order is irrelevant to this sort of composition: a functor can equally well combine with an argument to its left or to its right. There can of course be syntactic constraints on the distribution of the syntactic realizations of functors and arguments, but this is semantically irrelevant. For example, an intransitive verb in English always follows the subject. If the verb is the functor and the subject is the argument then we have right-left functor-argument order. However, the subject can be type-shifted such that it consumes the verb as an argument. In this case we have left-right functor-argument order. Another way to think about it is that it is the types of the expressions that determine functor-argument combination, not their order. For example, in their rule for Functional Application, Heim and Kratzer (1998:44,95) simply state that the functor applies to the argument, regardless of order. Semantics is resource-sensitive, though. We cannot simply disregard contentful expressions or use single occurrences of contentful expressions more than once. This was demonstrated by examples (1.2) and (1.5) in chapter 1, which I repeat here:

(3.9) Kim fooled Sandy.

(3.10) This innocent man is allegedly guilty, according to some.

As pointed out in chapter 1, the meanings of the words *Kim*, *Sandy*, and *fooled* in (3.9) can each be used to produce the meaning in (3.11), but it is not possible to disregard the meaning of *Sandy* and to use the meaning of *Kim* twice to derive the meaning in (3.12).

(3.11) $fool(kim,\ sandy)$

(3.12) $fool(kim,\ kim)$

Similarly, we cannot use the single occurrence of the adverb *allegedly* twice to give (3.10) a meaning equivalent to that of (3.13).

(3.13) This allegedly innocent man is allegedly guilty, according to some.

The two sentences are truth-conditionally distinct, since (3.10) entails that the man is innocent, whereas (3.13) does not. In sum, the fundamental combinatorics of semantics is not order-sensitive but is resource-sensitive.

We have seen that phonology, syntax and semantics are order-sensitive to differing degrees, with phonology being highly order-sensitive and semantics being order-insensitive. All three grammatical subsystems are resource-sensitive, however. This picture indicates that the logical understanding of grammar should focus on resource logics — i.e., logics that satisfy Logical Resource Sensitivity by lacking weakening and contraction. Order-sensitivity can then be enforced in a couple of different ways which I will discuss further shortly, the simplest being the removal of the structural rule of commutativity.

The resource logic that is of central interest in proof theory and substructural logic is *linear logic* (Girard 1987, 1989). An aspect of linear logic that makes it especially interesting to logicians and proof theorists in particular is its very articulated and controlled use of logical connectives and modalities. These aspects of the logic are not relevant to us here and indeed a surprising amount of linguistic work can be done by the very impoverished and logically weak multiplicative fragment presented in appendix A. Indeed, at our current level of understanding, this fragment seems to be sufficient for characterizing natural language semantics. Certain analyses of coordination and right-node raising in Glue Semantics (Kehler et al. 1999, Dalrymple 2001) have used a logically stronger fragment of linear logic with the *of course* modality (!), but these phenomena have also been successfully analyzed using the weaker multiplicative modality-free fragment adopted here (Asudeh and Crouch 2002a). It is crucial to the maintenance of the hypothesis of Linguistic Resource Sensitivity that the linear modalities are kept out of the logical fragment, because it is precisely these modalities that allow a controlled relaxation of resource accounting in linear logic. A premise that is prefixed with the of course modality, e.g. $!A$, can be reused an unlimited number of times or not used at all (discarded).[3] Assuming the modality-free fragment of linear logic allows a very strict notion of resource accounting and maintains the hypothesis of Resource Sensitivity in a very strong form.

Figures 3.2 and 3.3 contrast two well-known non-resource-sensitive logics — classical logic and intuitionistic logic — with linear logic. Figure 3.2 shows that in non-resource-sensitive logics we can use a premise in deriving some conclusion and then reuse the premise. In this case a conditional and its antecedent yield the conditional's conclusion (by modus ponens) and the antecedent is then conjoined with the conclusion. This is not possible in linear logic: the antecedent premise is used up in deriving the conclusion and cannot be reused to be conjoined with the result (recall that $\multimap$ is linear implication and $\otimes$ is (multiplicative) linear conjunction).

Classical/Intuitionistic Logic	Linear Logic
$A, \quad A \rightarrow B \vdash B$	$A, \quad A \multimap B \vdash B$
$A, \quad A \rightarrow B \vdash B \wedge A$	$A, \quad A \multimap B \not\vdash B \otimes A$
Premise A reused, conjoined with conclusion B	Premise A is consumed to produce conclusion B, no longer available for conjunction with B

Figure 3.2: Logical Resource Sensitivity: no reuse of premises/resources

Figure 3.3 shows the opposite situation. In classical or intuitionistic logic, if we have two premises we can ignore one and just conclude the other. This is not possible in linear logic: we cannot just leave one premise aside. It must be used in the proof. Classical logic is characterizable

[3]This is assuming a natural deduction presentation of the logic. If a sequent presentation is used the dual modality *why not* (?) must be present to allow fully general reuse and nonuse.

as a logic of truth and intuitionistic logic as a constructive logic of consequence or proof (Gamut 1991, van Dalen 2001). Linear logic captures the intuitionistic notions of constructions, proofs and consequence but is also a resource logic that requires strict use of resources.

Classical/Intuitionistic Logic	Linear Logic
$A, B \vdash A$ Can ignore premise B	$A, B \nvdash A$ Cannot ignore premise B

Figure 3.3: Logical Resource Sensitivity: no discarding premises/resources

We can make more precise the fit between particular substructural logics and modules of grammar by looking at a hierarchy of substructural logics characterized by the structural rules of weakening, contraction, and commutativity.[4] Such a hierarchy is shown in Figure 3.4 on page 80. The top of the hierarchy is occupied by the logic **L**, the simple non-commutative Lambek Calculus (Lambek 1958; for recent discussion see van Benthem 1991/1995 and Moortgat 1997), which lacks weakening, contraction and commutativity. We get logics on the hierarchy below **L** by adding the structural rule that labels the transition. By adding commutativity, we get the commutative Lambek Calculus **LP** (van Benthem 1991/1995, Moortgat 1997), which is roughly equivalent to linear logic. A proof theorist might balk at this characterization, since the points of divergence between **LP** and linear logic are logically important. Nevertheless, if we are keeping things simple by sticking to a consideration of just the three structural rules of weakening, contraction, and commutativity, adding commutativity to the simple Lambek Calculus basically gets us linear logic. The next two logics on the hierarchy are captured by adding either contraction or weakening. If we add contraction to linear logic we get relevance logic (Anderson and Belnap 1975, Read 1988). Relevance logic lacks weakening: a premise cannot be freely added while maintaining validity, because every premise in the premise set must be used in reaching the conclusion — i.e., every premise must be *relevant*. Contraction obtains though: multiple instances of the same premise may be discarded, since a single occurrence is sufficient to establish relevance. Thus, relevance logic allows reuse of premises but does not allow premises to be discarded. Each premise must be used in reaching the conclusion, since weakening is absent. Gregory (2001, 2002) has recently applied relevance logic to linguistic analyses. BCK logic, on the other hand, lacks contraction but has weakening.[5] In BCK logic, the condition of relevance does not hold: not every premise need be used in reaching the conclusion.

[4]The logics discussed here additionally all share the rule of associativity (B), but this rule is not really relevant to our considerations of order sensitivity and resource sensitivity.

[5]The name BCK comes from the structural rules that characterized the logic: associativity (B), commutativity (C), and weakening (K).

However, premises cannot be reused. In other words, relevance logic allows reuse of premises but not discarding, whereas BCK logic allows discarding of premises but not reuse. Linear logic allows neither: each premise must be used exactly once; i.e., no premise may go unused and no premise may be reused. By adding the last of the three proof rules — either weakening to relevance logic or contraction to BCK logic — we arrive at intuitionistic logic (Gamut 1991, van Dalen 2001). Finally, classical logic (Gamut 1991, Shapiro 2001, Hodges 2001) can be obtained by adding the Law of the Excluded Middle, which states that either a proposition or its negation must hold ($\phi \vee \neg \phi$); this is related to *reductio ad absurdum* (reasoning from contradiction) and *double negation* ($\neg\neg \phi \vdash \phi$). Intuitionistic logic is based on Brouwer's denial of the validity of this law, based on a constructive notion of proof (Gamut 1991, van Dalen 2001). The relationship between intuitionistic logic and classical logic is represented with a dotted line because the Law of the Excluded Middle is not a structural rule.

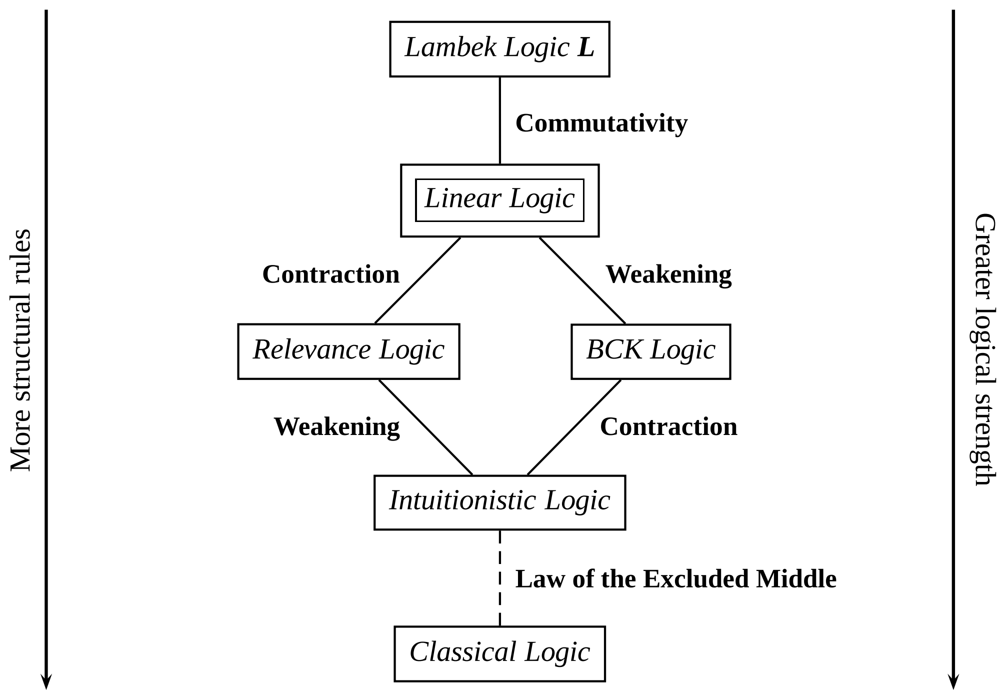


Figure 3.4: Hierarchy of logics related by structural rules

With this hierarchy of substructural logics at hand, let us turn back to our consideration of grammatical subsystems. I argued above that phonology, syntax, and semantics are all equally resource-sensitive. This means that the logics that characterize their combinatorics should be resource logics, which lack weakening and contraction. In terms of the hierarchy in Figure 3.4, this requirement picks out linear logic and the Lambek logic **L**. With respect to the three structural rules we have been considering, these two logics differ only on whether they have commutativity or not. The logic **L** does not have commutativity and is therefore appropriate for modeling rigid order. It is therefore the logic that is appropriate for phonology, where order is quite important. It was noted that metathesis, deletion, and epenthesis must be taken into account. These phonological processes can be enriched by adding modalities to **L** to obtain a *Multimodal Type Logic* (see discussion and references in Moortgat 1997). For syntax, where freedom of word order is fairly variable among languages, there are two basic options. One option is to model syntax with a non-commutative resource logic, which models strict word order well, and to add modalities for controlled relaxation of order, as in Multimodal Type Logic. The second option is to characterize syntactic combination using a commutative resource logic, which models free word order, and to add controlled non-commutativity. Lastly, it was argued that order is irrelevant to semantic composition. For semantics, then, a commutative resource logic is appropriate. The essential commutative resource logic is linear logic.

Linear logic is an appropriate choice for modeling semantic composition for a number of reasons. First, it is a logic of resources and therefore models the apparent resource sensitivity of natural language semantics. Second, it is a pure logic of composition for semantics, since it lacks commutativity and we have seen that order of composition is irrelevant for semantics. A different option is to use a non-commutative resource logic with controlled commutativity, as in Multimodal Type Logic, to simultaneously model syntax and semantic composition. This is certainly an option, but faces the danger of conflating properties of syntactic and semantic combination by failing to separate syntax, where order is fairly relevant, from semantics, where order is irrelevant. There may be complexities that arise in controlling syntactic or semantic combination, but these will not be localized in syntax or semantics and will instead infect the system as a whole. Using linear logic for semantic combination by contrast keeps syntax and semantics separate, as will be discussed further shortly, and therefore to a large extent quarantines one from the other. Finally, the use of linear logic for semantic composition forms a bridge between linguistics and proof theory, a burgeoning field at the intersection of logic, theoretical computer science and mathematics. Linear logic was devised largely as an investigation into properties of proofs (Girard 1987), rather than resources per se, and has led to a productive and influential research programme in proof theory (see Girard 1989 for a classic presentation and Girard 1995 for a recent overview; the journal *Theoretical Computer*

Science is a key publication for results in linear logic and proof theory).

There are consequences for grammatical architecture in choosing linear logic for semantic composition. The main consequence is that there must be some separate level of syntax, otherwise the commutative logic will wildly overgenerate. In Glue Semantics, linear logic is used for semantic composition in concert with a theory of syntax. The bulk of Glue work, including this dissertation, uses Lexical Functional Grammar (Kaplan and Bresnan 1982, Dalrymple et al. 1995, Bresnan 2001, Dalrymple 2001, Falk 2001) as the syntactic theory (Dalrymple et al. 1993, Dalrymple 1999, 2001, Andrews 2003, Asudeh 2000, 2002a, 2003a,b, Asudeh and Crouch 2002a,b). Glue based on LFG syntax is implemented as part of the LFG implementation at Palo Alto Research Center.[6] Some recent work has also coupled Glue Semantics to Tree-Adjoining Grammar (Frank and van Genabith 2001) and Head-Driven Phrase Structure Grammar (Asudeh and Crouch 2002c).

Summary

Phonology, syntax, and semantics all seem to require tight control of their elements of combination, i.e. resource accounting. Their combinatorics are thus best modeled with a resource logic, i.e. a logic that satisfies Logical Resource Sensitivity. Consideration of these grammatical subsystems in terms of resource logics naturally leads to the hypothesis of Linguistic Resource Sensitivity. According to this hypothesis elements of combination in grammar cannot be freely discarded or reused. To investigate this hypothesis we need to look for cases where their is apparent reuse or nonuse; resumptive pronouns constitute an apparent case of nonuse or surplus, as discussed in chapter 1. If these cases yield to analysis in terms of full resource use, then the hypothesis is maintainable. If the cases in question crucially require controlled relaxation of resource accounting through the use of modalities (*of course*, !, and *why not*, ?), then Linguistic Resource Sensitivity cannot be maintained in a strong form. If not even controlled resource reuse or nonuse is adequate for a satisfactory analysis and the phenomenon requires complete relaxation of resource accounting, then Linguistic Resource Sensitivity must be rejected.

3.2 Logical versus Linguistic Resource Sensitivity

I noted above that there are two related notions of resource accounting, Logical and Linguistic Resource Sensitivity. The former concerns properties of logics whereas the latter is a substantive

[6] See `http://www2.parc.com/istl/groups/nltt/`; checked 17/01/2004.

hypothesis about natural language as characterized by linguistic theory. There has been some explicit investigation of issues of resource accounting in the literature. Van Benthem (1991/1995) and Moortgat (1997) discuss resource sensitivity, but principally with respect to properties of the logics that they are concerned with. These works are essentially investigations of Logical Resource Sensitivity in logics that have linguistic applications. Dalrymple et al. (1993, 1999b) discuss Linguistic Resource Sensitivity explicitly, noting that the use of linear logic for semantic composition mirrors the apparent resource accounting of natural language, but do not pursue the matter in any depth. Recent in-depth investigations of both Logical and Linguistic Resource Sensitivity are found in the volumes edited by Bouma et al. (1999) and Kruijff and Oehrle (2004b), which primarily address the issues from a Categorial Grammar perspective. The latter volume concentrates specifically on resource issues raised by anaphora, which are relevant to this work, too (see section 2.2.2 of the previous chapter for some discussion of these issues), but also considers Linguistic Resource Sensitivity more broadly construed, particularly in the contributions by Kruijff and Oehrle (2004a) and Oehrle (2004). In sum, Linguistic Resource Sensitivity has only recently begun to receive sustained close attention. This dissertation aims to add to this research program by looking at resumptive pronouns and copy raising, which are apparent cases of resource surplus or resource nonuse, as sketched in chapter 1 and developed further in the rest of the dissertation.

In this section I consider Logical and Linguistic Resource Sensitivity in a little more detail. The main goal is to establish a fairly simple point: the relationship between Logical and Linguistic Resource Sensitivity is real but potentially more complex than one might initially think.[7] In particular, I will show that properties of the resource logic, in particular which connectives it contains, affect the relationship between Logical and Linguistic Resource Sensitivity. The take-home point is that Linguistic Resource Sensitivity is based on Logical Resource Sensitivity together with constraints derived from linguistic theory.

In order to establish this point, I need to review some further aspects of the linear logic approach to semantic composition. The relevant aspects were introduced in the previous chapter, but I present them here again. Note that the following observations apply equally to type logical approaches to semantic composition (van Benthem 1991/1995, Morrill 1994, Carpenter 1997, Moortgat 1997). Let us first assume a fragment of linear logic which contains only the implication connective ($\multimap$). In a natural deduction presentation, we need a rule for introducing the connective and one for eliminating the connective. The rules are identical to the more familiar rules for implication introduction

[7] This section has benefited greatly from discussions with Dick Crouch and Valeria de Paiva, who are nevertheless not responsible for any errors on my part.

and elimination in classical and intuitionistic logic (see, e.g., Gamut 1991:131ff.). The rule for elimination is just *modus ponens*:

(3.14) Implication Elimination

$$\frac{\begin{array}{c}\vdots\\ A\end{array} \qquad \begin{array}{c}\vdots\\ A \multimap B\end{array}}{B}\multimap_{\mathcal{E}}$$

The Curry-Howard Isomorphism (Curry and Feys 1958, Howard 1980) or "formulas-as-types" relates proof steps to operations in the lambda calculus. Implication elimination corresponds to functional application:

(3.15) Functional Application : Implication Elimination

$$\frac{\begin{array}{c}\vdots\\ a : A\end{array} \qquad \begin{array}{c}\vdots\\ f : A \multimap B\end{array}}{f(a) : B}\multimap_{\mathcal{E}}$$

It follows that if the premises consist of lexically specified meaning terms coupled with appropriate linear logic formulae then implication can do a lot of the work necesary for semantic composition (for much more detailed exposition of this point see van Benthem 1991/1995). Suppose we have the lexical meanings $thora$ and $laugh$ from the words *Thora* and *laughs*. We can then perform the following derivation for the sentence *Thora laughs*:

(3.16) $$\frac{thora : A \qquad laugh : A \multimap B}{laugh(thora) : B}\multimap_{\mathcal{E}}$$

If the only connective we have is implication, we can see a tight fit between Logical Resource Sensitivity and Linguistic Resource Sensitivity. Logical Resource Sensitivity, which is captured formally through the absence of the structural rules of weakening and contraction, requires that each premise is used exactly once. Consider the example we just looked at. If we have a premise $thora : A$ and a premise $laugh : A \multimap B$, then the only way to use both premises given only the implication connective is the proof shown in (3.16). There is just no other way to use both premises.

Suppose that we have conjunction in our logical fragment, though. Like implication, conjunction has rules for introduction and elimination. The introduction rule for conjunction is straightforward and corresponds to a product type via the Curry-Howard Isomorphism:

(3.17) Product : Conjunction Introduction

$$\dfrac{\begin{array}{c}\vdots\\ a : A\end{array} \qquad \begin{array}{c}\vdots\\ b : B\end{array}}{a \times b : A \otimes B} \otimes_{\mathcal{I}}$$

The type of the product is $\sigma \times \tau$, where σ is the type of the first conjunct and τ is the type of the second. Notice that this logical conjunction does not necessarily conjoin like types: we can form a product out of any two types. The like-types restriction seems to be valid for linguistic conjunction (e.g., English *and*), but it is not a feature of the conjunction connective in the purely logical sense.

We can now see that with the inclusion of conjunction Logical and Linguistic Resource Sensitivity diverge. The following proof on the premises $thora : A$ and $laugh : A \multimap B$ satisfies Logical Resource Sensitivity by using each premise exactly once in an instance of conjunction introduction:

(3.18) $$\dfrac{thora : A \qquad laugh : A \multimap B}{thora \times laugh : A \otimes (A \multimap B)} \otimes_{\mathcal{I}}$$

This proof is linguistically unilluminating but logically impeccable. Thus, conjunction drives a wedge between Logical and Linguistic Resource Sensitivity by allowing satisfaction of the former in a way that we intuitively feel should not satisfy the latter.

Two questions naturally arise. The first is: do we need a conjunction connective? The second is: if we do need conjunction, how do we regain a notion of Linguistic Resource Sensitivity? The answer to the first question is that there is indeed ample linguistic motivation for a conjunction connective. One application is in a variable-free treatment of anaphora, as discussed in section 2.2 of the last chapter. Jacobson (1999) provides extensive theoretical and empirical arguments in favour of such a variable-free theory. Recall that an anaphor is represented as follows in Glue Semantics, where A is the antecedent resource and P is the pronominal resource:

(3.19) $A \multimap (A \otimes P)$

The pronoun consumes its antecedent to compute pronominal reference but must then replicate the antecedent, since the antecedent is also an argument to some functor. The conjunction is thus necessary for the pronoun to output its own meaning together with a copy of its antecedent's meaning. The necessity of conjunction is evident if we also look at the meaning language side of the meaning constructor:

(3.20) $\lambda y.y \times y : A \multimap (A \otimes P)$

The meaning of the antecedent is applied once and becomes both the meaning of the copy of the antecedent and of the pronoun. The conjunction is necessary in order for the meaning to get distributed properly and for proper binding.

There are yet other reasons to pick a logical fragment containing conjunction. Crouch and van Genabith (1999) and van Genabith and Crouch (1999a) define a method of context update for Glue Semantics which involves contexts as linear logic resources. This effectively shifts the dynamics of dynamic semantics from the Glue meaning language to the linear logic that performs semantic composition. With context update handled in the linear logic, conjunction is necessary to bundle together the sentential semantics with the updated context. The result of a Glue derivation for a sentence s is then represented as follows (Crouch and van Genabith 1999:122):

(3.21) $\Gamma, \Delta_1 \vdash \ \phi : s \ \otimes \ \Delta_2$

Δ_1 is the input context, Δ_2 is the updated output context, and $\phi : s$ is the meaning assignment for the sentence.[8] Thus, the conjunction is necessary to derive a single premise that represents the static and dynamic aspects of sentential meaning.

A third use of conjunction that is similar in spirit to the context update that we just looked at is motivated by Potts's (2003) multidimensional semantics for conventional implicature. As discussed by Potts (2003:111–115), the logic $\mathcal{L}_{\text{CI}}$ that he uses to represent at-issue meanings (i.e., normal sentential semantics) and conventional implicatures can be translated into Glue Semantics by using premises that consist of at-issue type resources conjoined with CI-type meanings.

There is thus plenty of motivation for conjunction. The question is how Linguistic Resource Sensitivity can be regained. The basic method is to set some linguistically motivated goal for the resource logic proof that models the system in question. In Glue Semantics, the standard goal of a Glue derivation, which is a linear logic proof, is the following (see section 2.2.1 of chapter 2):

(3.22) $\Gamma \vdash \ \phi : s_t$

From a premise set Γ, the goal is to establish a type t conclusion s that corresponds to the semantics of the sentence, represented as ϕ. If the goal condition of the semantic proof is constrained in this manner, then proof (3.18) for *Thora laughed*, which has a conclusion $thora \times laugh : A \otimes (A \multimap B)$, is a valid linear logic proof but not a valid Glue proof. Although (3.18) satisfies Logical Resource Sensitivity, it does not satisfy Linguistic Resource Sensitivity.

[8] Crouch and van Genabith (1999) and van Genabith and Crouch (1999a) actually present a slightly more complex picture involving sets of contexts (represented as conjoined individual contexts), but the details of their presentation are peripheral to the main point, which is just that at least one conjunction is necessary.

Notice that we can accommodate the innovations of Crouch and van Genabith (1999), van Genabith and Crouch (1999a) and Potts (2003) by further articulating the goal condition. We saw above that the goal condition for the Crouch and van Genabith's context update work is the following:

(3.23) $\Gamma, \Delta_1 \vdash \phi : s \otimes \Delta_2$

Similarly, if we are dealing with conventional implicature using the types discussed by Potts (2003), then the goal condition can be defined as:[9]

(3.24) $\Gamma \vdash \phi : s^a \otimes \psi : s^c$

Here $\phi : s^a$ is an at-issue meaning and $\psi : s^c$ a conventional implicature. Providing we make the necessary adjustments so the logic can handle all the required types, we can even put together Crouch and van Genabith's context update approach with Potts's conventional implicature approach by having the following as a goal condition:

(3.25) $\Gamma, \Delta_1 \vdash \phi : s^a \otimes \psi : s^c \otimes \Delta_2$

Since the rest of the dissertation does not deal with context update or conventional implicature, the simple goal condition in (3.22) is sufficient and will be adopted here.

In sum, Linguistic Resource Sensitivity is based on Logical Resource Sensitivity, but requires that proofs are further constrained in a manner motivated by linguistic theory.

3.3 Resource Sensitivity and linguistic theory

In this section I consider various implicit appeals to Resource Sensitivity in the linguistics literature. By adopting a resource logic, such as linear logic, for semantic composition and thus obtaining a notion of Linguistic Resource Sensitivity, we point the way to elimination of the various heterogeneous proposals by capturing them directly in semantic composition. This would not only achieve theoretical simplification by eliminating unnecessary additional principles, it would also provide a bridge between the different theories in which the proposals have been made.

[9]Potts's (2003) logic allows multiple conventional implicature types. This could be represented using conjoined CI-types, on analogy with the conjoined contexts of Crouch and van Genabith (1999) (see footnote 8), but I set this complication aside.

3.3.1 Bounded Closure

An early appeal to resource accounting in the linguistic literature and the one which Dalrymple et al. (1993, 1999b) mention explicitly is *Bounded Closure* in Klein and Sag's (1985) influential type-driven translation. As a preliminary to defining Bounded Closure, Klein and Sag (1985:171) note that:

> Translation rules in Montague semantics have the property that the translation of each component of a complex expression occurs exactly once in the translation of the whole.

The property mentioned in this quotation just is resource accounting: the components to be translated are resources that must be used exactly once. The implicit claim is that natural language semantics is resource-sensitive. It should be noted, though, that Klein and Sag (1985) were writing before linear logic and other resource logics were well-understood.

Klein and Sag (1985:171ff.) define an operation of *functional realization* which is a mapping from a set of expressions of Montogovian intensional logic to a set of the expressions that can be built out of the input set. They note that functional realization must preserve the resource accounting property of translation in Montague semantics that is mentioned in the quote above. They write:

> This property must be preserved by functional realization. That is to say, we do not want the set S mentioned above to contain all meaningful expressions of IL [Intensional Logic — AA] which can be built up from the elements of S [a set of expressions of IL — AA], but only those which use each element of S exactly once. For example, suppose that $S = \{walk', \ quickly'\}$, where $walk'$ is of type VP and $quickly'$ is of type $\langle VP, \ VP\rangle$. Then S' should contain the expression $quickly'(walk')$, but not $quickly'(quickly'(walk'))$, or any other of the infinite number of expressions constructed in this way. Consequently, we shall take the preliminary step of defining the bounded closure of a set under a binary operation h. By contrast to the standard notion of the closure of a set under some operation, bounded closure obeys the restriction just discussed, namely that each element in the initial set is employed exactly once.
> (Klein and Sag 1985:172)

The bounded closure of a set is thus set closure with the added restriction that each item in the initial set must be used and no item can be used more than once. It is clear that this is a notion of resource accounting that cashes out the hypothesis of Resource Sensitivity. Since these notions were not available to Klein and Sag (1985), the best they could do was to stipulate a special kind of closure.

If we adopt a resource logic such as linear logic for semantic composition, not only do we capture the effects of bounded closure, we do so in a manner that ties in to a substantial body of work in the neighbouring disciplines of substructural logic and proof theory.

3.3.2 Completeness, coherence, and semantic forms

The principles of completeness and coherence were introduced in section 2.1.3.2 of chapter 2 as well-formedness constraints on LFG's f(unctional)-structures. The following are more precise formulations of the principles than what was offered in the last chapter.

(3.26) a. **Completeness**
An f-structure is *locally complete* if and only if it contains all the governable grammatical functions that its predicate governs. An f-structure is *complete* if and only if it and all its subsidiary f-structures are locally complete.
(Kaplan and Bresnan 1982:65[211–212])

b. **Coherence**
An f-structure is *locally coherent* if and only if all the governable grammatical functions that it contains are governed by a local predicate. An f-structure is *coherent* if and only if it and all its subsidiary f-structures are locally coherent.
(Kaplan and Bresnan 1982:65[211–212])

Completeness demands that every grammatical function required by a predicate is found in the f-structure and coherence demands that every grammatical function that is found in the f-structure is required by some predicate. Completeness and coherence thus perform analogous roles to the Theta Criterion, the Projection Principle, and Full Interpretation in Principles and Parameters Theory (see below). A key difference between completeness and coherence and these other principles is that completeness and coherence are defined recursively and thus have both a local and global sense.

It is easy to see how Resource Sensitivity can take over the role of completeness and coherence. If an f-structure does not satisfy completeness, then there is at least one semantic argument whose resource is missing. This means that the consumer of this resource cannot be satisfied and its premise cannot be properly used in the proof. Similarly, if an f-structure does not satisfy coherence, then there is at least one semantic resource that has no consumer. This resource cannot be used properly in the proof and Resource Sensitivity is not satisfied. In a version of LFG that is coupled to Glue Semantics, it may be that completeness and coherence are not necessary as separate grammatical statements. It is nonetheless still convenient to use them as descriptive labels, especially for local realization of grammatical functions.

The one potential challenge to taking over the roles of completeness and coherence with Resource Sensitivity comes from expletives. If expletives are semantically contentless, then their presence will not be ensured by the resource sensitivity of the semantics. There are a number of potential replies to this challenge. First, it might be that expletives are not semantically empty after all (Bolinger 1977). Second, semantics is not the only component of grammar that is resource-sensitive. I argued in section 3.1 that syntax is also resource-sensitive. It is therefore possible that a resource-sensitive perspective on syntactic combination could capture the expletive cases. Categorial Grammar would constitute a good starting point for such an investigation, since its syntax can be characterized by a resource logic (at least in the type-logical approach). The Resource-based LFG (R-LFG) approach of Johnson (1999a,b) — which treats LFG syntax as directly resource-sensitive rather than derivatively resource-sensitive off the semantics as in the present theory — is another potential avenue. Third, we could still assign a resource to an expletive despite a lack of semantics. One possible meaning constructor would be the following:

(3.27) $\lambda p.p : (\textsc{gf}\ \uparrow)_\sigma \multimap (\textsc{gf}\ \uparrow)_\sigma$

In this case the expletive is a modifier on the clause headed by its predicate. For example, the resource above would be instantiated to $r \multimap r$ for the sentence *It rained* (based on the mnemonic convention). The lack of semantics is maintained by using the identity function. The use of the identity function is not unusual in semantic theory. It is used in Partee's (1987) treatment of *be* and in Jacobson's (1999) treatment of pronouns.

LFG's semantic forms, i.e. PRED features, are another instance of an implicit appeal to Resource Sensitivity. Kuhn (2001) points out that in the current state of LFG the only function that PRED features seem to play that is not redundant with other aspects of the grammar (see Dalrymple 2001:220) is unique instantiation. This is the property that prevents distinct f-structures with the same PRED from unifying. This property can be reduced to Resource Sensitivity on the assumption that in the general case if multiple compatible predicates each contribute resources that are looking for the same arguments there will not be enough arguments to go around. Kuhn (2001) observes that there are several benefits to taking over the uniqueness role of PRED features with Resource Sensitivity. First, since this role is the last remaining role for PRED features in the syntax, they can be eliminated entirely. Second, it would remove the distinction between unifiable and ununifiable features from the theory. It must be said that this benefit is undercut by the introduction of *instantiated symbols* by Kaplan and Maxwell (1996). Instantiated symbols are not semantic forms but have the uniqueness property: identical instantiated symbols cannot be unified. Third, Kuhn (2001) notes that this results in an architecture where all resource accounting is performed by the semantics and the syntax is free to engage in acts of multiple exponence quite freely. Fourth, he notes that there are empirical reasons to suppose that there can be multiple exponence of PRED, just like other features. The case he looks at is split NPs in German, as shown in the following example:

(3.28) Bücher sieht Anna drei.
books sees Anna three
As for books, Anna can see three.
(Kuhn 2001:(1.1))

Despite the apparent elliptical nature of the second NP, the two NPs behave as complete NPs with respect to marking of declension class and determiner selection. It seems that this constitutes a case where two NPs with independent but compatible PRED features need to map to the same f-structure.

Although reduction of completeness, coherence, and the resource accounting aspect of semantic forms to Resource Sensitivity is appealing, I do not presuppose such a reduction in the rest of this work. Instead, I assume an LFG syntax that has the usual notions of completeness, coherence, and semantic forms. I leave the reduction of these mechanisms to Resource Sensitivity for future work.

3.3.3 The Theta Criterion

Another early implicit appeal to Resource Sensitivity was the *Theta Criterion* of Principles and Parameters (P&P), as first adopted in the Government and Binding Theory of Chomsky (1981) and also in early versions of its successor, the Minimalist Program (Chomsky 1995). A standard formulation of the Theta Criterion is:[10]

(3.29) **Theta Criterion**
Each argument bears one and only one θ-role and each θ-role is assigned to one and only one argument. (Chomsky 1981:36)

Once again we see that a notion of resource accounting is at play: theta roles are resources that must be assigned exactly once and each arguments must bear exactly one theta role.

[10] Chomsky (1986) subsequently refines the Theta Criterion in terms of movement chains (e.g., $\langle who_i, t_i \rangle$). He writes:

> Each argument α appears in a chain containing a unique visible θ-position P, and each θ-position P is visible in a chain containing a unique argument α. (Chomsky 1986:97)

This is then further refined:

> A CHAIN has at most one θ-position; a θ-position is visible in its maximal CHAIN. (Chomsky 1986:135)

A CHAIN is either a movement chain or a an expletive-associate pair (e.g., $\langle there_i, a\ book_i \rangle$ in *There is a book here.*).

A serious shortcoming of the Theta Criterion is that it actually conflicts with the larger theory of theta roles in which it is couched. Theta roles were originally proposed to make generalizations about event participants in related sentence types (Gruber 1965, Jackendoff 1972). Chomsky (1981:139, fn.14) notes that this original motivation for theta roles is at odds with the Theta Criterion. For example, *John* in the following sentence is both agent and theme (Jackendoff 1972):

(3.30) John deliberately rolled down the hill.

This sentence violates the Theta Criterion because there is an argument, *John*, that bears two theta roles. The problem here is that the notion of theta role is being overloaded. Chomsky's (1981:139) proposal is to reformulate theta role assigment to deal with such problems. But why should theta role assignment be complicated rather than just abandoning the Theta Criterion? In fact, a decade later this was exactly the move that was made, as we will shortly see in our discussion of Full Interpretation.

If we reduce the Theta Criterion to Resource Sensitivity then the problem does not arise in the first place. Resource Sensitivity achieves the goals of the bijective theta criterion with respect to arguments and predicates (ensuring a one-to-one match) while allowing theta roles as originally motivated. In the specific case of (3.30), for example, the intransitive version of *rolled* requires one resource, which is contributed by *John*.[11] The fact that *John* has two theta roles does not impinge on the fact that the lexical item provides a single resource.

A related problem has to do with coordination. In a VP-coordination like the following, each of the verbs has a subject theta-role to assign, but there is only one recipient:

(3.31) Kim sang and danced.

The subject *Kim* receives two theta-roles and this should therefore be a violation of the theta criterion. By contrast, it has been demonstrated that theories that propose resource-sensitive analyses of coordination, such as Categorial Grammar and Glue Semantics, can handle such cases without giving up Resource Sensitivity (Steedman 1985, Emms 1990, Asudeh and Crouch 2002a).

3.3.4 The Projection Principle

The *Projection Principle* (Chomsky 1981, 1982, 1986) requires that lexical properties must be preserved throughout the derivation. In particular, the Projection Principle requires that "the θ-marking

[11] I am assuming for the sake of argument that *down the hill* is an adjunct, not an argument. The point I am making is not affected if it is in fact analyzed as an argument and *rolled* therefore takes two resources. It is properties of the subject that are at issue.

properties of each lexical item must be represented categorially at each syntactic level" (Chomsky 1982:8). The Projection Principle is thus deeply related to the Theta Criterion and essentially ensures that the actions of the latter are syntactically realized. Although the Projection Principle is not as clearly an appeal to Resource Sensitivity as the cases we have looked at so far, it inherits Resource Sensitivity from the Theta Criterion. In any case, there is a resource accounting perspective we can take on the Projection Principle independently of the Theta Criterion.

The Projection Principle has not been well-defined formally; intuitive definitions like the following are typical:

> In general, the phrase structure rules expressing head-complement structure can be eliminated apart from order by recourse to a projection principle, which requires that lexical properties be represented by categorial structure in syntactic representations. (Chomsky 1986:82)

> The projection principle requires that complements of heads must be represented at each syntactic level (D-structure, S-structure, LF), so that, in particular, objects must be represented, but it says nothing about subjects. (Chomsky 1986:116)

If the complement is thought of as a resource, then it must be properly licensed (i.e., consumed) and cannot be freely discarded or inserted in the course of the derivation. Another way to think about this is that the lexical properties in question are resources that must be accounted for. Thus, the Projection Principle reduces to Resource Sensitivity quite apart from its relationship to the Theta Criterion.

As indicated by the second quote above, the Projection Principle is the requirement that complements to heads must be present at all levels of structure and in particular does not apply to subjects. Chomsky (1982:10) notes that θ-marked subjects cannot be required by the Projection Principle, citing as evidence nominalizations lacking subjects, passives with suppressed subjects, and expletive subjects:

(3.32) a. I do not find the claim that the earth is flat compelling.

b. That passive is NP-movement has been questioned.

c. It is virtually conceptually necessary that the earth is round.

The nominalization and passive sentences indicate that what would be the subject's theta role in the corresponding active declarative need not be realized. The expletive sentence indicates that even in the absence of a subject theta role there must be a syntactically realized subject. There is thus some separate subject condition that cannot be reduced to the Projection Principle.

The Projection Principle and this subject condition together constitute the Extended Projection Principle (Chomsky 1982, 1986), which has been a central research topic in the Minimalist Program under the guise of the EPP feature (see Svenonius 2002 for recent results and references). Resource Sensitivity gives a new perspective on the Extended Projection Principle and the EPP feature, particularly with respect to expletives. If expletives have no semantic content, they presumably contribute no resources for semantic composition. This means that semantic resource accounting will not guarantee their presence. This leaves the options discussed in section 3.3.2. The first is to argue that expletives are not semantically contentless after all (Bolinger 1977) and therefore contribute resources. The second option is to treat the requirement for expletive subjects as purely syntactic. This is the perspective that has stimulated much work in the Minimalist Program, since if everything is motivated by considerations at the interfaces to meaning and form, then any purely syntactic phenomenon is instantly suspect. The third option is for expletives to contribute a resource that is associated with the identity function.

3.3.5 No Vacuous Quantification

There have been appeals in the linguistic literature to a syntactic principle that bans vacuous quantification (Chomsky 1982, 1995, Kratzer 1995, Kennedy 1997, Heim and Kratzer 1998, Fox 2000). A recent review and critical discussion is provided by Potts (2002b). The ban on vacuous quantification, which I will henceforth refer to as No Vacuous Quantification (NVQ), following Potts (2002b), has been used to account for the ungrammaticality of a number of examples. Chomsky (1982:11, (6–7)) uses it to bar double quantification over the same restriction, as in (3.33), and to bar relative clauses and matrix and embedded questions with saturated scopes, as in (3.34).

(3.33) *all some men

(3.34) a. *the man who John saw Bill

b. *Who did John see Bill?

c. *I wonder who John saw Bill.

Kratzer (1995:129ff.) uses NVQ to block certain examples involving adverbial quantification, such as (3.35), which contrasts with (3.36).

(3.35) *When Mary knows French, she knows it well.
(Kratzer 1995:129, (15a))

(3.36) When a Moroccan knows French, she knows it well.
(Kratzer 1995:129, (15b))

Kennedy (1997) assumes that NVQ governs extraction of the null operator OP. Potts (2002b:(2a–b)) notes that NVQ should presumably similarly govern variable-binding by OP, explaining the following contrast:

(3.37) the soup OP_1 Martha prepared t_1

(3.38) *the soup OP_1 Martha prepared dinner

Fox (2000) builds his account of the Coordinate Structure Constraint (Ross 1967, Grosu 1973) on NVQ.

Kratzer (1995:131) offers the following formulation of No Vacuous Quantification (NVQ):

(3.39) *Prohibition against Vacuous Quantification*
For every quantifier Q, there must be a variable x such that Q binds an occurrence of x in both its restrictive clause and its nuclear scope.

Potts (2002b) points out that the requirement that the quantifier binds a variable in both its restriction and its scope fails to extend to empty operator (OP) cases like (3.38), because the empty operator has no restriction. He offers an alternative formulation of NVQ in terms of lambda abstraction. The following formulation from Heim and Kratzer (1998:126, (11)) similarly captures all of the intended cases:

(3.40) Each variable binder must bind at least one variable.

The main points are that NVQ bans vacuous quantification and that it has been appealed to as a condition on syntactic well-formedness. The last point is not necessarily obvious, given the formulations we have looked at, but it follows since variables and their binders are represented at LF (see, e.g., Heim and Kratzer 1998) and LF is a level of syntax — the only level of syntax in the Minimalist Program.

Potts (2002b) argues that NVQ should not be adopted as a syntactic costraint in the grammar based on both theoretical and empirical considerations. He argues following Marsh and Partee (1984) that the complexity of NVQ is such that it probably requires a grammar more powerful than an indexed grammar. The complexity of NVQ is thus quite bad. Furthermore, Potts (2002b) shows that data that has been thought to motivate NVQ can be reanalyzed in a simple Generalized Phrase Structure Grammar (GPSG; Gazdar et al. 1985). It is an established result that GPSGs are context-free and therefore cannot represent phenomena requiring indexed grammars. By providing analyses of NVQ phenomena in GPSG, Potts (2002b) thus demonstrates that these phenomena cannot require NVQ as a syntactic constraint, since GPSG could not capture such a constraint. Lastly, Potts presents several attested examples that violate NVQ as a condition on syntax and also provides contexts for examples like Kratzer's (3.35) which render them well-formed. Potts concludes that NVQ should not a statement of the grammar, although it could be theorem (i.e., consequence) of the grammar.

NVQ is in fact a consequence of Resource Sensitivity. It is sufficient to just look at the types of the expressions involved to establish this. Recall from section 3.2 that Linguistic Resource Sensitivity requires Logical Resource Sensitivity plus some linguistically motivated goal condition for the proof. Let us assume the goal condition is of type t. Let us also assume that operators are generalized quantifiers of type $\langle\langle e,t\rangle, \langle\langle e,t\rangle, t\rangle\rangle$. The empty operator lacks a restriction and is just of type $\langle\langle e,t\rangle, t\rangle$. Thus, the restriction and scope of operators are $\langle e,t\rangle$ types. Making the standard move of representing functional types by implication (van Benthem 1991/1995), which we know is valid due to the Curry-Howard isomorphism, a succesful semantic derivation involving an operator looks like this:

(3.41)
$$\dfrac{\dfrac{(e \multimap t) \multimap ((e \multimap t) \multimap t) \qquad (e \multimap t)}{(e \multimap t) \multimap t}\multimap_{\mathcal{E}} \qquad (e \multimap t)}{t}\multimap_{\mathcal{E}}$$

If the variable in the restriction is missing, this means that the restriction is not a $\langle e,t\rangle$ type. Representing the restriction's type as R and keeping $(e \multimap t)$ for the scope (annotated for clarity), we get the following proof, which does not satisfy Resource Sensitivity:[12]

(3.42)
$$\dfrac{\dfrac{(e \multimap t) \multimap ((e \multimap t) \multimap t) \qquad S : (e \multimap t)}{(e \multimap t) \multimap t}\multimap_{\mathcal{E}} \qquad R}{((e \multimap t) \multimap t) \otimes R}\otimes_{\mathcal{I}}$$

The proof does not terminate in a type t and is therefore not well-formed.[13]

[12] Notice that I have used implication introduction in this proof; see section 2.2 of the previous chapter and appendix A for details.

[13] Given the possibility of contextual update and conventional implicature discussed in section 3.2, we might want to generalize the stopping condition to a product of t types, but the above proof would still be ill-formed.

Similarly, if the variable in the scope is missing, we get the following invalid proof, where S represents the type of the scope and the restriction has its usual $(e \multimap t)$ type:

(3.43)
$$\dfrac{\dfrac{(e \multimap t) \multimap ((e \multimap t) \multimap t) \qquad R : (e \multimap t)}{(e \multimap t) \multimap t}\multimap_{\mathcal{E}} \qquad S}{((e \multimap t) \multimap t) \otimes S}\otimes_{\mathcal{I}}$$

The proof once again fails to terminate in a type t and therefore does not satisfy Resource Sensitivity.

A concrete example of this kind of proof failure is given by Chomsky's example in (3.33) above, which I repeat here with a scope:

(3.44) *All some men laughed.

The quantifier *some* will take the restriction and scope, leaving *all* without either. The proof we get for this is:

(3.45)
$$\dfrac{\dfrac{\dfrac{\begin{array}{c}\textbf{some}\\(e \multimap t) \multimap ((e \multimap t) \multimap t)\end{array} \qquad \begin{array}{c}\textbf{men}\\(e \multimap t)\end{array}}{(e \multimap t) \multimap t)}\multimap_{\mathcal{E}} \qquad \begin{array}{c}\textbf{laugh}\\(e \multimap t)\end{array}}{t}\multimap_{\mathcal{E}} \qquad \begin{array}{c}\textbf{all}\\(e \multimap t) \multimap ((e \multimap t) \multimap t)\end{array}}{t \otimes ((e \multimap t) \multimap ((e \multimap t) \multimap t))}$$

We can see that this proof does not satisfy Resource Sensitivity, since it does not terminate in a type t, but rather in the monstrous type $\langle t \times \langle\langle e, t\rangle, \langle\langle e, t\rangle, t\rangle\rangle\rangle$.

In sum, if we have Resource Sensitivity there is no requirement for NVQ as a separate statement of the grammar. It is instead a consequence of the grammar and we avoid the pitfalls that Potts (2002b) outlines while still capturing the effect of NVQ.

3.3.6 Full Interpretation

Chomsky (1986) describes the Principle of Full Interpretation (FI) as follows:

> We might express many of these ideas by saying that there is a principle of full interpretation (FI) that requires that every element of PF [Phonetic Form — AA] and LF [Logical Form — AA], taken to be the interface of syntax (in the broad sense) with systems of language use, must receive an appropriate interpretation — must be licensed in the sense indicated. None can simple be disregarded. (Chomsky 1986:98)

This is unfortunately rather vague and open to interpretation, and this is indeed a problem with FI that we return to below.

Chomsky (1986) gives the following as examples of the kind of sentences that FI blocks due to improper LF licensing:

(3.46) a. I was in England last year [the man]

b. John was here yesterday [walked]

c. [who] John saw Bill

d. [every] everyone was here

The postulation of a Principle of Full Interpretation is perhaps compelling but is in fact completely redundant with other principles that were active in the theory at the time. The Theta Criterion blocks the first two sentences. In the first, *the man* is not assigned a theta role. In the second, *walked* cannot properly assign its one theta role (assuming this is intransitive *walk*). The only potential recipient of the theta role is *John*, but if it were to receive *walk*'s theta role than the subject would bear two theta roles, violating the Theta Criterion. The last two examples are blocked by the ban on vacuous quantification, NVQ: the *wh*-operator *who* and the quantifier *every* do not have variables that they can bind. There was thus a point of considerable redundancy between various principles in the theory.

This redundancy was subsequently addressed by early work in the Minimalist Program. It was realized from quite early on in the Minimalist Program that Full Interpretation could subsume and eliminate both the Theta Criterion and the Projection Principle:

> Let us now look more closely at the economy principles. These apply to both representations and derivations. With regard to the former, we may take the economy principle to be nothing other than FI: every symbol must receive an “external” interpretation by language-independent rules. There is no need for the Projection Principle or θ-criterion at LF. A convergent derivation might violate them, but in that case it would receive a defective interpretation. (Chomsky 1993:32, Chomsky 1995:200)

Although all the Full Interpretation examples in (3.46) involve extra material, if Full Interpretation is to subsume the Theta Criterion and the Projection Principle, then FI must be understood in a completely resource-sensitive manner: it must not only block extra, unrequired material, but also enforce lexical requirements that certain material is obligatorily present.

(Chomsky 1995:151) also reduces no vacuous quantification to Full Interpretation:

> One consequence [of FI at LF — AA] is that vacuous quantification should be forbidden.

All of the P&P / Minimalist principles that I have reviewed have ultimately been reduced to FI.

Full Interpretation is obviously just a formulation of Resource Sensitivity. Proponents of FI may then feel that its reduction to Resource Sensitivity is unwarranted or trivial. I do not think this is so and here are several reasons why. First, Full Interpretation is vague, unformalized, and hence open to interpretation. It can lead to many potentially wasteful and misguided debates based on its lack of precision. Resource Sensitivity is by contrast strongly formalized in terms of resource logics, proof theory, and type theory. Second, if Full Interpretation is such a robust and pervasive property of language, there is no sense in leaving it as a separate principle, arguably a kind of theoretical appendage. Resource Sensitivity by contrast is worked into the formal system that performs composition. It is embedded as an integral part of the theory. Third, as an economy condition, Full Interpretation is inherently transderivational (Potts 2002b). Resource Sensitivity is not transderivational: it is a condition on a single structure (a proof). Given the worrying complexity properties of transderivational constraints and the theoretical and empirical arguments against them (Jacobson 1998, Johnson and Lappin 1997, 1999, Potts 2001, 2002a, Pullum and Scholz 2001), if FI and Resource Sensitivity are equivalent but the latter is not transderivational, this is reason enough to adopt it instead of FI. Fourth, to the extent that its precise content can be divined, FI seems to be a claim about contentful elements in semantics. By contrast, Resource Sensitivity is a claim about semantic composition, whatever the meanings being composed are. This means that Full Interpretation has nothing to say about the necessity of words that seem to have no semantic content, such as do-support *do*, the complementizer *that*, expletive pronouns, and certain subcategorized prepositions, such as *of* (Potts 2002b). However, as sketched in section 3.3.2, it is possible for semantically contentless elements to contribute bleached identity functions together with resources for composition. In that case, Resource Sensitivity covers these cases while FI does not.

3.3.7 Numerations and the Inclusiveness Condition

The Minimalist Program introduces the notion of *numeration* for the multi-set of lexical items from which a syntactic derivation is computed. Chomsky (1995:228) notes that a “perfect language” should meet the “condition of inclusiveness”:[14]

> Any structure formed by the computation (in particular, π and λ) is constituted of elements already present in the lexical items selected for N; no new objects are added in the course of the computation apart from rearrangements of lexical properties ...

[14]The inclusiveness condition is also discussed in relation to Resource Sensitivity by Potts (2003:112).

Chomsky (1995:228) goes on to note that the inclusiveness condition is not fully met.

It is clear that Resource Sensitivity entails the inclusiveness condition. The multi-set of lexically obtained premises (the “numeration”) must be exhaustively used up. Furthermore, Resource Sensitivity is a stronger condition than the inclusiveness condition. Not only can no items be entered into computation during derivation, the existing items cannot be reused and all existing items must be used up. Lastly, Resource Sensitivity entails a version of the inclusiveness condition that is fully met. If it holds, then there is no room for even slight departures from the condition. If such departures from the inclusiveness condition are strictly necessary in Minimalist terms, then they can still potentially be understood using the linear logic modalities. A recent issue of the journal *Research on Language and Computation*, edited by Christian Retoré and Ed Stabler, focuses on understanding the Minimalist Program in resource logic terms (see Retoré and Stabler 2004). It remains to be seen if this will prove influential on Minimalism at large.

Conclusion

This chapter concludes the presentation of the formal theory behind the guiding hypothesis of this dissertation, Resource Sensitivity:

(3.47) Natural language is universally *resource-sensitive*.

I more narrowly called this hypothesis Linguistic Resource Sensitivity and explored its relationship to the Logical Resource Sensitivity of resource logics. I argued that Logical Resource Sensitivity alone is insufficient to capture the intuitions behind Linguistic Resource Sensitivity, although the latter is based on the former.

I explored several proposals in the linguistic literature and showed how they can be construed as implicit appeals to Resource Sensitivity. However, this is no reason to conclude that Resource Sensitivity is an established aspect of linguistic theory or old hat in some way. In every case, I showed that Resource Sensitivity leads to a new understanding of the principles in question, offers new avenues of research, yields new interpretations of established results, or addresses theoretical or empirical problems with the principle in question.

Part II

Resumptive Pronouns

Chapter 4

A descriptive overview

Introduction

Before turning to the resource logical analysis of resumptive pronouns in the next chapter, I will review the major characteristics of resumptives that have been identified in the literature (section 4.1, A–G). Explaining these characteristics should constitute one of the principal goals of any theory of resumptive pronouns. The discussion will be kept informal and theory-neutral to the greatest extent possible, not just for exposition but also in an attempt to really untangle the empirical properties of resumptive pronouns from the theoretical thicket.

Any such overview must necessarily be limited in scope. I concentrate principally on Irish, Swedish, and Hebrew, touching on other languages along the way. These three languages, particularly Irish, are also the ones that will be examined in detail in the subsequent theoretically oriented chapters. I treat Irish as a benchmark for the analysis of resumptive pronouns for a number of reasons. First, its complementizer system morphologically reflects distinctions between gaps and resumptives (McCloskey 1979), meaning that Irish is particularly well-suited to the study of resumptive pronouns. Second, as a result Irish has received unparalleled sustained analysis of its resumptive system through the work of various authors, but principally through that of McCloskey, the latest installment of which is not only theoretically up-to-date, but also empirically rich (McCloskey 2002). Third, the aforementioned recent article identifies a series of complex resumptive phenomena in Irish that offer a particularly strong challenge to theories of resumptive pronouns, which the present analysis meets. Swedish and Hebrew are discussed partly because, aside from Irish, they have received the most in-depth theoretical analysis of their resumptive pronoun systems and therefore offer another good general yardstick for theoretical analyses of resumptive pronouns.

Much more importantly though, the resumptive pronoun system of Swedish exhibits superficially different properties from those of Irish and Hebrew (Sells 1984, 1987), such that it seems inappropriate for one overarching theory of resumptive pronouns to cover all three languages (see also McCloskey 1990). At the same time, there are certain core characteristics of resumptive pronouns that extend across the three languages, so it would be a mistake to treat the resumptive pronouns in Scandinavian in a radically different fashion. I will in fact show that by careful separation of grammaticized resumptives from other apparent resumptives, the resumptive system of Swedish can be unified with those of Irish and Hebrew to an extent that has not proved possible before, while allowing relevant distinctions to be made.

4.1 Characteristics of resumptive pronouns

The core characteristics of resumptive pronouns, classified by grammatical subsystem, are as follows:

A. Resumptive pronouns occur in unbounded dependencies.
(SYNTAX)

B. Resumptive pronouns are interpreted as bound pronouns.
(SEMANTICS)

C. Resumptive pronouns are the ordinary pronouns of the language.
(MORPHOLOGY / LEXICON)

D. Resumptive pronouns and gaps have distinct syntactic distributions.
(SYNTAX)

E. Resumptive pronouns display restrictions on their interpretation which gaps do not and which correlate with restrictions on the interpretation of non-resumptive pronouns.
(SEMANTICS)

F. Resumptive pronouns do not display certain key characteristics of gaps.
(SYNTAX)

G. Resumptive pronouns resemble gaps in their interaction with certain grammatical phenomena.
(SYNTAX, SEMANTICS)

Property A was discussed in the introduction. It was argued that A cannot constitute a satisfactory theoretical definition of the term resumptive pronoun, but it does serve well as a descriptive characterization. Properties A and B together constitute the definitional characteristics of resumptive pronouns, as argued extensively by Sells (1984).

A: Unbounded dependencies

The first definitional property of resumptive pronouns concerns a key aspect of their syntactic distribution:

A. Resumptive pronouns occur in unbounded dependencies.

In Irish there are no restrictions on which unbounded dependencies host resumptives. McCloskey (1990:208, (25)) notes that "resumptive pronouns appear in every WH-construction" and gives a comprehensive appendix of the distribution of Irish resumptive pronouns (McCloskey 1990:238–242). A subset of relevant examples is given here; the material containing the resumptive pronominal information is underlined:

(4.1) **Restrictive relative clauses**

a. an ghirseach a-r ghoid na síogaí í
the girl COMP-PAST stole the fairies her
the girl that the fairies stole away
(McCloskey 2002:189, (9b))

b. an fear a dtabharann tú an tairgead dó
the man COMP give you the money to.him
the man to whom you give the money
(McCloskey 1979:6, (3))

(4.2) **Nonrestrictive relative clauses**

a. Tháinig an saighdiúir eile, nach bhfaca mé roimhe é, aníos chugainn.
came the soldier other NEG.COMP saw I before him, up to.us
The other soldier, whom I hadn't seen before, came up to us.
(McCloskey 1990:238, (97a))

(4.3) **Questions**

a. Céacu ceann a bhfuil dúil agat <u>ann</u>?
which one COMP is liking at.you in.it
Which one do you like?
(McCloskey 2002:189, (10b))

b. d'inis siad cén turas a raibh siad <u>air</u>
told they what journey COMP be.PAST they on.3SG.MASC
they told what journey they were on (it)
(McCloskey 1990:238, (98a))

(4.4) **Clefts**

a. Is tú a bhfuil an deallramh maith <u>ort</u>.
COP.PRES you COMP is the appearance good on.2SG
It is you that looks well.
(McCloskey 1990:239, (99a))

(4.5) **"Reduced" Clefts**

a. Teach beag seascair a-r mhair muid <u>ann</u>.
house little snug COMP-PAST lived we in.it
It was a snug little house that we lived in.
(McCloskey 2002:189, (11b))

(4.6) **Comparatives**

a. Do fuair sé leaba chó math agus a-r lui sé riamh <u>uirthi</u>.
get PAST he bed as good as COMP lie.PAST he ever on.3SG.FEM
He got a bed as good as he ever lay on (it).
(McCloskey 1990:239, (100b))

Note that in all of these examples but (4.1a) and (4.2a) the pronominal is incorporated as an argument to an inflected preposition. It is generally agreed in the literature that these prepositions are best analyzed as contributing full pronominal information, just as if the pronoun were a prepositional object (McCloskey 1979:47, fn.2, McCloskey and Hale 1984:506ff., McCloskey 1986:252ff., Sells 1984:111–112). For further examples of Irish unbounded dependencies containing resumptive pronouns see McCloskey (1979, 1985, 2002) and especially McCloskey (1990).

In other resumptive pronoun languages, the unbounded dependencies which allow resumptive pronouns may be further restricted. For example, it was initially claimed of Hebrew that resumptives are ungrammatical in questions (Borer 1981:114) and this is supported by the following data:

(4.7) * mi raʔiti oto?
who I.saw him?
(Sells 1984:63, (58b))

(4.8) * mi nifgašta ito
who you.met with.him
(Sharvit 1999:591, (8b))

However, the claim that Hebrew disallows resumptives in questions is overly simplistic. First, Sells (1984:64) shows that resumptive pronouns are possible in Hebrew questions if the resumptive follows a complementizer:

(4.9) eyze xešbon kol maškia lo zoxer im hu noten ribit tova?
which account every investor not remembers if it gives interest good
Which account does every investor not remember if (it) gives good interest?
(Sells 1984:64, (61))

Thus, a resumptive can be used in a *that*-trace (ECP) environment.[1]

Second, Sharvit (1999:591) writes that *which*-questions in dialectal Hebrew do allow resumptives:

(4.10) eyze student nifgašta ito?
which student you.emt with.him
Which student did you meet with?
(Sharvit 1999:591, (9))

Sharvit (1999:591) attributes the grammaticality of resumptives in *which*-questions to the fact that *which*-phrases are "almost" D(iscourse)-linked (Pesetsky 1987) and tentatively concludes that "resumptive pronouns are sensitive to D-linking in a way that traces are not". However, it is not true that traces are *insensitive* to D-linking, which was after all initially proposed as part of an explanation of *wh*-superiority effects (Pesetsky 1987:107ff.). The D-linking explanation is thus somewhat tenuous.

Swedish similarly disallows resumptive pronouns in simple questions:

[1] Shlonsky (1992:448, fn.3) disputes this data. I return to this matter in chapter 7, section 7.2.1.

(4.11) * Vem såg du honom?
who see.PAST you him

Like Hebrew, Swedish allows resumptives in questions when a subject gap is not licensed:

(4.12) Vilket konto vet inte varje investerare om det ger bra ränta?
which account knows not every investor if it gives good interest
Which account does every investor not remember if (it) gives good interest?

However, unlike Hebrew, resumptives in relative clauses are also restricted to this kind of *that*-trace environment:

(4.13) Det var den fången som läkarna inte kunde avgöra om han verkligen var sjuk.
it was that prisoner that doctors.DEF not could decide if he really was ill
This is the prisoner that the doctors couldn't determine if (he) really was ill.
(Engdahl 1985:7, ∼(8))

(4.14) * Jag känner mannen som Maria träffade honom.
I know man.DEF that M. met him

The difference between (4.11) and (4.12) is a reflection of the broader generalization that Swedish resumptives are only licensed following material at the left periphery of CP (Engdahl 1982:156, Sells 1984, 1987:267, McCloskey 1990:235).

Further evidence for the generalization comes from the fact that, again unlike Hebrew, resumptives in simple Swedish *which*-questions are ungrammatical:

(4.15) * Vilken elev hade du möte med henne?
which student had you meeting with her

(4.16) * Vilken elev träffade du honom?
which student met you him

Thus, Swedish does not really distinguish between resumptives in relative clauses and questions, whereas Hebrew allows resumptives more freely in relatives than in questions.

In summary, a definitional characteristic of resumptive pronouns is that they occur in unbounded dependencies, but languages can differ as to which unbounded dependencies allow resumptives and under what circumstances. Irish allows resumptives in every kind of unbounded dependency. Hebrew allows resumptives in relatives, but their distribution in questions is more limited. Swedish allows resumptives in only a very specific circumstance — immediately following lexical material in the left periphery of CP — but does not distinguish between unbounded dependencies that meet the requisite requirement.

B: Bound pronouns

The second definitional property of resumptive pronouns concerns their semantic interpretation.

B. Resumptive pronouns are interpreted as bound pronouns.

Chao and Sells (1983) argue that this criterion distinguishes true resumptive pronouns from pronouns used to ameliorate island violations (Ross 1967:432–434), which Sells (1984:17) calls *intrusive pronouns*. Intrusive pronouns cannot receive bound interpretations. Chapter 8 discusses the interpretation of intrusive pronouns, which I include in the broader class of *processing-resumptives*.

Chao and Sells (1983) present three tests based on property B that distinguish resumptive pronouns from intrusive pronouns. Each test shows that an intrusive pronoun does not support the bound reading that a gap in the same position supports. The first is binding of the pronoun by a quantifier that does not license a coreferential or E-type reading (Evans 1980), such as *every*, *each*, or *no*.[2] The only available reading for a pronoun that takes a quantifier as its antecedent is a bound reading. A sentence with a quantifier-bound pronoun in an unbounded dependency should therefore be grammatical if the pronoun is a resumptive pronoun and ungrammatical if it is an intrusive pronoun. The ungrammaticality of the following English sentence indicates that the pronoun is an intrusive pronoun and not a true resumptive pronoun:

(4.17) *I'd like to review every book that Mary couldn't remember if she'd read <u>it</u> before.
(Chao and Sells 1983:49, ∼(5c))

The other two tests that Chao and Sells (1983) present concern answers to *wh*-questions. The first *wh*-test shows that an English intrusive pronoun does not support a list answer to a *wh*-question, which should be possible for a bound pronoun:

(4.18) a. Which of the linguists do you think that if Mary hires <u>him</u> then everyone will be happy?
(Sells 1984:13, ∼(10b))

[2] E-type readings are discussed further in chapter 8. It is actually only true that singular positive universals (e.g., *each*, *every*) resist singular E-type pronouns. They surprisingly permit plurals (Evans 1980), as also discussed in chapter 8.

The answer to this question can only be an individual, such as “Chris”, not a list of individuals, such as “Chris, Daniel, or Bill”. The second *wh*-test concerns functional answers to questions (Engdahl 1986), which a bound pronoun supports, as shown in (4.19):

(4.19) Which exam question does no professor believe will be tough enough?

a. The one her students aced last year (functional)

b. Question 2A (individual)

(Chao and Sells 1983:50, ∼(8a))

The pronoun *her* in the functional answer is bound and covaries with the professors in the domain of discourse. The individual answer specifies a particular question that no professor believes will be tough enough. An analogous question with a pronoun in the unbounded dependency, as shown in (4.20), disallows the bound, functional reading and allows only the individual reading:

(4.20) Which exam question does no professor even wonder if <u>it</u> will be tough enough?

a. #The one her students aced last year (functional)

b. Question 2A (individual)

(Chao and Sells 1983:51, ∼(10a))

The three Chao and Sells tests show that pronouns in English cannot be resumptive, although English does have a resumptive-like strategy of repairing island violations and processing difficulties with the insertion of intrusive pronouns.

By contrast, Chao and Sells (1983) and Sells (1984) show that languages with true resumptive pronouns do pass the tests. Thus, supporting a bound interpretation is a definitional characteristic of resumptive pronouns, which are like gaps in supporting such interpretations. Properties A and B indicate that, speaking broadly and pretheoretically, resumptives occur where gaps occur (in unbounded dependencies) and are interpreted like gaps (as bound variables). We will see shortly that neither of these claims can be strictly maintained, but they are adequate as rough generalizations.

C: Ordinary pronouns

McCloskey (2002) identifies a crucial yet rarely discussed morphological property of resumptive pronouns:

C. Resumptive pronouns are the ordinary pronouns of the language. (MORPHOLOGY/LEXICON)

McCloskey (2002:192) writes:

> A remarkable but little commented on property of resumptive pronouns is that they simply *are* pronouns. I know of no report of a language that uses a morphologically or lexically distinct series of pronouns in the resumptive function. (emphasis in original)

This observation has a morphological consequence about the form of resumptive pronouns and a consequence for their lexical specifications.

The morphological consequences are as follows:

(4.21)
1. Resumptive pronoun languages do not have resumptive-specific morphological paradigms.
2. Resumptive pronoun languages do not have certain pronouns that are only resumptive or have a resumptive-specific usage to the exclusion of other pronouns.

The second of these points is best understood in contrast to expletive pronouns. It is quite usual for a language to allow only certain pronominals to serve as expletives. For example, in English the only expletives are the pronominals *it* and *there*. These pronouns are not solely expletives, but they have expeletive-specific usages to the exclusion of other pronouns.

Irish provides a particularly telling demonstration of property C. The Irish resumptive pronouns are just the normal forms of the pronouns that would occur in the same positions. Compare the pronouns in the resumptive examples in (4.22–4.24a) with those in the non-resumptive examples in (4.22–4.24b):

(4.22) a. an fear ar dhúirt mé go dtiocfadh <u>sé</u>
the man COMP said I COMP would.come he
the man that I said (he) would come
(McCloskey 1990:214, (41))

b. dúirt mé go dtiocfadh sé
said I COMP would.come he
I said he would come

(4.23) a. an scríbhneoir a molann na mic léinn é
the writer COMP praise the students him
the writer whom the students praise (him)
(McCloskey 1979:6, (5))

b. molann na mic léinn é
praise the students him
the students praise him

(4.24) a. an fear a bhfuil a mháthair san otharlann
the man COMP is his mother in.the hospital
the man whose mother is in the hospital
(McCloskey 1979:6, (4))

b. tá a mháthair san otharlann
is his mother in.the hospital
his mother is in the hospital

In each case the resumptive pronoun is identical to the corresponding non-resumptive.

The most significant evidence comes from pronominal information borne by Irish inflection, which is discussed at length by McCloskey and Hale (1984), McCloskey (1986), and Andrews (1990). Irish verbal paradigms consist of forms that are traditionally called *synthetic* and *analytic* (McCloskey and Hale 1984:489). The analytic form does not exhibit subject agreement and is the form used with non-pronominal lexical subjects, with subject gaps, and with pronominal subjects under certain circumstances that will be specified shortly. The synthetic form bears subject person and number information. The crucial facts are:

1. The synthetic form cannot be used in conjunction with the appropriate pronominal. (McCloskey and Hale 1984:489–490)

(4.25) chuirfinn (Ulster)
put.CONDITIONAL.1SG
I would put

(4.26) * chuirfinn mé
put.CONDITIONAL.1SG 1SG

2. The analytic form generally[3] cannot be used in conjunction with the appropriate pronominal if a synthetic form with the relevant person-number information exists. (McCloskey and Hale 1984:491–492)

(4.27) chuirfinn
put.CONDITIONAL.1SG
I would put

(4.28) * chuirfeadh mé
put.CONDITIONAL 1SG

(4.29) —
put.CONDITIONAL.3PL

(4.30) chuirfeadh siad
put.CONDITIONAL 3PL
they would put

McCloskey and Hale (1984), working in Principles and Parameters Theory, analyze the synthetic form as contributing a null pronominal argument (i.e., *pro*). Andrews (1990), working in Lexical Functional Grammar, analyzes the synthetic form as contributing the PRED of its argument at functional structure. In both cases, the impossibility of using the synthetic form with an independent pronoun follows from the fact that the synthetic form iteself contributes pronominal information.

What is crucial for present purposes is that the pronominal information contributed by the synthetic form can function as a resumptive pronoun:

(4.31) na daoine aN raibh mé ag dúil goN gcuirfidis isteach ar an phost sin
the people COMP was I expext PROG COMP put.COND.3PL in on that job
the people that I expected (that they) would apply for that job
(McCloskey and Hale 1984:498, (23))

There are two reasons to conclude that the subject agreement on *gcuirfidis* is functioning as a resumptive. First, the relative clause exhibits the classic Irish resumptive complementizer pattern (McCloskey 1979, 1990, 2002), which consists of a resumptive-sensitive complementizer *aN* (identified by the nasalization mutation it triggers on the following word) immediately following the relative head and neutral complementizers *go* introducing each clause until the clause containing the resumptive pronoun:

(4.32) $\text{NP}_i\ [_{\text{CP}}\ \text{aN} \ldots [_{\text{CP}}\ \text{go} \ldots [_{\text{CP}}\ \text{go} \ldots \textit{Rpro}_i \ldots]]]$
(McCloskey and Hale 1984:498, ∼(22))

If the subject of the synthetic form were a gap, there would be a different pattern of complementizers. Second, McCloskey and Hale establish independently that subject gaps occur with the *analytic*

[3] Except in certain paradigm slots in certain dialects; e.g. Connacht third person plural conditional (McCloskey and Hale 1984:491).

verb form, "even in those cases where the binder of the trace is a pronoun with person-number features for which the verb in question has a synthetic form" (McCloskey and Hale 1984:490):

(4.33) Chan mise a chuirfeadh tisteach ar an phost sin.
COP.NEG me COMP put.COND in on that job
It's not me that would apply for that job.
(McCloskey and Hale 1984:490, (5))

Taken together, the complementizer pattern in (4.31) and the fact that subject gaps occur with the analytic form constitute strong evidence that the synthetic form can function resumptively.

The fact that resumptive pronouns are just ordinary pronominal forms is underscored by the data from Irish that we have been considering. Free-standing resumptives just have the form that one would expect to find in the relevant position, for the relevant person/number/gender features. Even more strikingly, the synthetic forms reveal that pronominal information contributed by *any* source can function resumptively. This last point is further underscored by the resumptive examples in (4.1) and (4.3–4.6) above, where the pronominal information is contributed by an inflected preposition. Resumptive pronouns in Hebrew and Swedish are similarly just the normal pronouns.

The generalization that resumptive pronouns are completely ordinary pronouns faces a challenge from Vata, which seems to have a paradigm of pronouns that is used only for resumptives. The resumptives are segmentally identical to the non-resumptive pronouns but bear different tone marking. For example, the normal third person pronoun is ɔ̍ and the resumptive form is ɔ̀ (Koopman 1982:128–129). Koopman (1982) reports that unbounded dependencies in Vata that target nominals in subject position must terminate in a resumptive pronoun and resumptives are barred from all other positions (see section D, page 120 below). It should be observed that this is not necessarily resumptive marking per se. That would only be true if the generalization is that unbounded dependencies terminating in subjects must leave pronouns marked with a special tone. An equally plausible generalization is that unbounded dependencies terminating in subjects a) mark the subject with a special tone[4] and b) must terminate in a pronoun. According to the second generalization, there is no special paradigm of resumptive pronouns. The apparent paradigm arises through independent workings of the grammar. This generalization fits Vata into the overwhelming pattern described in this section rather than revealing it as a curious isolate.

Suppose the first generalization were shown to be correct, though. The question is how a theory that treats resumptive pronouns as ordinary pronouns would handle such a case. The ordinary

[4] A similar phenomenon has been observed for Kikuyu (Clements 1979 as cited by Zaenen 1983).

pronoun theory predicts that in the absence of any additional lexical information any pronoun can be a resumptive (if the language licenses them). However, it is possible for the language in question to add additional lexical information to a particular pronoun that distinguishes it as a resumptive and to add lexical information to other pronouns that distinguishes them as non-resumptives (Koopman and Sportiche 1982). I do not think that this actually undermines an ordinary pronoun theory. The alternative theory is that resumptives are always special pronouns that are marked with some feature that distinguishes them as resumptives. Such a theory could not deal well with a language that has uniform pronouns, like Irish and most other languages. The best it could say is that the resumptive pronouns of Irish happen to be massively homophonous with its non-resumptive pronouns. This is clearly not satisfactory. An ordinary pronoun theory that special-cases Vata and gets Irish for free is therefore preferable to a special pronoun theory that special cases Irish but gets Vata for free.

D: Distribution

Resumptive pronouns and gaps generally have overlapping but non-identical distribution with respect to syntactic positions / grammatical functions that they can fill. Initial examination of Irish, Welsh and Hebrew points to the possibility of a rough characterization in terms of the accessibility / obliqueness hierarchy of Keenan and Comrie (1977), as noted by both McCloskey (1979:5) and Sells (1984:20–21), such that resumptives become obligatory in more oblique positions. However, the distribution of resumptives in Swedish and Vata shows that any hierarchical generalization is untenable, unless one is willing to claim that in some languages only the *least* oblique arguments can be resumptives (Swedish, Vata), while in others only the *most* oblique arguments can be resumptives (Irish, Welsh, Hebrew), in which case the utility of the hierarchy in a theory of resumptive pronouns is quite questionable. It is unsurprising that, having made the initial tentative connection to the hierarchy, neither McCloskey nor Sells incorporates it into his actual theory; they derive what effects it accounts for in other ways. Furthermore, even in Irish, Welsh and Hebrew the descriptive generalization offered by the hierarchy is quite weak, since it only only holds in one direction: grammatical functions at the top of the hierarchy can also be occupied by resumptive pronouns, except in certain specific circumstances to be discussed shortly. The distributional characteristic of resumptive pronouns forms the cornerstone of Last Resort theories of resumptives (Shlonsky 1992, Aoun et al. 2001). In section 7.1.3 of chapter 7, we will see that dialect data from Swedish casts serious doubt on the empirical validity of Last Resort accounts of resumptive pronouns.

McCloskey (1990:209) notes that, in Irish, “within each WH-construction, resumptive pronouns can appear in every clausal position but one.” The one clausal position in which they cannot appear is the subject position immediately following the relative head (the "highest" subject):

(4.34) a. * an fear a raibh <u>sé</u> breoite
the man COMP be.PAST he ill
the man that (he) was ill
(McCloskey 1990:210, (29a))

b. * na daoine a <u>rabhadar</u> breoite
the people COMP be.PAST.3PL ill
the people that (they) were ill
(McCloskey 1990:210, (29b))

McCloskey (1990:210) dubs this restriction the *Highest Subject Restriction* (HSR). He stresses that the restriction applies only to the highest subject; resumptives are licensed in the embedded subjects of both finite and nonfinite clauses:

(4.35) a. an t-ór seo ar chreid corr-dhuine go raibh <u>sé</u> ann
this gold COMP believed a few people COMP was it there
this gold that a few people believed (it) was there
(McCloskey 1990:210, (30a))

b. cúpla muirear a bhféadfaí a rá go <u>rabhadar</u> bocht
a.few families COMP one.could say.INF COMP be.PAST.3PL poor
a few families that one could say (they) were poor
(McCloskey 1990:210, (30b))

Resumptive pronouns are obligatory when a possessor or prepositional object is extracted (McCloskey 1979:6, McCloskey 1990:209), as demonstrated here for the object of the preposition *le* ('with'):

(4.36) a. an fear a raibh mé ag caint <u>leis</u>
the man COMP was I talk.PROG with.3SG.MASC
the man that I was talking to him
(McCloskey 1990:209, (28a))

b. * an fear a bhí mé ag caint le __
the man COMP was I talk.PROG to __
the man that I was talking to
(McCloskey 1990:209, (28b))

The usual account of Irish is that resumptives can appear anywhere except in the highest subject position. The HSR is typically accounted for by an anti-locality requirement between the resumptive-binder and the resumptive, defined in such a way that it applies to subjects, but not objects or other arguments (Borer 1984, McCloskey 1990:212–224).[5] The apparent obligatoriness of certain resumptives stems from gaps not being licensed in the relevant positions due to conditions on extraction. For example, extraction of a possessor is a subjacency violation and it is assumed that extraction of a prepositional object is an Empty Category Principle (ECP) violation due to prepositions in Irish not being proper governors (Sells 1984, Chung and McCloskey 1987).

Welsh is similar to Irish with respect to the HSR, except that in Welsh the highest *object* is also inaccessible to resumptive pronouns, as shown by the following examples:[6]

(4.37) a. y car a werthodd Gareth __
the car COMP sold Gareth __
the car that Gareth sold
(Willis 2000:533, (4))

b. * y llyfr y darllenais i <u>ef</u>
the book COMP read I it
the book that I read
(Sells 1984:133, (27))

In Welsh, an unbounded dependency terminating in a highest direct object gap is grammatical, but one terminating in a highest direct object resumptive is not.

Sells (1984:143ff.) identifies a further difference between Welsh and Irish: filler-gap dependencies into embedded clauses are grammatical in Irish but ungrammatical in Welsh. The empirical claim is that resumptive pronouns are obligatory in embedded clauses in Welsh, but not in Irish. However, recent work by Willis (2000) argues that filler-gap dependencies in Welsh can also access embedded positions. This issue clearly requires further empirical and theoretical investigation, but

[5] McCloskey's work on this anti-locality condition, essentially an extension of Principle B of the binding theory to $\bar{\text{A}}$-binding, dates to the early eighties but was first published in the article cited.

[6] Willis (2000:534, (5b)) offers the following example as a minimal pair for (4.37a):

(i) * y car a ('i g-) werthodd Gareth <u>ef</u>
the car COMP 3SG.ACC sold.3SG Gareth it
the car that Gareth sold (it)

There is unfortunately a mitigating factor in this example, since the 'direct relative' particle *a* is introducing a relative clause containing a resumptive pronoun. Such 'indirect relatives' must be introduced by a different particle, *y(r)* (Sells 1984:132, Willis 2000:540) . The use of *a* is sufficient for ungrammaticality and the example therefore does not address the issue at hand.

I will follow Willis (2000) in assuming that embedded clauses in Welsh can host gaps (and resumptives). The key difference between Irish and Welsh is that the former allows highest objects to be resumptives, while the latter does not.

Shlonsky (1992:445–446) reports that Hebrew and Palestinian Arabic[7] are like Irish in disallowing a resumptive as the highest subject, as shown respectively in (4.38) and (4.39):

(4.38) ha-ʔiš še __ / * še-hu ʔet Rina
the-man that __ / * that-he loves ACC Rina
the man who loves Rina
(Shlonsky 1992:445, (6))

(4.39) l-bint ʔilli __ / * hiy raayḥa ʕal beet
the-girl that __ / * she going to house
the girl that is going home
(Shlonsky 1992:446, (12))

The distribution of gaps and resumptives in Hebrew and Palestinian Arabic is otherwise quite distinct (Shlonsky 1992:444–446). In Palestinian Arabic relative clauses, gaps and resumptives are in complementary distribution: gaps are only licensed in the highest subject, where resumptives may not occur, and pronouns are obligatory in every other position (Shlonsky 1992:444). By contrast, in Hebrew the distribution of gaps and resumptives overlaps in embedded subject and all direct object positions. Resumptives are blocked only in highest subject position and are obligatory in possessor and oblique positions. The HSR in Hebrew is also accounted for by an anti-locality condition on $\overline{\text{A}}$-binding (Borer 1984:251ff.). Both the proposals of Borer (1984) and McCloskey (1990) essentially extend Principle B of binding theory to $\overline{\text{A}}$-binding of pronouns, such that pronouns must be both A-free and $\overline{\text{A}}$-free in their governing categories.

Table 4.1 summarizes the distribution of gaps and resumptives in Irish, Welsh, Hebrew, and Palestinian Arabic. Overlapping distribution is identified by bold and the HSR column further highlights the fact that all four languages obey this restriction (with Welsh further disallowing resumptives in highest object position). The information in the table is compiled from McCloskey (1979, 1990), Sells (1984), Shlonsky (1992), and Willis (2000).

Table 4.1 reveals that there is no position that is categorically unavailable to resumptive pronouns in these languages. The highest subject and object may be unavailable, but none of the

[7] The varieties of Arabic spoken in Palestine and Egypt are close enough that authors often refer to both as Levantine Arabic.

	Gap	Resumptive	HSR?
Irish	Highest subject		Y
	Embedded subject	**Embedded subject**	
	Direct object	**Direct object**	
		Possessor	
		Oblique	
Hebrew	Highest subject		Y
	Embedded subject	**Embedded subject**	
	Direct object	**Direct object**	
		Possessor	
		Oblique	
Welsh	Highest subject		Y
	Highest object		
	Embedded subject	**Embedded subject**	
	Embedded object	**Embedded object**	
		Possessor	
		Oblique	
Palestinian Arabic	Highest subject		Y
		Embedded subject	
		Direct object	
		Possessor	
		Oblique	

Table 4.1: Distribution of gaps and resumptives in Irish, Welsh, Hebrew, and Palestinian Arabic

languages block resumptives from subject and object position in general. There is therefore no categorical statement that one can make in terms of a hierarchy of grammatical functions or syntactic positions to the effect that grammatical functions that are more oblique than X must be realized as a resumptive pronoun. Any such statement would in addition have to minimally refer to level of embedding. Furthermore, although it is true that resumptives become "more obligatory" as one moves down the obliqueness hierarchy, the converse does not hold: it is not the case that gaps become obligatory if the hierarchy is traversed in the other direction. In fact, all of the languages except Palestinian Arabic show some overlap in the distribution of gaps and pronouns. A simpler generalization about the distribution of resumptive pronouns in Irish, Welsh, Hebrew, and Palestinian is that they can appear anywhere, except where independent constraints block them (McCloskey 1990). In this case, the independent constraint is the HSR (extended appropriately for Welsh), however it is implemented. Similarly, extending the observation of McCloskey (1990:209) about Irish, the basic generalization about the distribution of gaps in the four languages is that they are permitted everywhere, except where they are blocked by independent constraints, such as subjacency and the ECP or whatever handles their work in other theories. This way of looking at things is in contrast to Last Resort theories of resumptive pronouns which hold that resumptives are only inserted in order to rescue derivations that would fail due to ungrammatical filler-gap dependencies.

The HSR (and the modified version for Welsh) is potentially all one has to say about the distribution of resumptive pronouns in Irish, Welsh, Hebrew, and Palestinian Arabic with respect to syntactic position / grammatical function. If the grammars of these languages freely generate resumptive pronouns and the HSR further blocks them from the highest subject (and object, for Welsh), then the correct distribution is generated. Of course, there is plenty to say about resumptives in these languages in other respects. For example, other constraints could block resumptives altogether in certain environments. We saw one such case in section A above, where it was shown that Hebrew resists resumptives in questions, except in certain specific circumstances.

However, the distribution of resumptive pronouns in Vata is strikingly different from that of Irish, Welsh, Hebrew and Palestinian Arabic. Resumptive pronouns in Vata are obligatory *only* in subjects, highest or embedded. The resumptive system of Vata is described in work by Hilda Koopman and Dominique Sportiche (among others, Koopman 1982, Koopman and Sportiche 1982, 1986). Vata makes very limited use of resumptive pronouns: they are obligatory in subject extraction and prohibited elsewhere, as shown in (4.40).

(4.40) a. **Highest subject**

àlɔ́ ɔ̱̀ / * __ lē sa̍ká la̍
who he / * __ eat rice *wh*
Who is eating rice?
(Koopman 1982:128, (1a))

b. **Embedded subject**

àlɔ́ ǹ gūgūnā ɔ̱̀ / * __ yì la̍
who you think that he / * __ arrive *wh*
Who do you think arrived?
(Koopman 1982:128, (4a))

c. **Highest object**
yī kòfi le̍ __ / * mí la̍
what Kofi eat __ / * it *wh*
What is Kofi eating?
(Koopman 1982:128, (1b))

d. **Embedded object**
àlɔ́ ǹ gūgūnā wa̍ yɛ̍` __ / * mɔ̀ yé la̍
who you think that they see __ / him PART *wh*
Who do you think they saw?
(Koopman 1982:128, (4b))

Koopman and Sportiche (1986:154) note that resumptive pronouns are also barred for indirect objects and subcategorized PPs. Unbounded dependencies terminating in these positions are grammatical, but must terminate in gaps. Koopman (1982:128) notes that all unbounded dependencies in Vata — *wh*-questions, focus constructions (roughly clefts), and relative clauses — fall under the same generalization: resumptives are obligatory in subject position and prohibited elsewhere (see Koopman 1982:128, (2–3) for additional data). The Vata facts indicate that the HSR should not be treated as a general linguistic principle, although it could potentially be parameterized.

E: Restricted, pronominal interpretation

Doron (1982) observed that an opaque verb such as the equivalent of *seek* in Hebrew allows a non-specific / *de dicto* reading for its object if the object is a gap, but not if its object is a resumptive pronoun (Doron 1982:26, (49–50)):

(4.41) dani yimca et haʔiša še hu mexapes __
Dani will-find ACC the.woman that he seeks __
Dani will find the.woman that he seeks.

(4.42) dani yimca et haʔiša še hu mexapes ota
Dani will-find ACC the woman that he seeks her
Dani will find the woman that he seeks (her).

The second sentence only allows a reading that can be paraphrased as “There is a woman that Dani seeks and Dani will find this woman”.

The observation that pronouns block non-specific / *de dicto* readings is in fact quite old and was observed at the inception of formal semantics (Partee 1970, Montague 1973:32). The contrast above would therefore follow naturally if a resumptive pronoun just is a pronoun. Given a proper analysis of the pronominal behaviour, nothing further would need to be said to capture the resumptive pronoun's behaviour. This line of reasoning is pursued by Sells (1984, 1987) who relates the impossibility of the non-specific reading to the general impossibility of pronominal reference to concepts. He therefore calls the non-specific / *de dicto* reading the *concept* reading. Following Doron (1982) he assumes that the resumptive pronoun, like pronouns in general, forces its antecedent to be extensional. The inability to take a concept as an antecedent then follows, since concepts are intensional.

Support for this line of reasoning comes from the following contrasting sentences. The one with the gap allows three readings, represented below, whereas the one with the resumptive pronoun does not have the third, concept reading (Sells 1984, 1987):

(4.43)

kol	gever	yimca	ʔet	haʔiša	še	hu	mexapes	__
every	man	will-find	ACC	the.woman	that	he	seeks	__

Every man will find the woman that he seeks.
(Sells 1987:288, (48a))

a. There is a particular individual woman (e.g., Lauren Bacall) that every man is looking for and will find.

b. Each man is looking for a woman particular to that man (e.g., Sam is looking for Susie and Jay is looking for his mother and Will for Anne . . .).

c. (CONCEPT) Each man is looking for a woman with certain properties, but does not know who such a woman might be (e.g., Sam is looking for a woman the same size as his wife, Jay needs a woman who can milk goats, and Will is looking for someone to act in his movie.

(4.44)

kol	gever	yimca	ʔet	haʔiša	še	hu	mexapes	<u>ota</u>
every	man	will-find	ACC	the.woman	that	he	seeks	her

Every man will find the woman that he seeks (her).
(Sells 1987:288, (48b))

a. ✓

b. ✓

c. —

Sells (1984, 1987) argues that the inability to take concept readings follows if resumptive pronouns are treated as ordinary pronouns, since pronouns in general do not take concept readings. This is illustrated by the contrast between the following sentences:

(4.45) Dani owns a unicorn. It is tall.
(Sells 1987:290, ∼(52a))

(4.46) Dani seeks a unicorn. # It is tall.
(Sells 1987:290, ∼(52b))

Sells (1984, 1987) goes on to show that apparent counterexamples that seem to show pronouns taking concept antecedents actually involve them taking individual kinds (Carlson 1977) as antecedents and furthermore, that pronouns cannot take concept kinds as antecedents (Sells 1987:290–292).

Sharvit (1999) provides further evidence and argumentation supporting the claim that resumptive pronouns are interpreted like ordinary pronouns. Her argument is two-fold. The first part centers on showing that both resumptive pronouns and non-resumptive pronouns generally do not allow pair-list answers to *wh*-questions that contain a quantifier (Engdahl 1980). This is straightforwardly shown for resumptive pronouns by the inability to answer a question containing a resumptive with a pair-list answer, although a pair-list answer is available for the corresponding question with a gap:

(4.47) ezyo iša kol gever hizmin __
which woman every man invited
Which woman did every man invite?
(Sharvit 1999:594, (16))

a. et Gila
ACC Gila
Gila

b. et im-o
ACC mother-his
His mother

c. Yosi et Gila; Rami et Rina
Yosi ACC Gila; Rami ACC Rina
Yosi, Gila; Rami, Rina

(4.48) ezyo iša kol gever hizmin <u>ota</u>
which woman every man invited her
Which woman did every man invite (her)?
(Sharvit 1999:594, (17))

a. et Gila
ACC Gila
Gila

b. et im-o
ACC mother-his
His mother

c. * Yosi et Gila; Rami et Rina
Yosi ACC Gila; Rami ACC Rina
Yosi, Gila; Rami, Rina

The pair-list answer is not possible if the question is formed with a resumptive. Sharvit goes on to show that both the individual answer (4.47a) and the natural function answer (4.47b) can provide the antecedent for a non-resumptive pronoun, but that the pair-list reading cannot. Thus, only (4.47a) and (4.47b) can be followed by a sentence like:

(4.49) hi gam ha-iša še kol gever baxar
she also the-woman that every man chose
She is also the woman that every man chose

There is once again a correlation between non-resumptive pronominal interpretation and resumptive pronominal interpretation. The second part of Sharvit's argument brings the correlation out further by showing that pair-list readings are possible for pronouns in specificational (equative) clauses and that these readings appear for resumptive pronouns in the same environment (Sharvit 1999:596). There is thus quite a strong correlation between resumptive pronoun interpretation and the interpretation of non-resumptive pronouns.

F: Evidence against resumptives as gaps

One of the two definitional characteristics of resumptive pronouns, discussed above as characteristic A, is that they occur in unbounded dependencies. The question is whether the binder-resumptive dependency can be reduced to a filler-gap dependency or whether languages have resumptive strategies that are distinct from filler-gap dependencies. Both positions have been taken in the literature. McCloskey (1990, 2002), Sells (1984, 1987), and Merchant (2001) all take the position that binder-resumptive dependencies cannot be reduced to filler-gap dependencies and that resumptive pronouns cannot be gaps in the syntax. I think it is fair to say that this is the prevailing view. The theory that I propose also takes this position. The position that binder-resumptive dependencies are reducible to filler-gap dependencies, or at least arise from the same mechanism, and that resumptive pronouns are essentially gaps in the syntax has been held by, among others, Kayne (1994), Noonan (1997), and Boeckx (2001, 2003). Related to this position are the positions that resumptives are either spelled out gaps (Zaenen et al. 1981, Engdahl 1985) or that they are inserted to rescue illicit filler-gap derivations as a last resort (Shlonsky 1992, Aoun et al. 2001).

The central piece of evidence against reducing the binder-resumptive dependency to a filler-gap dependency is that resumptive pronouns freely occur in islands, or alternatively:

(4.50) The dependency between a resumptive pronoun and its binder is not island-sensitive.

It seems clear that islands are not a monolithic phenomenon and that in addition to syntactic factors there are semantic, pragmatic, and processing factors involved (Cinque 1990, Rizzi 1990, the papers in Goodluck and Rochemont 1992). However, all that matters is that filler-gap dependencies are blocked in certain environments, for whatever reason and however the environments are characterized, but that binder-resumptive dependencies are permitted in the same environments.

McCloskey (1979) discusses two island constraints (Ross 1967), the Complex NP Constraint and an Irish correlate of the *wh*-Island Constraint, the latter of which is descriptively characterized by the statement that "no item can be extracted from an embedded question" (McCloskey 1979:31, (81)). A filler-gap dependency, as signalled by use of the direct relative marker *aL*, is ungrammatical in either case. This is shown for both relative clause formation and *wh*-question formation in the following examples:

(4.51) a. * an fear aL phóg mé an bhean aL phós
the man COMP kissed I the woman COMP married
the man who I kissed the woman who married
(McCloskey 1979:30, (78))

b. * Cén fear aL phóg tú an bhean aL phós?
which man COMP kissed you the woman COMP married
Which man did you kiss the woman who married?
(McCloskey 1979:30, (80))

(4.52) a. * fear nachN bhfuil fhios agam cén cineál mná aL phósfadh
a man COMP.NEG I know what sort of a woman COMP would marry
a man who I don't know what woman would marry
(McCloskey 1979:32, (87))

b. * Cén sagart nachN bhfuil fhios agat caidé aL dúirt?
which priest COMP.NEG you know what COMP said
Which priest don't you know what said?
(McCloskey 1979:32, (88))

c. * Cén sagart aL d'fhiafraigh Seán diot arL bhuail tú?
which priest COMP asked John of you QUEST
Which priest did John ask you if you hit?
(McCloskey 1979:32, (89))

By contrast, a binder-resumptive dependency, signalled by the indirect relative marker *aN*, can freely cross these islands, as shown for a complex NP island in (4.53) and for an embedded question island in (4.54):

(4.53) Sin teanga aN mbeadh meas agam ar duine ar bith aL tá ábalta i a labhairt
that a.language COMP would be respect at me on person any COMP is able it to speak
That's a language that I would respect anyone who could speak it.
(McCloskey 1979:34, (95))

(4.54) Sin fear nachN bhfuil fhios agam cén cineál mná aL phósfadh é
that a man COMP.NEG I know what sort of a woman COMP would marry him
That's a man who I don't know what kind of woman would marry him.
(McCloskey 1979:33, (91))

Thus, Irish filler-gap dependencies are island-sensitive, but binder-resumptive dependencies are not. This is strong evidence that the two kinds of dependencies are distinct and that the resumptive dependency cannot be reduced to the filler-gap dependency.

Borer (1984:221,(3–4)) shows that Hebrew binder-resumptive dependencies are similarly island-insensitive. Such dependencies can reach into complex NP islands and coordinate structure islands:

(4.55) raʔiti ʔet ha-yeled she- / asher dalya makira ʔet ha-ʔisha she- ʔohevet <u>ʔoto</u>
saw-I ACC the-boy that Dalya knows ACC the-woman that loves him
I saw the boy that Dalya knows the woman who loves him.
(Borer 1984:221, (3))

(4.56) raʔiti ʔet ha-yeled she- / asher dalya makira ʔet ha-ʔisha she-xashva <u>ʔalav</u>
saw-I ACC the-boy that Dalya knows ACC the-woman that-thought about-him
I saw the boy that Dalya knows the woman who thought about him.
(Borer 1984:221, (3))

(4.57) raʔiti ʔet ha-yeled she-/ʔasher rina ʔohevet <u>ʔoto</u> ve- ʔet ha-xavera shelo
saw-I ACC the-boy that Rina loves him and- ACC the-friend of.his
I saw the boy that Rina loves him and his girlfriend.
(Borer 1984:221, (4))

If the resumptive were a gap, then the second example would be a violation of the Coordinate Structure Constraint (CSC; Ross 1967); the sentence would be equivalent to *I saw the boy that Rina loves [__ and his girlfriend]*.

Swedish is less revealing with respect to islands than Irish and Hebrew, since it allows island violations quite freely in any case (Engdahl 1982). The only islands it seems to partially respect are left-branch islands and subject islands. However, Engdahl (1982:163–165) shows that in certain circumstances even these islands can be extracted from. Engdahl (1985:10) points out that island violations that are judged ungrammatical (for whatever reason) are not improved by insertion of a resumptive:

(4.58) ?* Vilken bil$_j$ åt du lunch med [$_{\mathrm{NP}}$ någon$_i$ [$_{\mathrm{S}'}$ som t_i körde t_j / * den?
which car ate you lunch with someone that drove __ / * it
Which car did you have lunch with someone who drove it?
(Engdahl 1985:10, (16))

It is a little unclear what this example indicates about islands and resumptives, since its unacceptability likely has to do with processing difficulty. In addition to a complex NP island violation, it is a garden path sentence that makes no sense on the first pass (*Which car did you have lunch with?*). The cautious conclusion about Swedish is that it is fairly island-insensitive to begin with and that it does not distinguish between filler-gap and binder-resumptive dependencies with respect to islands.

A second argument against the reduction of binder-resumptive dependencies to filler-gap dependencies comes from weak crossover (McCloskey 1990:236–237). This argument inevitably sinks into the usual crossover morass, but at least for Irish there is data that indicates that — just as in the island case — no matter what the account of weak crossover is, there is a plain contrast between the two kinds of dependencies. McCloskey (1990:237) shows that weak crossover effects hold in Irish in filler-gap dependencies:

(4.59) a. * fear a d'fhág a bhean __
man COMP left his wife
a man that his wife left

b. * an fear so a mhairbh a bhean féin __
this man COMP killed his own wife
this man that his own wife killed
(McCloskey 1990:237, (95a–b))

The corresponding examples with the gap replaced by a resumptive pronoun are grammatical:

(4.60) a. fear ar fhág a bhean é
man COMP left his wife him
a man that his wife left

b. an fear so ar mhairbh a bhean féin é
this man COMP killed his own wife him
this man that his own wife killed
(McCloskey 1990:236–7, (94a–b))

Thus, whatever the analysis of weak crossover, Irish filler-gap dependencies and binder-resumptive dependencies behave differently with respect to the phenomenon and it therefore constitutes evidence that the two kinds of dependency are distinct. Doron (1982), Sells (1984, 1987), and Shlonsky (1992) show that resumptive pronouns do not result in weak crossover in Hebrew either. The situation for Swedish is a little more subtle and I will return to it in chapter 7. I will argue that weak crossover for Swedish resumptives has in part been misanalyzed and that it in fact patterns like Irish and Hebrew in allowing resumptive pronouns in what would be a weak crossover configuration for a gap. Showing this involves first establishing certain facts about Swedish resumptives.

Merchant (2001:128–146) identifies a third argument against conflating the two kinds of dependency. He notes that a filler and its gap show form-identity effects, whereas a resumptive binder and its resumptive do not. The particular form-identity effect in question is case marking. Merchant (2001:132) writes:

> The basic point of the argument is simple: while moved wh-phrases always take their case from their base position, wh-phrases linked to resumptives need not do so, and in general cannot, appearing instead in some default case if possible.

This observation extends to English intrusive pronouns and accounts for the following pattern:

(4.61) a. Who did the police say that finding his car took all morning?

b. *Whose did the police say that finding his car took all morning?
(Merchant 2001:133, (65a–b))

Merchant (2001:146, (99)) offers the following general principle:

(4.62) *Case and resumptive-binding operator generalization*
No resumptive-binding operator can be case-marked.

Merchant (2001:146) notes that "this follows directly if resumptive-binding operators are base-generated in SpecCP and can never check their Case feature." A more theory-neutral formulation is that a resumptive binder never occupies the argument position of the resumptive, where case is assigned, and therefore cannot receive the case. A filler does occupy the position of its gap, whether by originating there and moving away or via simultaneous occupation of two grammatical functions / positions (i.e., structure-sharing). The filler therefore receives the case of the gap position. If the binder-resumptive dependency were to be reduced to a filler-gap dependency, this contrast would be unexplained, since the resumptive-binder should also occur in the resumptive position (e.g., if it is a spelled out trace).

It is not possible to test Irish with respect to this, because the relevant case marking does not exist (although this means that Irish vacuously satisfies the generalization). However, both Hebrew and Swedish behave exactly as predicted. Hebrew allows resumptives in topicalization, as shown in (4.63a), but the topicalized element cannot bear case if a resumptive is used. If the topic bears case, only a gap is grammatical (Itamar Francez, p.c.):

(4.63) a. Dani, Miriam raʔata ʔoto.
Dani Miriam saw him
Dani, Miriam saw.

b. * ʔet Dani, Miriam raʔata ʔoto.
ACC Dani Miriam saw him

c. ʔet Dani, Miriam raʔata __ .
ACC Dani Miriam saw __
Dani, Miriam saw.

If the topicalized element is case-marked, then the resumptive pronoun cannot be case-marked.

Swedish offers further strong evidence for Merchant's generalization. Swedish has distinct forms for the interrogative pronoun *whose*, which is *vems*, and the relative pronoun *whose*, which is *vars*. Neither of these can occur as the top of an unbounded dependency terminating in a resumptive:

(4.64) * Vems undrar du om någon minns vem som finansierat <u>hans</u> film?
Whose wonder you if anyone remembers who that financed his film
(Whose do you wonder if anyone remembers who financed his film?)

(4.65) * I går såg jag regissören vars jag undrar vem som finansierat <u>hans</u> film.
Yesterday saw I the.director whose I wonder who that financed his film
(Yesterday I saw the director whose I wonder who financed his film.)

Like in English, the corresponding examples with a gap are ungrammatical, whether the *wh*-word bears genitive or default case (recall that Swedish in general has left-branch islands). Again like in English, the corresponding examples with a default case-marked *wh*-word or neutral relative pronoun and a resumptive pronoun are grammatical:

(4.66) Vem undrar du om någon minns vem som finensierat <u>hans</u> film?
Who wonder you if anyone remembers who that financed his film
Who do you wonder if anyone remembers who financed his film?

(4.67) I går såg jag regissören som jag undrar vem som finensierat <u>hans</u> film.
Yesterday saw I the.director that I wonder who that financed his film
Yesterday I saw the director that I wonder who financed his film.

Merchant's form-identity generalization holds up for both Hebrew and Swedish and shows that the resumptive pronoun cannot be a gap and the binder-resumptive dependency cannot be reduced to a filler-gap dependency.

In summary, evidence from islands, weak crossover, and form-identity effects indicate that resumptive pronouns are not syntactically gaps and that binder-resumptive dependencies cannot be reduced to filler-gap dependencies — at least not in Irish, Hebrew, or Swedish.

G: Evidence for resumptives as gaps

There seems to be no evidence for a gap-like status for resumptive pronouns in Irish (McCloskey 2002). The literature on Swedish has revealed three phenomena that provide prima facie evidence for resumptive pronouns being gaps in the syntax: reconstruction, across-the-board extraction, and parasitic gaps. The latter has also been discussed in the literature on Hebrew.

Zaenen et al. (1981) show that Swedish resumptive pronouns allow what is now commonly called *reconstruction* (Lebeaux 1988, Chomsky 1993) of a phrase containing a reflexive in place of the resumptive pronoun. They first show that reflexive possessors in Swedish must be in the proper subordinate configuration to their antecedents and that they must take a local antecedent within the sentence. They note that the following sentence is grammatical, even though the reflexive is in a fronted constituent:

(4.68) Vilken av sina$_i$ flickvänner tror du att Kalle$_i$ inte längre träffar __ ?
which of his girlfriends think you that Kalle no longer sees
Which of his girlfriends do you think that Kalle no longer sees?
(Zaenen et al. 1981:680, (5))

The grammaticality of the sentence follows automatically (without reconstruction) on structure-sharing accounts of filler-gap dependencies (the kind adopted in much LFG work, including here, and in many HPSG accounts, such as that of Bouma et al. 2001): the fronted material is simultaneously in object position of the clause containing the subject binder. The grammaticality of the sentence follows in movement theories if the fronted material is reconstructed in its base position.

If a resumptive pronoun is a pronoun in the syntax, reconstruction should be blocked by the presence of a resumptive pronoun. Surprisingly, it is not:

(4.69) Vilken av sina$_i$ flickvänner undrade du om det att Kalle$_i$ inte längre fick träffa <u>henne</u>$_i$
which of his girlfriends wondered you if it that Kalle no longer sees her
kunde ligga bakom hans dåliga humör?
could lie behind his bad mood
Which of his girlfriends do you think the fact that Kalle no longer gets to see (her) could be behind his bad mood?
(Zaenen et al. 1981:680, (5))

Zaenen et al. (1981:679) conclude based on this and evidence from ATB extraction, which I turn to shortly, that Swedish resumptives are “syntactically bound”, which essentially means they are gaps in the syntax.

A noticeable property of this example is that the resumptive pronoun is not the kind of resumptive that Engdahl (1982) identifies as the only real resumptive in Swedish, which occurs only in embedded subject position after material in the left periphery of CP. The resumptive is therefore optional:

(4.70) Vilken av sina$_i$ flickvänner undrade du om det att Kalle$_i$ inte längre fick träffa __$_i$ kunde ligga bakom hans dåliga humör?
which of his girlfriends wondered you if it that Kalle no longer sees __ could lie behind his bad mood
Which of his girlfriends do you think the fact that Kalle no longer gets to see could be behind his bad mood?
(Zaenen et al. 1981:680, (5))

Speakers vary as to whether they consider this sentence completely well-formed or somewhat ill-formed, but none of my informants rejected it outright. The pronoun arguably makes the sentence easier to process, and this will in fact form the basis of my explanation for this aspect of Swedish in the chapters to come.

Furthermore, the Swedish reconstruction facts are far from clear-cut. Reconstruction in relative clauses seems to be impossible, according to my informants, one of whom is a co-author of the original Zaenen et al. (1981) paper:

(4.71) * Jag känner en / den av sina$_i$ flickvänner som du undrade om det att Kalle$_i$ inte längre fick träffa <u>henne</u> kunde ligga bakom hans dåliga humör.
I know one / the.one of his girlfriends that you wondered if it that Kalle no longer sees her could lie behind his bad mood
I know one of / (the one of) his girlfriends that you wondered if the fact that Kalle no longer gets to see (her) could be behind his bad mood.

If the explanation for the *wh*-question's grammaticality is that the resumptive pronoun is syntactically a gap, then this sentence would be expected to be just as good, since it is structurally equivalent in the relevant respect. In fact, speakers in this case require the reflexive possessive pronoun to be replaced by the non-reflexive possessive (*hans*), in which case the sentence is grammatical:

(4.72) Jag känner en / den av hans$_i$ flickvänner som du undrade om det att Kalle$_i$ inte
I know one / the.one of his girlfriends that you wondered if it that Kalle no
längre fick träffa henne kunde ligga bakom hans dåliga humör.
longer sees her could lie behind his bad mood
I know one of / (the one of) his girlfriends that you wondered if the fact that Kalle no longer gets to see (her) could be behind his bad mood.

This would seem to indicate that the relative head or its operator is not being reconstructed. More work needs to be done to reveal the true generalization, but in the meantime accounting for the *wh*-question in (4.69) would seem to necessitate treating the resumptive as a gap.

The second Swedish phenomenon that has indicated a gap status for resumptive pronouns is across-the-board extraction from a coordinate structure (Zaenen et al. 1981, Sells 1984, Engdahl 1985). Swedish normally respects the condition that extraction from a coordinate structure must be across-the-board (Williams 1978), i.e. must extract from all conjuncts, but apparent extraction out of a single conjunct is allowed if the other conjunct contains a resumptive pronoun:

(4.73) Där borta går en man som jag ofta träffar __ men inte minns vad han heter.
There goes a man that I often meet __ but not remember what he is called
There goes a man that I often meet but don't remember what he is called.
(Zaenen et al. 1981:681, (9))

The fact that the resumptive pronoun in question occurs as the subject of a clause with left-peripheral material in CP is important, because this is the one position that Engdahl (1982) identifies as obligatorily requiring a resumptive pronoun in (standard) Swedish. If the pronoun in this sentence is meant to refer freely, the sentence is ungrammatical.

The third and final phenomenon that shows a gap-like status for Swedish resumptive pronouns is that they license parasitic gaps. This property potentially extends to Hebrew, as well. Engdahl (1985) presents examples like the following for Swedish:

(4.74) Det var den fången$_i$ som läkarna inte kunde avgöra om han$_i$ verkligen var sjuk utan
it was that prisoner that the.doctors not could decide if he really was ill without
att tala med $\underline{p}_i$ personligen.
to talk with __ in person
(This is the prisoner that the doctors couldn't detemine if he really was ill without talking to in person.)
(Engdahl 1985:7, (8))

Notice that the English translation is ill-formed, even though a weak island is a position where English allows intrusive pronouns (Sells 1984). Note once more that the resumptive pronoun is a true resumptive, sine it occurs immediately following a complementizer. The fact that the resumptive licenses a parasitic gap and the ATB evidence discussed above leads Engdahl (1985) to propose that Swedish resumptive pronouns are variables at S-structure; i.e., they are spelled out gaps.

The status of parasitic gaps in Hebrew is more controversial (Sells 1984, Shlonsky 1992, Ouhalla 2001). Sells (1984:79ff.) and Shlonsky (1992:462–463) are in agreement that parasitic gaps in adjuncts — the kind shown for Swedish above — cannot be licensed by a resumptive pronoun, even though they can at least marginally be licensed by a gap (i.e., it is not the case that Hebrew lacks parasitic gaps entirely):

(4.75) ? ʔelu ha-sfarim$_i$ še-Dan tiyek __$_i$ bli likro $\underline{p}_i$.
these the-books that-Dan filed __ without reading __
These are the books that Dan filed without reading.
(Shlonsky 1992:462, (32b))

(4.76) * ʔelu ha-sfarim$_i$ še-Dan tiyek <u>otam</u>$_i$ bli likro $\underline{p}_i$.
these the-books that-Dan filed them without reading __
These are the books that Dan filed without reading.
(Shlonsky 1992:462, (32c))

Sells (1984:82) notes that the grammaticality of a resumptive-pronoun-licensed parasitic gap is improved if there is a further level of embedding, in particular a tensed clause, between the resumptive-binder and the resumptive. Shlonsky (1992:462, fn.19) points out that distance in general improves the acceptability of otherwise ungrammatical resumptive pronouns (Erteschik-Shir 1992). We will pick this up again in chapter 8. For the moment we can conclude that Hebrew resumptive pronouns in base position do not license the classic adjunct parasitic gaps. The fact that Hebrew resumptives do not robustly license parasitic gaps has been related to a Leftness Condition by, among others, Sells (1984) and Demirdache (1991).

Shlonsky (1992:463) observes that if the resumptive pronoun is fronted and cliticized to the relative pronoun then a parastic gap is permitted in an adjunct clause:

(4.77) ʔelu ha-sfarim$_i$ še-<u>otam</u>$_i$ Dan tiyek bli likro $\underline{p}_i$.
these the-books that-them Dan filed without reading __
These are the books that Dan filed without reading.
(Shlonsky 1992:463, (33))

Borer (1984) argues that this process involves movement. It is therefore not surprising that pronoun-fronting licenses a parasitic gap, since there is a non-parasitic gap in object position. Shlonsky (1992:463) reaches a similar conclusion.

Subject parasitic gaps however seem to be licensed by resumptive pronouns in Hebrew even without pronoun-fronting (Sells 1984):

(4.78) zo-hi ha-iša še ha-anašim še šixnati levaker $\underline{p}_i$ teʔaru $\underline{\text{ota}}_i$
this-is the-woman that the-people that I-convinced to-visit __ described her
This is the woman who the people who I convinced to visit described (her).
(Sells 1984:79, (86a))

Shlonsky (1992:462, fn.19) observes that it is not obvious that subject parasitic gaps are licensed in the same manner as adjunct parasitic gaps. However, Nissenbaum (2000) is a recent instance of a theory that unifies the two, although it is true that subject parasitic gaps do not follow from the simplest possible analysis of adjunct parasitic gaps on his theory, in the sense that certain adjustments must be made to the initial, satisfactory treatment of adjunct parasitic gaps in order to accommodate subject parasitic gaps.

In sum, the behaviour of resumptive-pronouns in reconstruction, across-the-board extracton, and parasitic gaps in Swedish seems to indicate that they are syntactically gaps, unlike ordinary pronouns. The status of resumptive-licensed parasitic gaps is less clear in Hebrew than in Swedish.

Conclusion

In this chapter I reviewed the following core characteristics of resumptive pronouns:

A. Resumptive pronouns occur in unbounded dependencies.

B. Resumptive pronouns are interpreted as bound pronouns.

C. Resumptive pronouns are the ordinary pronouns of the language.

D. Resumptive pronouns and gaps have distinct syntactic distributions.

E. Resumptive pronouns display restrictions on their interpretation which gaps do not and which correlate with restrictions on the interpretation of non-resumptive pronouns.

F. Resumptive pronouns do not display certain key characteristics of gaps.

G. Resumptive pronouns resemble gaps in their interaction with certain grammatical phenomena.

Explaining these characteristics should constitute one of the major goals of any theory of resumptive pronouns. The generalization C that resumptive pronouns are ordinary pronouns receives tremendous cross-linguistic support but is apparently challenged by data from Vata. I argued that the Vata data could receive a plausible interpretation that is consistent with C and that an ordinary pronoun theory of resumptives is to be preferred even if Vata can be shown to have special resumptive pronouns. Characteristic G is also potentially challenging to the sort of theory that I propose. I show in chapter 7, section 7.1.5.1 that careful analysis of the data discussed in section G above reveals it to be consistent with the theory developed here.

Except for G, all of these characteristics empirically support theories that treat resumptive pronouns as ordinary pronouns over theories that treat them as special pronouns of some kind. There is also a theoretical reason to adopt an ordinary pronoun theory of resumption. If resumptive pronouns are just ordinary pronouns, then the term *resumptive pronoun* is just a descriptive cover term and there is no such thing as a resumptive pronoun per se in the theory. An ordinary pronoun theory thus eliminates resumptive pronouns as theoretical constructs. By contrast, unless a special pronoun theory can show that the special pronouns in question have some kind of independent justification outside of a theory of resumption, then the special pronoun theory is admitting *resumptive pronoun* as a theoretical construct. Theoretical parsimony would then dictate that the ordinary pronoun theory is to be preferred.

Chapter 5

Resumptive pronouns as resource surplus

Introduction

In the last chapter I laid out a number of characteristics of resumptive pronouns that have been identified in the literature. I concluded the chapter by arguing that, despite occasional evidence to the contrary, the overwhelming majority of evidence weighs against treating resumptive pronouns as special pronouns (e.g., "spelled out" gaps or stranded pronouns with moved complements) and instead supports treating them as ordinary pronouns. In this chapter I will show how the hypothesis of Resource Sensitivity and formalization of the syntax–semantics interface in terms of a resource logic pinpoints the essential problem posed by resumptive pronouns as a problem of semantic composition. Specifically, it is a problem of a surplus resource.

I first present in fairly abstract terms the formal theory of resumptive pronouns in section 5.1. In section 5.2 I show how manager resources are integrated into an LFG architecture. Section 5.3 addresses a potential alternative LFG analysis and shows that it is problematic. Section 5.4 closes the chapter with a consideration of the theoretical implications and empirical predictions of the theory. The two chapters following this one apply the theory to detailed analyses of Irish (chapter 6) and Swedish and Hebrew (chapter 7).

5.1 The resource management theory of resumptives

The resource management theory of resumptives is based on two key assumptions:

1. Resumptive pronouns are ordinary pronouns.

2. Resource Sensitivity: natural language is resource-sensitive.

The logic behind the theory is as follows. If a resumptive pronoun is an ordinary pronoun, then it constitutes a surplus resource. If Resource Sensitivity is to be maintained, then there must be an additional consumer of the pronominal resource present.

In section 5.1.1 I briefly review the variable-free Glue theory of anaphora which was presented in chapter 2. I show in section 5.1.2 that an ordinary pronoun theory of resumptives leads to resource surplus and therefore poses a problem for semantic composition. In section 5.1.3 I present the concept of *manager resources*, which are the heart of the resource logical analysis of resumptives. Manager resources constitute the additional consumers of pronominal resources that allow Resource Sensitivity to be maintained. I give a schematic presentation of the analysis which identifies its core insights. Section 5.2 presents further details about the mechanics of integrating the resource management theory of resumptives into a Lexical Functional Grammar architecture.

5.1.1 A brief review of anaphora in Glue Semantics

This section is a quick review of section 2.2.2 of chapter 2, which dicusses anaphora in Glue Semantics in more detail. Recall from chapter 2 that lexical items contribute *meaning constructors* of the form $\mathcal{M} : G$, where $\mathcal{M}$ is a term from the meaning logic and G is a term of linear logic. Semantic composition in Glue begins by taking the lexically contributed meaning constructors for a sentence as premises in a linear logic proof. Composition proceeds via application of the proof rules of linear logic to the linear logic side of the meaning constructors, with corresponding operations carried out on the meaning side, as determined by the Curry-Howard isomorphism.

A schematic representation of a pronominal meaning constructor is as follows, where A is the antecedent's resource and P is the pronoun's resource:[1]

(5.1) $\quad A \multimap (A \otimes P)$

The pronoun's meaning constructor consumes its antecedent's resource to produce a conjunction of the antecedent resource and the pronoun's resource. The pronoun has a functional type from type e to the product type $e \times e$. The pronoun's type is therefore $\langle e, \langle e \times e \rangle \rangle$. This theory of anaphora is variable-free (see Jacobson 1999 and references therein): the pronoun takes its antecedent as an argument in calculating its reference and there is therefore no assignment function.

[1]Recall that $\multimap$ is linear implication and that $\otimes$ is one form of linear conjunction, multiplicative conjunction.

The generalized form of a pronominal meaning constructor, shown in (5.2), uses the semantic structure attribute ANTECEDENT to fix the identity of the pronoun's antecedent or binder. Note that the variables in the meaning language are lambda-bound and therefore dispensible (Jacobson 1999; see chapter 2, section 2.2.1).

(5.2) $\lambda z.z \times z : (\uparrow_\sigma \;\; \text{ANTECEDENT})_e \multimap ((\uparrow_\sigma \;\; \text{ANTECEDENT})_e \otimes \uparrow_{\sigma_e})$

On the meaning language side of the meaning constructor there is a product that pairs the individual that is the referent of the antecedent with both the antecedent and the pronoun. Thus, the pronoun calculates its reference by consuming its antecedent as an argument and yields a product in the meaning language which is matched pairwise with the replicated antecedent resource and the pronominal resource in the linear logic. Although the pronoun calculates its reference by consuming its antecedent, it is important that another copy of the antecedent is outputed by the pronominal function, or else the resource corresponding to the antecedent will have been completely consumed and could not be used elsewhere in the derivation, as it must be. The possible values of ANTECEDENT at s-structure are constrained by syntactic factors (Dalrymple et al. 1999c:58), including LFG's binding theory, which is stated using f-structural relations and the mapping from functional structure to semantic structure (Dalrymple 1993, 2001, Bresnan 2001; see section 2.1.5 of chapter 2).

We can construct the proof in (5.4) for the simple example in (5.3), using the mnemonic convention for naming resources, where p indicates 'pronoun'. Recall from chapter 2, section 2.2.1 that the let operator performs simultaneous, pairwise substitution and that $\Rightarrow_\beta$indicates β-reduction of a lambda term.

(5.3) Bo fooled himself.

(5.4)
$$\dfrac{\dfrac{\dfrac{bo : b \quad \lambda z.z \times z : b \multimap (b \otimes p)}{bo \times bo : b \otimes p} \qquad \dfrac{\dfrac{[x : b]^1 \quad \lambda u \lambda v.fool(u, v) : b \multimap p \multimap f}{\lambda v.fool(x, v) : p \multimap f} \quad [y : p]^2}{fool(x, y) : f}}{\mathsf{let}\ bo \times bo\ \mathsf{be}\ x \times y\ \mathsf{in}\ fool(x, y) : f}\otimes_{\mathcal{E},1,2}}{fool(bo, bo) : f}\Rightarrow_\beta$$

As mentioned above, binding-theoretic constraints apply to the feature ANTECEDENT and in this case would enforce proper local binding of the reflexive. Note that there is nothing special about the transitive verb *fool*. It has not undergone a type shift or been modified in any way to accommodate the pronoun (this contrasts with the variable free semantics of Jacobson 1999). Note also that the resource corresponding to the pronoun is the right member of the conjunction pairing and that it is a type e atomic resource, just like that of a name. Recall, though, that the proof rule for conjunction elimination requires simultaneous substitution of the products and does not permit separate projection into one or the other. Finally, observe that the pronoun does not correspond to a free variable, since the corresponding variable is lambda-bound. Thus, we have a variable-free analysis of pronouns.

As mentioned above and discussed at length in chapter 2 (section 2.2.1), operations in the meaning language are determined by the Curry-Howard isomorphism, which relates the linear logic terms to the meaning terms. A consequence of the isomorphism is that meaning terms cannot constrain proofs. It is therefore sufficient to show proofs using only the linear logic, since the meaning terms follow. The proof rules used in example (5.4) are implication elimination ($\multimap_{\mathcal{E}}$), which corresponds to functional application, and conjunction elimination ($\otimes_{\mathcal{E}}$), which corresponds to pairwise substitution.

5.1.2 The problem of resumptives as resource surplus

In this section I will show how a resumptive pronoun constitutes a surplus resource and therefore poses a problem for semantic composition. Consider the English sentence in (5.5), which contains a resumptive pronoun in a relative clause and is therefore ungrammatical, since the grammar of English does not license resumptive pronouns.

(5.5) *Every clown who Mary knows <u>him</u> laughed.

It is sufficient to look at the linear logic resources to reveal the problem for composition, since the meaning terms follow by the Curry-Howard isomorphism.

The linear logic content of the meaning constructors that are contributed by the lexical items in (5.5) is as shown in (5.6). All resources are named mnemonically, as per the conventions outlined in chapter 2.

(5.6)

1.	$(v \multimap r) \multimap \forall X.[(c \multimap X) \multimap X]$	Lex. **every**
2.	$v \multimap r$	Lex. **clown**
3.	$(p \multimap k) \multimap [(v \multimap r) \multimap (v \multimap r)]$	Lex. **who**
4.	m	Lex. **Mary**
5.	$m \multimap p \multimap k$	Lex. **knows**
6.	$c \multimap (c \otimes p)$	Lex. **him**
7.	$c \multimap l$	Lex. **laughed**

For further details on meaning constructors and what kinds of meaning constructors are contributed by different lexical items, refer to chapter 2. A brief review should be sufficient for present purposes.

The common noun *clown* contributes a type $\langle e,t\rangle$ resource, an implication from its s-strucure VARIABLE (v) to its RESTRICTION (r). The quantifier *every* contributes a generalized quantifier resource of type $\langle\langle e,t\rangle, \langle\langle e,t\rangle, t\rangle\rangle$ that consumes the resource of the common noun to find its restriction and, in this case, consumes the resource contributed by the matrix verb to find its scope.[2] The name *Mary* refers to an individual and contributes a type e resource. As discussed in the previous section, the pronoun consumes its antecedent's resource and reproduces it along with its own resource. In this case, the antecedent is the DP headed by the common noun *clown*. Recall from chapter 2.1, section 2.1.2 that I am adopting a DP analysis of nominal phrases in order to be consistent with Toivonen's phrase structure theory (Toivonen 2001, 2003). Nothing hinges on this: an NP analysis would not affect any crucial aspect of the theory. The verb *know* contributes a resource that needs to consume two arguments, the embedded object pronoun and the embedded subject name. The intransitive matrix verb *laughed* contributes a resource that needs to consume one argument, the matrix subject. Lastly, the relative pronoun contributes a resource that performs modification of the relative head by the relative clause. The first argument is the resource corresponding to the relative clause it introduces, i.e. the scope of the relative operator. This is a type $\langle e,t\rangle$ implication from the relativized argument's resource to the resource corresponding to the head of the relative clause. In this case, the relativized argument is the embedded OBJ and the first argument of the modificational resource is therefore $p \multimap k$, which is the resource corresponding to the embedded transitive once it has combined with its subject. The second argument of the relative modifier is the resource being modified, which is that of the head noun (i.e., $v \multimap r$). Note that the relative modifier resource is not necessarily associated with a relative pronoun. It can be associated with the c-structure rule that forms the relative clause, in order to account for relatives clauses without relative pronouns (Dalrymple 2001:419), whether this is optional (as in English *the clown Mary knows*) or obligatory (as in Irish, which lacks relative pronouns). This was discussed further in chapter 2, section 2.1.6.

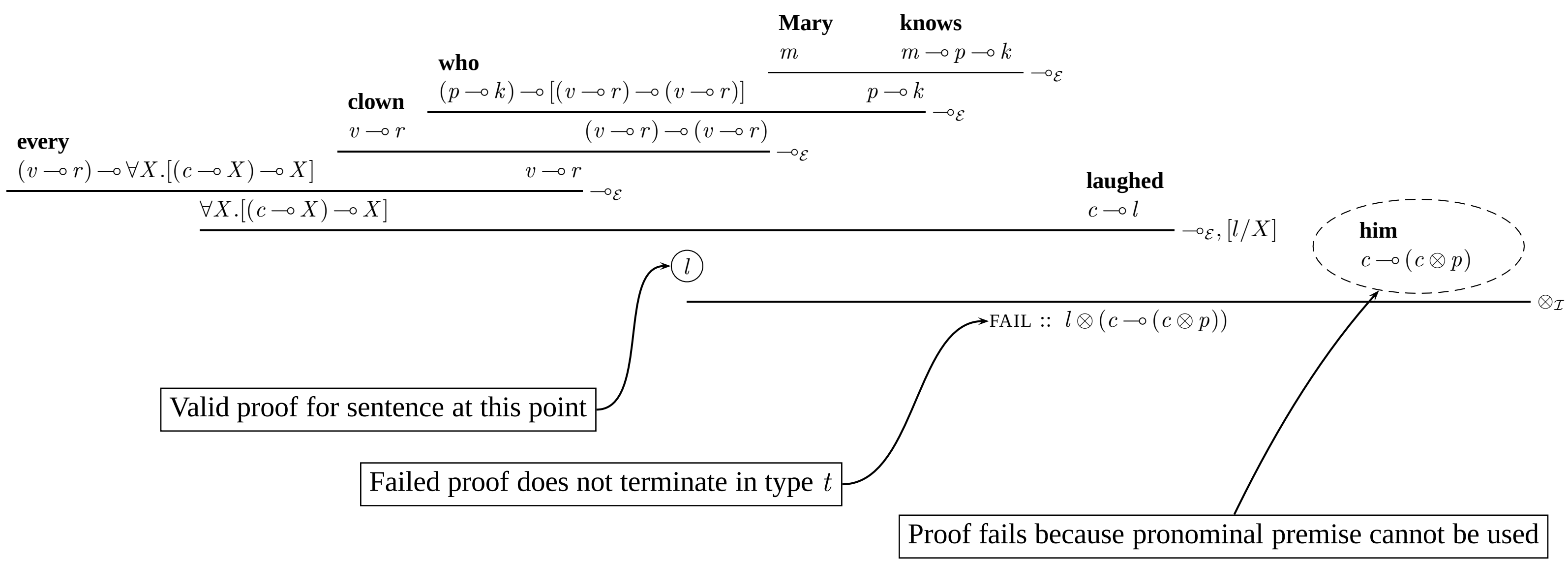
A Glue proof for the semantics of a sentence S succeeds if and only if from the premises contributed by the lexical items in S there is a proof that uses each premise exactly once and terminates in a linear logic atom corresponding to the semantic projection of the sentence. For example, in the sentence *Bo chortled* the lexical items *Bo* and *chortled* contribute premises like b and $b \multimap c$, where the premise contributed by *Bo* is identified as the subject of *chortled* in the syntax and is therefore consumed as the argument of the premise $b \multimap c$. The linear logic atom c corresponds

[2] See section 2.2 of chapter 2 for a discussion of the use of the universal quantifier in the linear logic side of meaning constructors. Importantly, the linear universal is used in calculating scope and has nothing to do with the denotational semantics of the scope-taking element in the meaning side. In other words, all scope-taking elements have such a universal in their linear logic.

to the semantic projection of the sentence *Bo chortled*, because it is the consequent of the premise contributed by of the matrix verb that heads the sentence. From these two premises, there is a successful proof of c by one instance of implication elimination on b and $b \multimap c$.

Given the premises in (5.6), a proof for (5.5) must therefore terminate in the linear logic atom l, because l is the consequent of the premise contributed by the matrix verb *laughed*. The attempted proof in Figure 5.1 shows that there is no such proof from the premises in (5.6) *that uses all of the premises*. Note that the lexically contributed premises are decorated with the corresponding word solely for added readability; this is not an integral part of the proof. The pronominal resource is identified as the culprit. There are other proofs that we could attempt to construct, but none of them could get rid of the resource p. It is easy to see why this is so. The only consumer of p is the premise $m \multimap p \multimap k$ contributed by the verb *know* in the relative clause. The resource p is the resource corresponding to the relativized object. In order for the body of the relative clause to compose with the relative pronoun, this argument of *know* must not be saturated. Therefore, there is in fact no consumer for the resource p and there is no valid proof of this sentence from the premises in (5.6). The resumptive pronoun's resource is a surplus resource that leads to proof failure. In other words, if the resumptive pronoun were to saturate its position in the relative clause, then semantic composition of the relative clause with the rest of the sentence would be blocked.

Figure 5.1: Proof failure due to a surplus resumptive pronoun resource



The resource logic perspective reveals that a resumptive pronoun is a *surplus resource*. As discussed briefly in the introduction, the notion of resource surplus allows us to give a unified theory of resumption which encompasses resumptive pronouns and copy raising. This will be the focus of part III. The theory in outline, just with respect to resumptive pronouns in the narrow sense, is as follows. If a resumptive pronoun is surplus to the basic compositional requirements of its sentence, then Resource Sensitivity entails that there must be a consumer of the resumptive pronoun's resource. The resumptive consumer is a further resource that consumes a pronominal resource. These resources are called *manager resources*, because they manage an otherwise unconsumable pronominal resource. A resumptive pronoun language has such manager resources in the portion of its lexical inventory that concerns unbounded dependencies. A language which does not license resumptive pronouns in unbounded dependencies lacks manager resources in the relevant part of its lexicon. A language may have manager resources in some environments without having them in others. This is exemplified by English, which exhibits copy raising and therefore has a subset of raising verbs that contribute manager resources, but which lacks resumptive pronouns in unbounded dependencies and therefore lacks manager resources in its complementizer / *wh*-inventory.

5.1.3 Manager resources

If resumptive pronouns are ordinary pronouns then Resource Sensitivity dictates that there must be an extra consumer for the pronoun, or else the resource surplus problem shown in the previous section will arise. The extra consumers of pronominal resources are *manager resources*. A manager resource is a lexically contributed premise that consumes a pronominal resource. Manager resources are the licensing mechanism for resumption in general, both for resumptive pronouns and for copy raising pronouns. In the specific case of resumptive pronouns, manager resources are contributed through the part of a language's lexical inventory that concerns unbounded dependencies. More specifically, resumptive-licensing manager resources are contributed by complementizers, and perhaps also other material in the left periphery of CP (i.e., *wh*-words).

Manager resources have the following general compositional schema, where P is some pronoun that the lexical contributor of the manager resource can access and A is the antecedent or binder of P:

(5.7) $$(A \multimap A \otimes P) \multimap (A \multimap A)$$

The antecedent of the main implication in (5.7) has the form of a pronominal meaning constructor: a manager resource needs to consume a pronominal resource. The result of this consumption is a function on the binder. The function has the form $\phi \multimap \phi$ and is therefore a modifier on the binder.

The resources corresponding to the manager resource, the resumptive pronoun and the binder of the resumptive pronoun together yield just the binder. Suppose we have the following lexically contributed premises:

(5.8)	1. A	Lex. **(antecedent)**
	2. $A \multimap (A \otimes P)$	Lex. **(pronoun)**
	3. $[A \multimap (A \otimes P)] \multimap (A \multimap A)$	Lex. **(manager resource)**

Note that the ANTECEDENT is a simple type e nominal in this case, such as a name. Figure 5.2 shows the simple linear logic proof that is constructed from these premises. The proof terminates in the antecedent resource. The manager resource has removed the pronoun from composition. It is important that the consequent of the main implication in the manager resource is itself an implication on the pronoun's binder ($A \multimap A$), rather than just another instance of the binder's resource (A). In the latter case, there would be a new copy of the resource A and this would lead to a resource management problem, as there would be two copies of A where only one is required. This should be intuitively clear if one bears in mind that the role of the manager resource is to consume a pronominal resource, leaving the rest of the proof undisturbed.

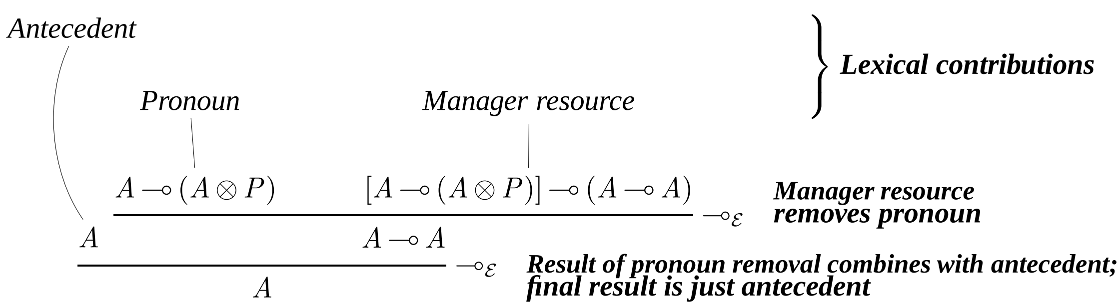


Figure 5.2: A manager resource in action (simple antecedent)

The binder of the resumptive is not necessarily a type e nominal, though. If the binder is a quantifier, we would instead get the following schematic meaning constructors for the binder of the resumptive, the resumptive pronoun, and the manager resource.

(5.9)	1. $\forall X.[(A \multimap X) \multimap X]$	Lex. **(quantificational binder)**
	2. $A \multimap (A \otimes P)$	Lex. **(pronoun)**
	3. $[A \multimap (A \otimes P)] \multimap (A \multimap A)$	Lex. **(manager resource)**

The premise marked *Antecedent* in Figure 5.2 is replaced by an assumption of a type e resource on which the quantificational binder's scope depends. The manager resource consumes the pronoun and then modifies the assumption. The resulting resource A is taken as an argument by the scope of the quantificational binder. The assumption is then discharged and the scope can compose with the quantifier. This is sketched in Figure 5.3. Notice that the boxed proof chunk in Figure 5.3 is equivalent to Figure 5.2.

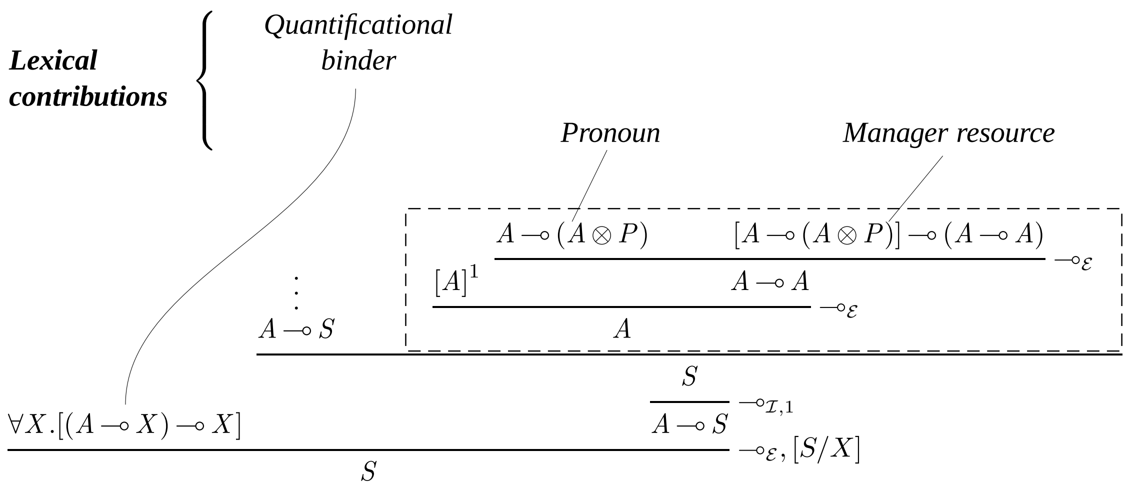


Figure 5.3: A manager resource in action (quantificational binder)

The basic function of the manager resource is to remove the pronoun from composition. A resumptive pronoun that is licensed by a manager resource behaves syntactically exactly like a non-resumptive pronoun — the resumptive is an ordinary pronoun — but behaves semantically like a gap: the semantic argument position corresponding to the pronoun gets saturated by the pronoun's antecedent or bound by the pronoun's binder, rather than being saturated by the pronoun. The fact that a manager resource removes a pronoun from semantic composition is reflected in the meaning side of the manager resource's meaning constructor by vacuous lambda abstraction over the pronoun's function. The function in the meaning language that corresponds to the modification on the antecedent resource is an identity function.

(5.10) $\lambda P \lambda x.x : (A \multimap A \otimes P) \multimap (A \multimap A)$

A manager resource is therefore a type $\langle\langle e, \langle e \ \times \ e\rangle\rangle, \langle e, e\rangle\rangle$ function. Its role is exclusively to remove a pronoun from semantic composition, without affecting the rest of the composition at all.

The proof in (5.12) shows the meaning language side of Figure 5.2. The proof is constructed from the lexically contributed premises in (5.11), which are just the premises in (5.8) with the meaning side of the meaning constructors added.

(5.11)
1. $a : A$ Lex. **(antecedent)**
2. $\lambda z.z \times z : A \multimap (A \otimes P)$ Lex. **(pronoun)**
3. $\lambda P \lambda x.x : [A \multimap (A \otimes P)] \multimap (A \multimap A)$ Lex. **(manager resource)**

(5.12)
$$\dfrac{a : A \qquad \dfrac{\lambda z.z \times z : A \multimap (A \otimes P) \qquad \lambda P \lambda x.x : [A \multimap (A \otimes P)] \multimap (A \multimap A)}{\lambda x.x : (A \multimap A)} \multimap_{\mathcal{E}}}{a : A} \multimap_{\mathcal{E}},\ \Rightarrow_{\beta}$$

It is worth reiterating that the effect of a manager resource is to remove a pronoun from semantic composition but that both in the syntax and semantics there is no difference between resumptive and non-resumptive pronouns. The resumptive pronoun is an ordinary pronoun that makes a normal syntactic contribution and a normal resource contribution.

At this stage it will be useful to look at the derivation for a full sentence containing a resumptive in order to see in some detail how resumptives work according to this theory. I will abstract away from language-particular details by using English words for expository purposes. This should *not* be taken as an implicit claim that English has resumptive pronouns.

(5.13) Every clown who$_{pro}$ Mary knows him laughed.

Let us suppose that *who*$_{pro}$ is a relative pronoun that licenses a resumptive pronoun.

Making certain simplifications, we get the meaning constructors in (5.14) from the lexical items in this example. The precise manner in which manager resources are integrated into the larger Glue and LFG theories is the subject of section 5.2. For now it suffices to use the usual mnemonic convention in naming the resources.

(5.14)
1. $\lambda R \lambda S.every(x, R(x), S(x)) :$
   $(v \multimap r) \multimap \forall X.[(c \multimap X) \multimap X]$ Lex. **every**
2. $clown : v \multimap r$ Lex. **clown**
3. $\lambda P \lambda Q \lambda z.Q(z) \wedge P(z) : (p \multimap k) \multimap [(v \multimap r) \multimap (v \multimap r)]$ Lex. **who**$_{pro}$
4. $\lambda P \lambda x.x : [c \multimap (c \otimes p)] \multimap (c \multimap c)$ Lex. **who**$_{pro}$ **(MR)**
5. $mary : m$ Lex. **Mary**
6. $\lambda x \lambda y.know(x, y) : m \multimap p \multimap k$ Lex. **knows**
7. $\lambda z.z \times z : c \multimap (c \otimes p)$ Lex. **him**
8. $laugh : c \multimap l$ Lex. **laughed**

Note in particular that the relative complementizer *who*$_{pro}$ is contributing two meaning constructors. The first is the normal meaning constructor for a restrictive relative clause, a modifier on the relativized noun's meaning. The second meaning constructor is the manager resource.

The proof in Figure 5.4 shows how the lexically-contributed linear logic resources in (5.14) compose the meaning of the sentence. The operations in the meaning language follow straightforwardly by the Curry-Howard isomorphism, but are also shown in detail in Figure 5.5 below. The manager resource removes the pronoun from composition (the first line of Figure 5.4), clearing the way for the argument corresponding to the pronoun in the semantics to be bound by the pronominal binder, *every clown*, just as if the relative clause had been a non-resumptive relative. In sum, a manager resource removes a pronoun from composition. The proof proceeds as if the pronoun had been a gap.

$$
\dfrac{
\dfrac{\textbf{every}}{(v \multimap r) \multimap \forall X.[(c \multimap X) \multimap X]}
\quad
\dfrac{
\dfrac{\textbf{clown}}{(v \multimap r)}
\quad
\dfrac{
\dfrac{\textbf{who}_{pro}}{(p \multimap k) \multimap [(v \multimap r) \multimap (v \multimap r)]}
\quad
\dfrac{\dfrac{\textbf{Mary}}{m} \quad \dfrac{\textbf{knows}}{m \multimap p \multimap k}}{p \multimap k}\multimap_{\mathcal{E}}
}{(v \multimap r) \multimap (v \multimap r)}\multimap_{\mathcal{E}}
}{(v \multimap r)}\multimap_{\mathcal{E}}
}{\forall X.[(c \multimap X) \multimap X]}\multimap_{\mathcal{E}}
\quad
\dfrac{
\dfrac{
\dfrac{\textbf{laughed}}{c \multimap l}
\quad
\dfrac{
\dfrac{\dfrac{\textbf{him}}{c \multimap (c \otimes p)} \quad \dfrac{\textbf{who}_{pro}\ \textbf{(MR)}}{[c \multimap (c \otimes p)] \multimap (c \multimap c)}}{(c \multimap c)}\multimap_{\mathcal{E}}
\quad [c]^1
}{c}\multimap_{\mathcal{E}}
}{l}\multimap_{\mathcal{E}}
}{c \multimap l}\multimap_{\mathcal{I},1}
}{every(x, clown(x) \wedge know(mary, x), laugh(x)) : l}\multimap_{\mathcal{E}}, [l/X]
$$

Figure 5.4: Proof for expository resumptive example *Every clown who*$_{pro}$ *Mary knows him laughed.*

$$
\dfrac{
\begin{array}{l} \lambda R\lambda S.every(x,R(x),S(x)) : \\ (v \multimap r) \multimap \forall X.[(c \multimap X) \multimap X] \end{array}
\quad
\dfrac{
\begin{array}{l} clown : \\ (v \multimap r) \end{array}
\quad
\dfrac{
\begin{array}{l} \lambda P\lambda Q\lambda z.Q(z) \wedge P(z) : \\ (p \multimap k) \multimap [(v \multimap r) \multimap (v \multimap r)] \end{array}
\quad
\dfrac{
\begin{array}{l} mary : \\ m \end{array}
\quad
\begin{array}{l} \lambda x\lambda y.know(x,y) : \\ m \multimap p \multimap k \end{array}
}{
\begin{array}{l} \lambda y.know(mary,y) : \\ p \multimap k \end{array}
}
}{
\begin{array}{l} \lambda Q\lambda z.Q(z) \wedge know(mary,z) : \\ (v \multimap r) \multimap (v \multimap r) \end{array}
}
}{
\begin{array}{l} \lambda z.clown(z) \wedge know(mary,z) : \\ (v \multimap r) \end{array}
}
}{
\begin{array}{l} \lambda S.every(x,R(x),clown(x) \wedge know(mary,x)) : \\ \forall X.[(c \multimap X) \multimap X] \end{array}
}
\quad
\dfrac{
\dfrac{
\begin{array}{l} laugh : \\ c \multimap l \end{array}
\quad
\dfrac{
\dfrac{
\begin{array}{l} \lambda z.z \times z : \\ c \multimap (c \otimes p) \end{array}
\quad
\begin{array}{l} \lambda P\lambda x.x : \\ [c \multimap (c \otimes p)] \multimap (c \multimap c) \end{array}
}{
\lambda x.x : (c \multimap c)
}
\quad
[y : c]^{1}
}{
y : c
}
}{
\begin{array}{l} laugh(y) : \\ l \end{array}
}
\multimap_{\mathcal{I},1}
}{
\begin{array}{l} \lambda y.laugh(y) : \\ c \multimap l \end{array}
}
}{
every(x, clown(x) \wedge know(mary,x), laugh(x)) : l
}
\; [l/X]
$$

Figure 5.5: Proof with meanings for expository resumptive example *Every clown who$_{pro}$ Mary knows him laughed.*

5.1.4 Summary

The basic idea behind this theory of resumptive pronouns is that the problem of resumption is a problem of resource surplus: the resumptive pronoun's resource apparently goes unconsumed. The consumer of the resource is a manager resource and it is the presence of a manager resource that licences a resumptive use of a pronoun. Manager resources are lexically specified and operate at the syntax–semantics interface. The result is a theory of resumptives that treats resumptive pronouns as ordinary pronouns in the syntax and ties their exceptional ability to occur at the base of a long distance dependency to the presence of a manager resource.

5.2 Integrating resource management in LFG

5.2.1 The lexical specification of manager resources

In the previous section I introduced manager resources and showed how they dispose of a surplus pronominal resource. However, the meaning constructors for manager resources were given in only schematic form. In this section I show how manager resources are integrated into an LFG architecture. In particular, I show how manager resources are lexically specified using functional descriptions and the σ-projection function from f-structure to s-structure. I also discuss the interaction of an ordinary pronoun theory of resumptives with LFG's theory of unbounded dependencies, in particular the Extended Coherence Condition. Finally, I discuss how the ordinary pronoun theory necessitates an auxiliary mechanism of dependency relabeling, given the usual method for handling anaphora and resource mapping in Glue Semantics.

The generalized form of a manager resource's meaning constructor is shown in (5.15), where I have abbreviated the feature ANTECEDENT as ANT after its first occurrence.

(5.15)
$$[((\uparrow\ \textsc{gf}^{+})_{\sigma}\ \ \textsc{antecedent})_{e} \multimap [((\uparrow\ \textsc{gf}^{+})_{\sigma}\ \ \textsc{ant})_{e} \otimes (\uparrow\ \textsc{gf}^{+})_{\sigma_e}]] \\ \multimap [((\uparrow\ \textsc{gf}^{+})_{\sigma}\ \ \textsc{ant})_{e} \multimap ((\uparrow\ \textsc{gf}^{+})_{\sigma}\ \ \textsc{ant})_{e}]$$

The meaning constructor has two constituent s(emantic)-descriptions, $((\uparrow\ \textsc{gf}^{+})_{\sigma}\ \ \textsc{antecedent})$ and $(\uparrow\ \textsc{gf}^{+})_{\sigma}$. The feature ANTECEDENT is proper to semantic structures and therefore does not need to be σ-mapped. The feature GF is short for any f-structural grammatical function and the specification $(\uparrow\ \textsc{gf}^{+})_{\sigma}$ uses Kleene plus to indicate that it can be satisfied by the σ-projection of a grammatical function in the f-structure of the manager resource's contributor (designated by $\uparrow$) or by an arbitrarily deeply-embedded grammatical function. The linear logic atoms are *typed* (see section 2.2 of chapter 2 and appendix A.1). A manager resource is therefore of type $\langle\langle e, \langle e \times e\rangle\rangle, \langle e, e\rangle\rangle$.

The meaning constructor in (5.15) is rather unconstrained. There is no guarantee that the instances of $(\uparrow\ \text{GF}^{+})_{\sigma}$ get instantiated to the same s-structure node. It would in principle be possible to satisfy a manager resource by constructing its antecedent through the linear logic proof rules of conjunction introduction (to get the conjunction $\otimes$) and implication introduction (to get the implication into the conjunction) applied to resources that satisfy the component s-descriptions of $((\uparrow\ \text{GF}^{+})_{\sigma}\ \ \text{ANTECEDENT})$ and $(\uparrow\ \text{GF}^{+})_{\sigma}$. However, the resource sensitivity of linear logic guarantees that a successful proof will be found only if an actual resumptive pronoun is removed. This is easy to prove by cases:

(5.16) **Proof of Resource Logical Constraints on Manager Resources**

1. *There is no resumption pronoun present*

   The manager resource is satisfied by somehow putting together its antecedent by application of proof rules. It can only do this by finding instances of GF^{+} that satisfy the equations in the manager resource's meaning constructor and that contribute resources. Each GF resource contributed must have a consumer, or else the proof would fail independently of the manager resource. If the manager resource consumes a GF that has a consumer, it cannot be a resumption pronoun by definition of the case. Removal of the GF therefore results in no way to satisfy the resource needs of the GF's consumer. The result is resource deficit. No valid proof.

2. *There is a resumption pronoun present, but the manager resource removes some other resource*

   The resumption pronoun results in resource surplus. No valid proof. (Case 1 also applies.)

Each instance of GF^{+} must therefore be instantiated to the same s-structure node due to constraints of the logic.

The instantiation of the two component s-descriptions $((\uparrow\ \text{GF}^{+})_{\sigma}\ \ \text{ANTECEDENT})$ and $(\uparrow\ \text{GF}^{+})_{\sigma}$ results in the following schematic meaning constructor.

(5.17) $(A \multimap A \otimes P) \multimap (A \multimap A)$

This is just the schematic form of the manager resource familiar from (5.7) above.

Although resource sensitivity is sufficient, there is an additional method for exercising more control over the realization of separate instances of $(\uparrow\ \text{GF}^{+})_{\sigma}$; this additional control might be desirable in computational applications, since it would prevent the prover from attempting certain proofs that are known to fail. The method involves the use of *local names* (Kaplan and Maxwell 1996), which are f-structure variables that have scope only in the lexical item or rule element in which they occur (Dalrymple 2001:146–148). Using a local name $\%\mathrm{RP}$, we would break up (5.15) as follows:

(5.18)
$$\begin{array}{l} \%\mathrm{RP} = (\uparrow\ \textsc{gf}^{+}) \\ [(\%\mathrm{RP}_\sigma\ \ \textsc{ant}) \multimap ((\%\mathrm{RP}_\sigma\ \ \textsc{ant}) \otimes \%\mathrm{RP}_\sigma)] \\ \quad \multimap [(\%\mathrm{RP}_\sigma\ \ \textsc{ant}) \multimap (\%\mathrm{RP}_\sigma\ \ \textsc{ant})] \end{array}$$

The local name $\%\mathrm{RP}$ is set to the f-structure of the resumptive pronoun. Every instance of $\%\mathrm{RP}$ in the scope of the lexical item that contributes the manager resource refers to the same f-structure.

The specification of manager resources can be further simplified if we take into account the fact that a manager resource is a device for eliminating resumptives and copy pronouns. Both kinds of pronoun are bound pronouns (McCloskey 1979, Sells 1984, Lappin 1983). The lexical contributor of the manager resource will therefore specify anaphoric binding of the resumption pronoun that is to be removed in terms of some local GF, as follows:

(5.19)
$$(\uparrow \textsc{gf})_\sigma = ((\uparrow \textsc{gf}^{+})_\sigma\ \ \textsc{antecedent})$$

Given this equality, the expression $((\uparrow \textsc{gf}^{+})_\sigma\ \ \textsc{antecedent})$ in the manager resource's meaning constructor can be replaced by $(\uparrow \textsc{gf})_\sigma$. The resulting meaning constructor is shown in (5.20). For extra readability, the GF local to the manager resource's f-structure is underlined and the resumption pronominal's GF, which is an unbounded distance away, is double underlined.

(5.20)
$$[\underline{(\uparrow \textsc{gf})_\sigma} \multimap (\underline{(\uparrow \textsc{gf})_\sigma} \otimes \underline{\underline{(\uparrow \textsc{gf}^{+})_\sigma}})] \multimap [\underline{(\uparrow \textsc{gf})_\sigma} \multimap \underline{(\uparrow \textsc{gf})_\sigma}]$$

Thus, if we take into account the function of a manager resource — the removal of a bound, resumption pronoun — the theory allows a completely local statement of manager resource, except for the part that concerns anaphoric binding, which is independently known to be a non-local process.

Local names can again be used to constrain realization of the various instances of GF and the instance of $\textsc{gf}^{+}$. The lexical contributor of the manager resource would then contain the following information:

(5.21)
$$\begin{array}{l} \%\mathrm{GF} = (\uparrow \textsc{gf}) \\ \%\mathrm{RP} = (\uparrow \textsc{gf}^{+}) \\ \%\mathrm{GF}_\sigma = (\%\mathrm{RP}_\sigma\ \textsc{antecedent}) \\ [\%\mathrm{GF}_\sigma \multimap (\%\mathrm{GF}_\sigma \otimes \%\mathrm{RP}_\sigma)] \multimap [\%\mathrm{GF}_\sigma \multimap \%\mathrm{GF}_\sigma] \end{array}$$

The theory therefore allows a compact, controlled, and most importantly *local* specification of manager resources. At the end of section 5.2.2, once some further facts about binder-resumptive dependencies have been taken into account, I will make a slight further refinement to the lexical specification of manager resources for resumptive pronouns.

Summary

Manager resources can be specified in a highly general form, as shown in above. The resource logic tightly constrains how the generalized manager resource may be realized: a manager resource must remove a resumption pronoun and it can remove only a resumption pronoun, or else there is no valid Glue proof from lexically contributed premises. The use of local names provides further control over the specification of manager resources. Lastly, the theory allows specification of manager resources in local terms. This follows from the fact that a resumption pronoun is a bound pronoun and the fact that the lexical contributor of the manager resource will in general require anaphoric binding of the resumption pronoun by a local grammatical function, i.e. one that is found in the f-structure of the lexical contributor of the manager resource. The actual anaphoric binding of the resumption pronoun is non-local, but anaphoric binding is non-local in general. A manager resource thus acts (principally) locally, but has a non-local effect.

5.2.2 Satisfaction of the ECC and integration of the binder

Unbounded dependencies in LFG are represented by the features TOPIC and FOCUS, depending on the kind of unbounded dependency (see chapter 2, section 2.1.6). I use the grammatical function UDF, which is mnemonic for *unbounded dependency function*, to abstract over TOPIC or FOCUS:

(5.22) $\text{UDF} := \{\ \text{TOPIC} \mid \text{FOCUS}\ \}$

The Extended Coherence Condition (ECC) requires an unbounded dependency to be integrated into the grammatical representation (Zaenen 1980, Bresnan and Mchombo 1987, Fassi-Fehri 1988). The formulation of Bresnan and Mchombo (1987:746) is repeated here:

(5.23) **Extended Coherence Condition**
FOCUS and TOPIC must be linked to the semantic predicate argument structure of the sentence in which they occur, either by functionally or by anaphorically binding an argument.

The ECC can be satisfied in one of two ways: functionally or anaphorically.

The functional means of satisfying the ECC is through what is called "functional binding" in the quote above. I prefer the term *functional equality*, because it gets to the heart of the matter better. Functional binding / equality occurs when there is a functional equation that equates the UDF (TOPIC or FOCUS) with some GF, resulting in two grammatical functions with a single, shared f-structure as their value. This is sketched in (5.24):

(5.24)
$$\begin{bmatrix} \textsc{pred} & \text{'\ldots'} \\ \textsc{udf} & \begin{bmatrix} \textsc{pred} & \text{'\ldots'} \end{bmatrix} \\ \textsc{gf} & \rule{4em}{0.4pt} \end{bmatrix}$$

Some lexical entry or rule element must provide the functional equation that integrates the UDF into the f-structure (Kaplan and Zaenen 1989, Dalrymple 2001).

Functional integration of the UDF must also involve specification of a PRED feature. The grammatical function that is equated with the UDF is a gap that is not lexically realized. In order for this GF to satisfy the completeness condition (see section 2.1), it must have a PRED.[3] The GF gets its PRED from the UDF with which it is equated. The UDF will get its PRED from lexical material in many cases. For example, a *wh*-phrase in SpecCP will contribute the UDF's PRED.

Alternatively, the PRED of the UDF may be added by a c-structure rule. For example, the rule for constructing an English relative that lacks a relative pronoun, as in (5.25), would include the information in (5.26):

(5.25) a guy I know

(5.26)
$$\begin{array}{lcc} \text{CP} \longrightarrow & \epsilon & \text{C}' \\ & (\uparrow \textsc{topic pred}) = \text{'pro'} & \uparrow = \downarrow \end{array}$$

This rule is a simplification of the rule proposed by Dalrymple (2001:419).[4] The rule has the effect of adding PRED 'pro' to the f-structure of the TOPIC. The empty string ϵ is by definition not realized in c-structure. Rather, the empty string is a means to introduce functional constraints in the absence of an overt word or phrase (see Dalrymple 2001:175–176). This is distinct from an empty category, which actually does occupy a position in the tree, is assigned a syntactic category, etc. For example,

[3]Completeness requires that all arguments that are selected by a predicate must be realized in the predicate's f-structure and furthermore, that all semantic arguments (i.e., non-expletives) must have their own PRED (Kaplan and Bresnan 1982:65[211–212], Bresnan 2001:63). See section 2.1.3.2 of chapter 2.

[4]The rule that Dalrymple gives integrates the TOPIC through functional equality. In addition, the rule contributes the meaning constructor for modification of the relative head by the relative clause, since in the absence of a relative pronoun there is no contributor of this resource. See the discussion of the equivalent Irish rule in (6.21) below.

Bresnan (1995) uses empty categories to explain certain facts about weak crossover in German (also see Bresnan 2001). A traceless alternative is offered by Dalrymple et al. (2001). There is no sense in which the empty category in Bresnan's analysis could be replaced by an ϵ. The version of LFG I adopt here does not countenance empty categories, however. It should also be noted that rather than adopting the ϵ analysis we could postulate a null relative pronoun. At this point it is not obvious that one approach is superior to the other, although future work could decide the matter. For further discussion of ϵ, see chapter 2, section 2.1.

The assumption that the value of the PRED introduced in this manner is 'pro' — the value for pronominals — is justified for English on the grounds that a relative clause is otherwise introduced by a relative pronoun. In general though, it does not matter what the PRED of the UDF is, just that it has one. The least specific PRED value in LFG is 'pro' and this is the value that is typically used when no specific value seems appropriate. There is also work in the transformational literature that indicates that null operators are a kind of *pro* (Browning 1987).

The second way to satisfy the ECC is through anaphoric binding, which involves the s-structure feature ANTECEDENT. This is sketched in (5.27):

(5.27)
$$\begin{bmatrix} \text{PRED} & `\ldots' \\ \text{UDF} & \begin{bmatrix}\text{PRED} & `\ldots'\end{bmatrix} \\ \text{GF} & \begin{bmatrix}\text{PRED} & `\ldots'\end{bmatrix} \end{bmatrix} \quad \xrightarrow{\sigma} \quad \begin{bmatrix} \text{ANTECEDENT} & \begin{bmatrix}\ \end{bmatrix} \end{bmatrix}$$

The UDF is integrated into the grammatical representation by anaphorically binding an argument.

Independent aspects of the theory I have presented together entail that a resumptive binder must satisfy the ECC through the anaphoric binding option. The resumptive pronoun itself contributes a PRED, on the assumption that it is an ordinary pronoun. The top of the unbounded dependency, i.e. the binder in the binder-resumptive dependency, will also contribute a PRED feature. The value of the feature PRED is a *semantic form* (Kaplan and Bresnan 1982:32–35[177–180]). Each instance of a semantic form is unique (Kaplan and Bresnan 1982:124–125[274]). This means that even two semantic forms that bear the same information, e.g. 'pro', cannot be equated. If two different sources attempt to specify an f-structure's PRED value, there is therefore a violation of the Uniqueness Condition (also known as Consistency; Kaplan and Bresnan 1982:58[204], Dalrymple 2001:39). Uniqueness requires that each f-structure may only have one value for a particular attribute, but since semantic forms cannot be merged there would be two values for the attribute PRED. If a resumptive pronoun is an ordinary pronoun which contributes a PRED attribute and the top of the unbounded dependency (e.g., a *wh*-phrase or SpecCP itself) also contributes a PRED attribute, then there cannot be functional equality between the resumptive pronoun's f-structure and the f-structure of the UDF, since this would result in a Uniqueness violation. This entails that the only way to integrate the binder in a binder-resumptive dependency is through anaphoric binding.

We can use the fact that a resumptive pronoun's binder is an unbounded dependency function to further refine the lexical specification of manager resources. The binding equation in (5.19) can therefore be rewritten as:

(5.28) $(\uparrow \text{UDF})_\sigma = ((\uparrow \text{GF}^+)_\sigma \text{ ANTECEDENT})$

We can then replace the manager resource (5.20) with the one shown in (5.29).

(5.29) $[(\uparrow \text{UDF})_\sigma \multimap ((\uparrow \text{UDF})_\sigma \otimes (\uparrow \text{GF}^+)_\sigma)] \multimap [(\uparrow \text{UDF})_\sigma \multimap (\uparrow \text{UDF})_\sigma]$

We thus get a version of the manager resource that is specified locally to the UDF that binds the resumptive pronoun.[5] The local name specification in (5.21) is essentially unaffected, except that we replace $\%\text{GF} = (\uparrow \text{GF})$ with $\%\text{GF} = (\uparrow \text{UDF})$.

5.2.3 Dependency mismatch and relabeling

There is a final complication that must be dealt with to fully integrate manager resources into Glue Semantics for LFG. The issue is best highlighted if we consider another expository "resumptive" sentence, this time with a *wh*-phrase binder:

(5.30) Who did Thora see <u>him</u>?

I reiterate that I am using English words only for exposition and am not claiming that English is a resumptive pronoun language. The theory constructs the mnemonically labelled f-structure and s-structure in (5.31) for (5.30).

[5] We can in fact take advantage of the projection architecture and use inside-out functional uncertainty at semantic structure to define a completely local version of the manager resource. Observe that the local UDF is the ANTECEDENT of GF^+ at s-structure, given the binding equation in (5.19). The following equality therefore holds:

(i) $(\uparrow \text{GF}^+)_\sigma = (\text{ANTECEDENT } (\uparrow \text{UDF})_\sigma)$

The right hand side of the equation picks out the node at semantic structure that has a feature ANTECEDENT whose value is the s-structure node corresponding to the local UDF. We know by (5.19) that the UDF is the ANTECEDENT of the resumptive pronoun, which is the GF^+ in question. Given this equality we can replace (5.20) with (ii):

(ii) $[(\uparrow \text{UDF})_\sigma \multimap ((\uparrow \text{UDF})_\sigma \otimes (\text{ANTECEDENT } (\uparrow \text{UDF})_\sigma))] \multimap [(\uparrow \text{UDF})_\sigma \multimap (\uparrow \text{UDF})_\sigma]$

This is a completely local specification of the manager resource. However, its specification depends on the binding equation (5.19), which is non-local, since anaphoric binding is unbounded. As the inside-out functional uncertainty in (ii) may be a little bit hard to keep track of for some readers, I do not use (ii) and instead specify manager resources as in (5.20) and (5.29). It is nonetheless useful to know that (ii) is a possible specification for manager resources.

(5.31)
$$s\begin{bmatrix} \textsc{pred} & \text{`see'} \\ \textsc{focus} & w\begin{bmatrix} \textsc{pred} & \text{`pro'} \\ \textsc{prontype} & \text{wh} \end{bmatrix} \\ \textsc{subj} & t\begin{bmatrix} \textsc{pred} & \text{`Thora'} \end{bmatrix} \\ \textsc{obj} & p\begin{bmatrix} \textsc{pred} & \text{`pro'} \end{bmatrix} \end{bmatrix} \quad \sigma \quad \begin{bmatrix} \textsc{antecedent} & \begin{bmatrix}\ \end{bmatrix} \end{bmatrix}$$

The manager resource will remove the pronominal resource contributed by the resumptive pronoun *him*, clearing the way for the dependency on the resumptive, $p \multimap s$, to serve as the scope of the *wh*-phrase.

However, there is a slight hitch that has to do with how the resource mapping and naming works. The binder in the binder resumptive dependency is a scopal element that needs to find its scope. The generalized meaning constructor for the *wh*-word *who* is shown in (5.32) and the instantiated version in terms of node labels from the f-structure above is shown in (5.33):

(5.32) $\forall X.[(\uparrow_\sigma \multimap X)] \multimap \mathrm{X}]$

(5.33) $\forall X.[(w \multimap X) \multimap X]$

The scope of the binder is specified in terms of its local f-structure label, which is w. But the dependency which it actually needs to consume, the one left by removal of the resumptive pronoun, is not a dependency on w. It is a dependency on p, the resumptive pronoun's label. That is, the dependency available is $p \multimap s$, but the *wh*-word needs something of the form $w \multimap X$. Putting things another way, the predicate that locally selects for the resumptive does not "know" that it is in a resumptive environment and the binder does not "know" that it is in a binder-resumptive dependency. The top and the bottom of the binder-resumptive dependency are completely locally specified and blind to what is happening elsewhere in the structure.

This local / blind specification holds for filler-gap dependencies too, but the crucial difference is that these are integrated through functional equality. The situation is sketched in the following f-structure:

(5.34)
$$s\begin{bmatrix} \textsc{pred} & \text{`\ldots'} \\ \textsc{focus} & w\begin{bmatrix} \textsc{pred} & \text{`\ldots'} \end{bmatrix} \\ \textsc{gf} & \underline{\qquad\qquad} \end{bmatrix}$$

The f-structure of the filler is the same f-structure as that of the gap and the scope of the filler will therefore match the dependency that is missing the gap. In this case the scope of the filler will be specified as $\forall X.[(w \multimap X) \multimap X]$ and the dependency on the functionally bound GF will be $w \multimap s$.

The problem of dependency mismatch exemplified by (5.31) above extends to other kinds of binder-resumptive dependencies. For example, the relative clause predicate that modifies a common noun is named locally in terms of the attribute TOPIC. If the relative clause is a resumptive relative, the TOPIC f-structure anaphorically binds the f-structure of the resumptive pronoun. However, the two f-structures are distinct. The relative clause modifier's first argument will be named in terms of the f-structure of the unbounded dependency function TOPIC, but the predicate that contains the resumptive pronoun is named in terms of the resumptive's f-structure. Again there is a mismatch between the dependencies.

This dependency mismatch problem does not have the same status as the resource surplus problem that manager resource solve. The latter problem stems from an assumption that resumptives are ordinary pronouns and the hypothesis of Resource Sensitivity. The resource surplus problem concerns the whole enterprise of using a resource logic at the syntax–semantics interface. By contrast, the dependency mismatch problem is essentially a bookkeeping problem. It concerns how resources are *labelled* based on the regular mapping from the syntax to the linear logic proofs. A valid linear logic proof could easily be constructed from the relevant premises so long as the resource labels could be made to match. There are various ways one could think of doing this. One way would be to have pronouns output a multiplicative conjunction that has as conjuncts two instances of the antecedent-labeled resource, rather than an antecedent-labeled conjunct and a pronominal-labeled conjunct. Another option would be to state that unbounded dependency functions that are integrated into the grammatical representation by anaphorically binding an argument bear the resource identifier of the argument. Either option would effectively mean that a pronominal resource has the form $b \multimap (b \otimes b)$. The dependency mismatch would not arise, then, because the dependency on the resumptive pronoun would be stated in terms of the binder's resource identifier.

A simpler option than modifying the basic resource-mapping conventions is available, though. The licensers of resumptive pronouns not only contribute manager resources, they also perform *resumptive dependency relabeling* by contributing an additional meaning constructor of the following general form:

(5.35) $\lambda P.P : ((\uparrow \text{GF}^{+})_{\sigma} \multimap \uparrow_{\sigma}) \multimap ((\uparrow \text{UDF})_{\sigma} \multimap \uparrow_{\sigma})$

This meaning constructor takes a dependency on a resumptive pronoun and returns a dependency on the unbounded dependency function that binds it, without affecting the semantics (the meaning language is just an identity function). This meaning constructor can be further controlled by using local names, as was shown above:

(5.36) $\lambda P.P : (\%\mathrm{RP}_\sigma \multimap \uparrow_\sigma) \multimap (\%\mathrm{GF}_\sigma \multimap \uparrow_\sigma)$

With this meaning constructor, the problematic resumptive dependency $p \multimap s$ for (5.31) is consumed and the dependency $w \multimap s$ is produced. This dependency can serve as the scope for the *wh*-phrase that is the resumptive's binder. The same dependency relabeling will properly adjust a relative clause predicate. Dependency relabeling is a general lexical mechanism for renaming dependencies at the top and bottom of binder-resumptive dependencies that are mismatched due to the normal resource naming conventions.

5.3 A problematic alternative analysis

There is an alternative LFG analysis of resumptive pronouns that seems initially plausible. Since it is an analysis that might seem tempting to LFG theoreticians, I want to quickly sketch it and explain why it is untenable.

It is common in LFG analyses of pro-drop and incorporated pronominals to specify a pronoun with an optional PRED feature and a verb or predicator that optionally provides a PRED 'pro' for the null grammatical function (Grimshaw 1982, Andrews 1990, Bresnan 2001). This means that the verb can provide the grammatical function information of, e.g., its subject at f-structure through its morphological inflection. The null pronoun is completely absent at c-structure and does not correspond to a silent *pro*. If the verb does not provide the pronominal information but the pronoun's PRED feature is optional, then we get a system in which pronouns may occur as purely grammatical markers in addition to other overt grammatical functions, as in clitic doubling (Grimshaw 1982, Bresnan 2001). Finally, if pronouns do not have optional PRED features but certain verb forms also provide PRED 'pro' to a grammatical function, we get a situation in which synthetic verb forms containing pronominal information cannot occur with overt pronouns, which is the basis for Andrews's (1990) analysis of the Irish synthetic and analytic verbs that were discussed in section C of chapter 4.

None of these proposals were concerned with semantics, but the necessary move would be to state that whatever provides a PRED PRO feature also provides a pronominal meaning constructor.

For example, in a subject pro-drop language, the finite verb optionally provides a pronominal meaning constructor for a missing pronominal subject. I have previously sketched this sort of analysis for Serbo-Croatian pro-drop (Asudeh 2000, 2003b). The potentially tempting LFG analysis is to simply treat resumptive pronouns as lacking a PRED 'pro' and a pronominal meaning constructor. In that case, there would be no resource surplus, since there is no extra pronominal resource.

There are a number of objections to such a proposal. First, if the resumptive pronouns can simply lack PRED features and meaning constructors, this predicts that it should be independently possible to use them as grammatical markers or doubled clitics. This is not the case in many resumptive pronouns languages, including the ones examined here. There are certain resumptive pronouns in languages like Greek that may be candidates for this kind of analysis, though (Alexopoulou 2003 provides an excellent recent overview of resumption in Greek). Second, in many languages the strong pronouns are used in resumption (Aoun and Li 2003), but weak pronouns are used for marking and/or clitic doubling. The proposal would therefore make two wrong empirical predictions: that strong pronouns could be used for marking and clitic doubling and that weak pronouns could be used as resumptives. These predictions are in general false. Third, as alluded to by the mention of strong and weak pronouns, many languages distinguish pronouns with optional PRED features morphologically and phonologically. The prediction is therefore that resumptive pronouns could have a special form. However, this is overwhelmingly false, as argued in chapter 4. Fourth, in general resumptive pronouns in many languages would be predicted to have much freer distribution than they in fact do. PRED features, or alternatively meaning constructors (see section 3.3.2 of chapter 3), are the principal methods in LFG for ensuring that extra lexical material surfaces in a controlled manner. Since elements of c-structure rules are typically thought to be optional, c-structure realization does not provide tight enough control.

In sum, it is not tenable within LFG to simply assume that resumptive pronouns have no meaning constructor. Such a theory would make several wrong predictions and would have a hard time explaining the realization and distribution of resumptives.

5.4 Theoretical implications

The resource management theory of resumptives treats resumptive pronouns as ordinary pronouns that constitute surplus resources. The licensing mechanism for resumption is a manager resource. A manager resource consumes the surplus resumptive pronoun resource, allowing the composition of the unbounded dependency to proceed as if the resumptive had been absent. The fact that the pronoun is treated as an ordinary pronoun means that the pronoun is syntactically and lexically distinct from a gap, which in this theory is literally nothing. That is, a gap is not a trace or a special gap object (e.g., the gap-$synsem$ of Bouma et al. 2001), but rather an unrealized syntactic argument that is integrated into the grammatical representation by either being functionally equated with or anaphorically bound by an unbounded dependency function.

The manager resources that license resumptives are lexically contributed meaning constructors and are therefore specified in particular lexical entries. The theory makes the following prediction:

(5.37) Resumption must be licensed through the presence of lexically-specified licensers in lexical inventories.

This theory is thus solidly lexicalist. Theories as otherwise disparate as Lexical Functional Grammar, Head-driven Phrase Structure Grammar, Principles and Parameters Theory (specifically, the Minimalist Program), and Categorial Grammar have converged on the desirability of locating language variation in the lexicon.

Given the uncontroversial premise that lexical specification affects morphological exponence, the theory makes the following further prediction:

(5.38) Resumptive licensers may be distinguished by morphology or lexical class.

This prediction is borne out by the complementizer system of Irish, as we will see in detail in the next chapter. The prediction will be further discussed in Chapter 9, after the theory of resumption has been extended to copy raising.

Finally, the theory offers an answer to what must be one of the central questions about resumption:

(5.39) Why are only pronouns used for resumption?
Pronouns are the only items used for resumption because they lack inherent meaning.

The Glue specification of the linear logic term for a pronoun and the way in which pronouns take their antecedents are such that pronouns are the only lexical items that can be consumed by manager resources. Thus, the first answer to this question is that pronouns are the only things that can be used in resumption because they are the only things that have the correct form in the resource logic to be consumed by manager resources. The question then becomes why pronouns have the form that they do. They have this form because on a variable-free theory of anaphora, such as the one presented here, a pronoun is a function on its antecedent. However, the pronoun must also replicate the antecedent resource. The answer thus becomes that pronouns are used in resumption because of how they receive their meanings. The question then becomes why pronouns receive their meanings in this manner. The answer is that pronouns receive their meanings in the specific manner that they do because they lack inherent meaning and must take on the meaning of their antecedent, through saturation, coreference, or binding. In other words, pronouns are the only items used for resumption because they lack inherent meaning. It is therefore unsurprising that pronominal elements can be consumed by manager resources, because it is precisely these elements whose removal is recoverable from elsewhere in the semantics.

5.4.1 Explaining the descriptive characteristics of resumptives

In the previous chapter I presented a descriptive overview of resumptive pronouns and identified seven characteristics of resumptives. The two definitional characteristics are the following:

A. Resumptive pronouns occur in unbounded dependencies.

B. Resumptive pronouns are interpreted as bound pronouns.

These properties follow from the manager resources that license resumptives. The manager resource identifies the resumptive in terms of an unbounded dependency function and binds the resumptive to the UDF. The manager resource then removes the pronoun from composition. Well-formedness of the result depends on something else consuming the dependency on the resumptive pronoun, since that dependency can no longer consume the pronoun which is gone. Ultimately, it is the top of the unbounded dependency that in one way or another consumes the vacated dependency. The result is that the resumptive is licensed only in an unbounded dependency and is interpreted as a bound pronoun. In fact, in terms of semantic composition (i.e., the proofs) and semantic representation (i.e., the meaning language side of the Glue logic) the resumptive pronoun is just like a gap: a bound argument.

Resumptive pronouns are syntactically and lexically just ordinary pronouns, though, as per the third characteristic:

C. Resumptive pronouns are the ordinary pronouns of the language.

On this theory resumptives are not gaps that somehow surface with a pronominal form. The only way in which resumptives resemble gaps is at the level of semantic composition, as mentioned above. But this has nothing to do with information that is specified for the resumptive pronoun and is rather the effect of a manager resource. There is no special lexical specification or resumptive "feature" that is borne by a pronoun or required by a manager resource: resumptive pronouns are just ordinary pronouns. The analysis therefore predicts that resumptive pronouns are morphologically identical to non-resumptive pronouns with the same case and agreement features. For example, if the third person object pronoun in some language is *foo* and the language has resumptives, then the third person object pronoun will also be *foo* in its resumptive usage. In fact, manager resources consume components of pronominal *meaning* (resources for composition) and are completely insensitive to the form of the pronoun. This means that a manager resource licenses all instances of pronominal information, whether instantiated by a free-standing pronoun or incorporated into a head (such as Irish verbs and prepositions).

The fourth characteristic of resumptive pronouns concerns their syntactic distribution:

D. Resumptive pronouns and gaps have distinct syntactic distributions.

While it is true that resumptives and gaps often overlap in their distribution, their distributions are not identical. In each resumptive language, there are normally at least some positions or grammatical functions that resumptives can fill but not gaps, and vice versa. The theory presented here does not specify specific positions in which resumptives may not appear or in which they must appear. Rather, like the theory of McCloskey (1990), resumptives appear obligatory where gaps are blocked by independent aspects of the theory and similarly resumptives can be blocked from certain positions or grammatical functions for independent reasons. We will see an example of this kind of interplay for Irish in the next chapter. Resumptives are obligatory as objects of prepositions. This is not hardwired into the lexical entry for the manager resources, the complementizer *aN* or any other aspect of the analysis. The obligatoriness arises because the complementizer that licenses gaps (*aL*) cannot reach prepositional objects, since these are necessarily embedded in an OBL or other appropriate grammatical function.

The fifth descriptive characteristic concerned the interpretation of resumptives:

E. Resumptive pronouns display restrictions on their interpretation which gaps do not.

The fact that resumptive pronouns are bound arguments, just like gaps, does not mean that they cannot place further restrictions on interpretation. Gapped objects of intensional verbs like *seek* allow both *de re* / specific and *de dicto* / non-specific readings, whereas corresponding resumptives allow only specific readings (Doron 1982, Sells 1984, 1987). Zimmermann (1993) has argued against the classic quantifier scope analysis of the specific / non-specific difference for certain intensional verbs, including *seek*. He has shown that properties of the quantified DP are relevant to whether the ambiguity arises, as are properties of the particular verb. He notes in particular that the class of quantifiers that induce de dicto readings in opaque verbs are those that can be characterized as existential (Zimmermann 1993:163). The opaque verb takes as an object the relativizing property of the quantifier (Zimmermann 1993:164–165). Sells (1984, 1987) has shown that the relevant kind of non-specific reading, which he calls a *concept* reading, is similarly unavailable for pronouns in general. For example, the mini-discourse in (5.40) can only mean that Dani is looking for a particular unicorn that is tall. It cannot mean that Dani is looking for something or other that is a unicorn and is tall.

(5.40) Dani seeks a unicorn. It is tall
(Sells 1987:290, ∼(52b))

The general conclusion that Sells (1984, 1987) comes to is that the restriction on interpretation for resumptives hold for non-resumptive pronouns too and is explained if resumptive pronouns are ordinary pronouns.

Even though manager resources remove pronouns from composition, these pronouns can still place conditions on their antecedents. I have been assuming a simple extensional semantics, but an intensional semantics would have to be assumed to handle individual concepts (for intensional semantics in Glue, see Dalrymple et al. 1999c), which is what Sells (1984) argues the object of *seeks* denotes. Zimmermann's (1993) treatment is more sophisticated and complex, but it is not at base incompatible with this. If a pronoun takes only a type e antecedent, following Sells (1984, 1987), then it can only be of type $\langle e, \langle e \times e \rangle \rangle$. Since an individual concept has type $\langle s, e \rangle$, a pronoun cannot take it as an antecedent. Since resumptive pronouns on this theory are ordinary pronouns. This means that a manager resource can only consume an ordinary pronoun, which cannot take a concept antecedent. It thus follows without further ado that resumptive pronouns have the same restriction on interpretation as ordinary pronouns: resumptive pronouns just are ordinary pronouns.

The sixth characteristic of resumptives concerns the difference between resumptive unbounded dependencies and those involving gaps:

F. Resumptive pronouns do not display certain key characteristics of gaps.

Two particular hallmarks that were identified were island sensitivity and form-identity effects.

The lack of island sensitivity follows directly from the Extended Coherence Condition and the fact that the theory presented here treats resumptives as ordinary pronouns. The ECC requires that an unbounded dependency function be integrated into the grammatical representation either through functional equality or anaphoric binding. The ordinary pronoun theory means that the pronoun contributes full syntactic information to f-structure, including a PRED feature. The top of the unbounded dependency will also contribute a PRED feature. It is impossible to functionally equate two grammatical functions that each have a PRED feature, because the value of PRED is a unique semantic form and the result of the attempted functional equality will necessarily violate Uniqueness. The only option available is anaphoric binding. Now, anaphoric binding is in general not sensitive to islands. It therefore follows that binder-resumptive dependencies are not island sensitive, because the mechanism that integrates them — anaphoric binding — is not island sensitive.

Form-identity effects concern features borne by the unbounded dependency function that could only be assigned at its terminus, such as case (Merchant 2001:128–146). The observation is that such form-identity effects routinely arise for filler-gap dependencies but not for binder-resumptive dependencies. This is predicted by the theory. The ordinary pronoun theory of resumptives and the ECC requires that the grammatical function of the resumptive and the unbounded dependency function of the binder have distinct f-structures as values. Therefore, whatever features occur in the f-structure of the resumptive will not be transmitted to the f-structure of the binder, since it is a distinct f-structure. By contrast, filler-gap dependencies are realized via functional equality. The filler and the gap share the very same f-structure. Therefore, whatever features are added at the gap site will necessarily be borne by the filler.

The seventh and final characteristic that I presented is the one that is potentially most problematic for an ordinary pronoun theory of resumption, such as this one:

G. Resumptive pronouns resemble gaps in their interaction with certain grammatical phenomena.

If resumptives are ordinary pronouns then it may be surprising that they behave like gaps in certain respects. This characteristic is obviously not surprising if resumptives are not ordinary pronouns and are furthermore like gaps at some underlying level. I have two replies to this, both of which are explored in detail in chapter 7. The first reply is that this only counts against the theory presented here if the phenomena in question — reconstruction, across-the-board extraction, and parasitic gaps — are irreducibly *syntactic*, since resumptives in this theory are not like gaps at all in the syntax. However, as mentioned above, once manager resources are done with them, resumptives are like gaps in semantic composition and representation. Thus, if the phenomena in question are not syntactic but rather governed either at the proof level or in the meaning language, the theory in fact predicts the possibility of resumptives being like gaps with respect to these phenomena. It turns out that none of the phenomena are uncontroversially syntactic.

The second and more decisive reply concerns the interpretation of resumptives and constitutes an argument that an ordinary pronoun theory of resumptives is to be preferred despite these potentially problems. The form of the argument is simple. If resumptive pronouns are just “spelled out” gaps, then their morphological form is perhaps predictable given certain modern assumptions about morphological realization. The language that has constituted the best case for an analysis of resumptives as spelled out gaps is Swedish. I present data on Swedish that shows that the putatively spelled out gaps are also *interpreted* like pronouns and not like gaps. In particular, the same lack of non-specific reading that Doron (1982) identifies for Hebrew holds robustly for Swedish. This would be completely unpredicted if resumptives are underlyingly gaps. They should then be intepreted like gaps, whatever their surface form.

Chapter 6

Resumptives in Irish

Introduction

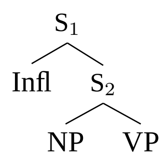
This chapter applies the resource management theory of resumption to a detailed empirical consideration of data from Irish. I first present the basic clausal structure of Irish that I am adopting (section 6.1), based on work by McCloskey (1979, 1996), Chung and McCloskey (1987), and Sells (1984). I adapt these proposals to LFG using Toivonen's (2003) theory of phrase structure. I then present in some detail the data that I aim to account for (section 6.2). In section 6.3 I present detailed analyses of core Irish filler-gap and binder-resumptive dependencies. In section 6.4 I extend these analyses to deal with the difficult "mixed chain" cases recently discussed by McCloskey (2002). I conclude the chapter with a discussion of the further empirical predictions of the analysis of Irish, some directions for future work, and an extended comparison to the recent Minimalist analysis of McCloskey (2002). Appendix B is a fragment of Irish, where I present some of the analyses in this chapter in more detail.

6.1 Basic clausal structure of Irish

The clausal structure of Irish has been described in detailed generative terms in work by McCloskey (see in particular McCloskey 1979, 1990, Chung and McCloskey 1987), and others (e.g., Sells 1984, 1987, Duffield 1995). In this section I will present the basic structure that I assume for Irish clauses, basically adapting the proposals of Chung and McCloskey (1987) to LFG. I also want to review the syntax of complementizers that I have previously presented elsewhere (Asudeh 2002b). The upshot of the analysis is that it reconciles two seemingly incompatible analyses of Irish complementizers, one by Sells in his dissertation (Sells 1984) and the other by McCloskey in various publications, but principally McCloskey (1979) and McCloskey (1996).

The basic clausal structure of Irish is VSO in finite matrix and subordinate clauses (McCloskey 1979, 1990, Chung and McCloskey 1987). The order in non-finite clauses is subject-initial and generally SOV, although SVO order occurs in certain dialects under certain conditions (Chung and McCloskey 1987:211–212,230–232). Chung and McCloskey (1987) argue that the complement of Infl in both finite and non-finite clauses is a small clause, yielding a structure like the following:

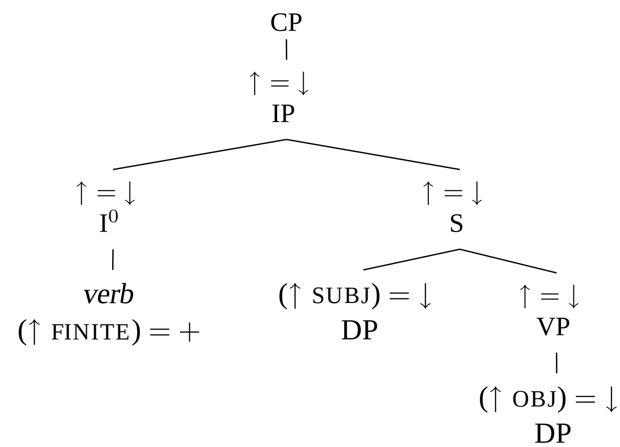
(6.1)



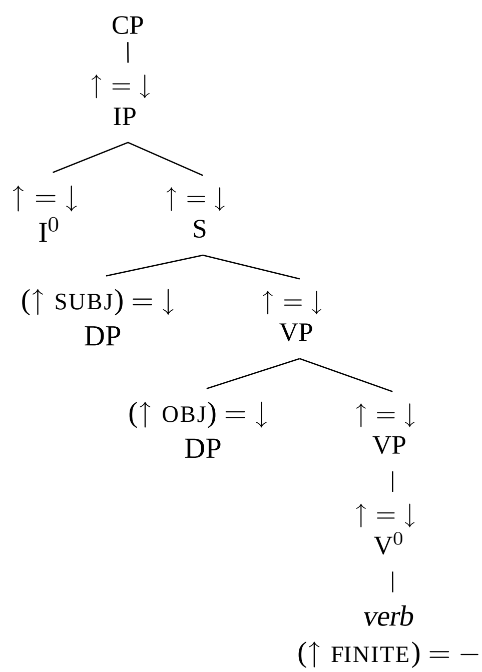
This structure accounts for the word order facts as follows on the Chung and McCloskey analysis. The finite verb moves from V to Infl (see also McCloskey 1996), with the subject in the NP position of the small clause and the object in the VP. This derives VSO order. The non-finite verb does not occupy Infl. It occupies V in the VP. This derives SV order. Base-generation of the object in a preverbal position would derive the correct word order in both finite and non-finite clauses: in finite clauses the verb moves to Infl, leaving the subject and object in place, and in non-finite clauses nothing moves and the correct SOV order is derived. However, Chung and McCloskey (1987:230) argue against this sort of analysis based on the fact that Irish is "an overwhelmingly regular head-initial language" (Chung and McCloskey 1987:230) and the fact that there are other kinds of VPs that have VO order. They instead propose an analysis on which the object moves and left-adjoins to the VP dominating the non-finite V. The final general aspect of Irish clause structure that bears mentioning is that pronominal direct objects tend to occur at the right edge of their clause (Chung and McCloskey 1987:195). That is, even though full objects immediately follow the subject and precede obliques and adverbials, pronominal objects follow obliques and adverbials and occur clause-finally.

I will adopt the structures that Chung and McCloskey propose for both finite and non-finite clauses, but since I am working in a non-transformational framework there will be no head movement from V to finite Infl, no leftward movement for adjunction of an object to the VP that contains non-finite V, and no rightward movement in postposing of a pronoun. Everything will instead be base-generated by c-structure rules and controlled by appropriate functional descriptions on these rules, as is standard in LFG. A small fragment of Irish is given in appendix B. Following King (1995) and Bresnan (2001:127–131), I derive the effect of head movement of V to I through lexical category specification. Finite verbs in Irish will have the category I^0 and non-finite verbs will have the category V^0. I will adopt Chung and McCloskey's small clause structure for the complement of I^0. I assume that full clauses in Irish have the category CP. The basic structures generated for finite and non-finite clauses are as follows:

(6.2)



(6.3)



These c-structures presuppose the theory of phrase structure developed by (Bresnan 2001) and (Toivonen 2001, 2003). Note that Infl in (6.2) counts as an extended head for the VP, satisfying the LFG version of endocentricity (Zaenen and Kaplan 1995:221, Bresnan (2001:132–134); see section 2.1). Note also that the equation $(\uparrow\ \text{FINITE}) = -$ on the verb in (6.3) will introduce this specification into the f-structure for the whole CP. Therefore a finite verb could not appear elsewhere in the c-structure material contributing to the matrix CP's f-structure.

The broad structure of Irish clauses is now in place. It is the complementizer system that is of key interest, though, since it is the complementizers *aL* and *aN* that register filler-gap and binder-resumptive dependencies. There is strong evidence that the Irish particles of particular interest here — *aL*, *aN*, and *go* — are indeed complementizers and not *wh*-words or relative pronouns (McCloskey 1979, 2001). First, they occur left-peripheral to the clause they introduce. Second, they co-occur with *wh*-words in questions, which indicates that they themselves are probably not *wh*-words. Third, they bear no inflection for case, animacy, number or gender, despite the fact that the pronouns of Irish normally inflect for one or more of these features (McCloskey 1979:11). Fourth, the complementizers do inflect for properties of the clause they introduce, in particular tense and mood, as summarized in Table 6.1 from McCloskey (1979:11, (18)). Based on this sort of evidence, McCloskey has consistently treated these particles as complementizers, right up to his most recent work (McCloskey 2001, 2002). McCloskey (2001) gives a thorough overview of arguments for the complementizer status of the particles.

	Non-past	Past
go		
Affirmative	***goN***	***gurL***
Negative	***nachN***	***nárl***
aN		
Affirmative	***aN***	***arL***
Negative	***nachN***	***nárL***
aL		
Affirmative	***aL***	***aL***
Negative	***nachN***	***nárL***

Table 6.1: Irish complementizers

However, Sells (1984:127–131) has explicitly argued that the particles are not complementizers and that they are actually head-adjoined to the verb. In particular, he proposes that the preverbal particles are base-generated as adjuncts to the verbal head:

(6.4)
```
      V
   /     \
particle   V
```

As adjuncts to V, the preverbal particles are still within the verbal domain. In fact, they are part of the core verbal domain, rather than the extended functional domain of the verb that complementizers appear in. The evidence that McCloskey gives for the complementizer status of the preverbal particles (that they are left-peripheral, register extraction phenomena, and register tense and negation information) is therefore compatible with Sells's position that they are head-adjoined to the verb.

Two pieces of evidence that Sells (1984) presents for his position are that no material can separate the particle from the verb, and that in VP-coordination structures the particle must occur in each conjunct, as shown here:

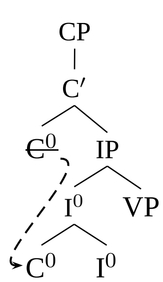
(6.5) a. an fear aL cheannaionn agus aL dhíolann tithe
the man aL buys and aL sells houses
the man that buys and sells houses
(Sells 1984:131, (25a))

b. *an fear aL cheannaionn agus d(h)íolann tithe
the man aL buys and sells houses
(Sells 1984:131, (25b))

If the particles occurred in C (COMP in Sells's terms), then the obligatory repetition of the particle in VP-coordination would be unexplained.

The claim that the particles are head-adjuncts to the verb is incompatible with the claim that they are complementizers if the complementizers project X-bar structure. For independent reasons having to do with adjunction, McCloskey (1996) proposes that there is complementizer lowering in Irish. He effectively ends up with a similar structure to (6.4), but by lowering of the complemenizer from CP to adjoin to Infl:

(6.6)

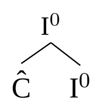


The C^0 does project a CP, but it is lowered and head-adjoined to I^0. The lowered C^0 under current transformational assumptions would leave a deleted copy at its extraction site.

In Asudeh (2002b) I present a base-generated LFG analysis that reconciles the head-adjunction analysis of Sells (1984) with the complementizer analysis of McCloskey (1996). Rather than lowering a complementizer, I built on Toivonen's theory of non-projecting words (Toivonen 2001, 2003).

Toivonen argues for a revised X-bar theory which accommodates heads that do not project any X-bar structure. These are non-projecting words, represented as $\hat{\mathrm{X}}$ ("X-roof"). Projecting heads are annotated X^0. In Toivonen's X-bar theory, non-projecting heads are head-adjoined to an X^0 (see chapter 2, section 2.1.2). I proposed that the Irish complementizers are base-generated as non-projecting adjuncts to I^0:

(6.7)



This structure is generated by the following c-structure rule:

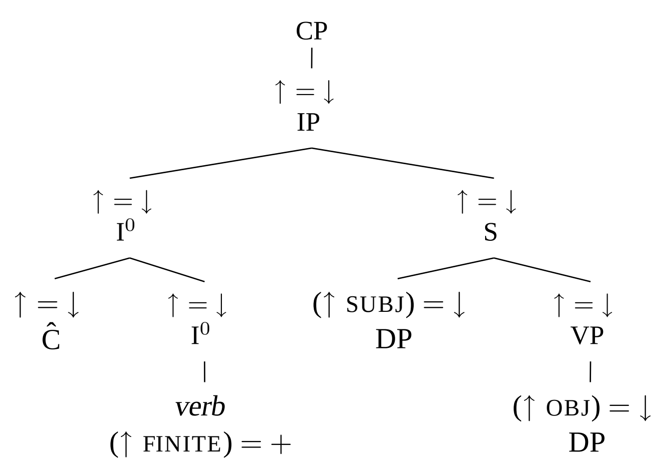
(6.8) $$\mathrm{I}^0 \longrightarrow \begin{array}{cc} \hat{\mathrm{C}} & \mathrm{I}^0 \\ \uparrow = \downarrow & \uparrow = \downarrow \end{array}$$

Part of the motivation for McCloskey's (1996) complementizer-lowering analysis was the explanation of certain facts about adjunction in Irish which motivate the presence of a CP node above IP. In Asudeh (2002b) I show how the base-generated non-projecting word analysis can ensure presence of such a CP node even though it is not projected by the non-projecting $\hat{\mathrm{C}}$. Here I will make the simplifying assumption that all selected COMPs in Irish are CPs (which is descriptively true) and that the c-structure rules generate CP nodes appropriately. The LFG theory of endocentricity and extended heads will again ensure that the CP has a head (in this case the $\hat{\mathrm{C}}$ and I^0 are co-heads of both IP and CP).

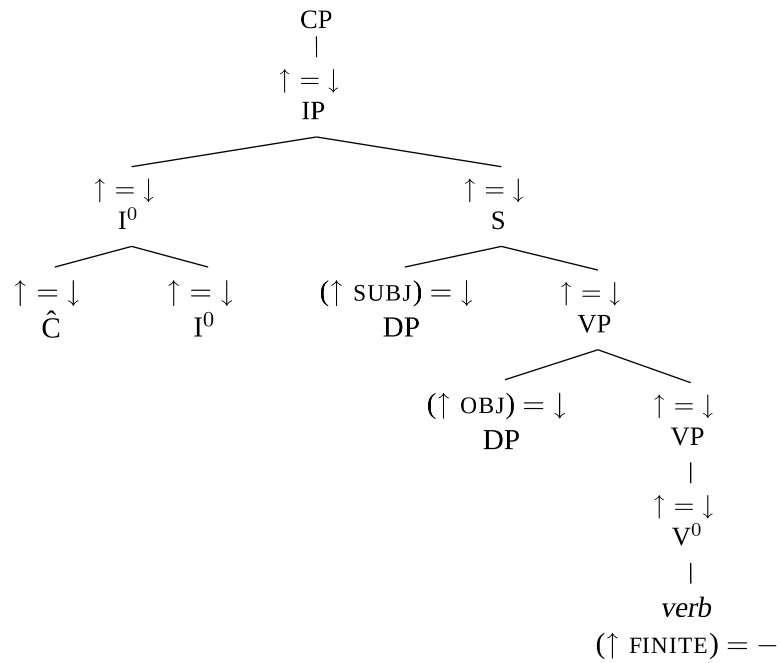
6.1.1 Summary

The resulting structure for finite and non-finite clauses are as follows:

(6.9)



(6.10)



These structures are based on the structures motivated by Chung and McCloskey (1987) and the theory of non-projecting heads developed by Toivonen (2001, 2003). The structure of the I^0 adjunction structure and the theory of non-projecting Irish complementizers is further developed in Asudeh (2002b). The LFG theory of Endocentricity and Extended Heads (Zaenen and Kaplan 1995, Bresnan 2001) is also instrumental to the analysis.

6.2 Irish unbounded dependencies: the data

We have already seen a lot of data on Irish in chapter 4. In this section, I want to present in one place the commonly occurring core patterns for unbounded dependencies, as well as three patterns that are much less frequent, but which nevertheless do occur in both spontaneous speech and text and must therefore be accounted for by the theory. The latter patterns are what McCloskey (2002) calls "mixed chains". I will continue to use this terminology for the sake of continuity with McCloskey's work, but the term "chain" is purely a descriptive one in this analysis and has no theoretical status. I will present both the core and peripheral patterns schematically, with relevant exemplification. Analyses follow in the next sections.

We have seen that unbounded dependencies in Irish may terminate in a gap or a resumptive pronoun, subject to relevant restrictions reviewed in chapter 4. The complementizers of Irish are sensitive to the two kinds of unbounded dependency: the complementizer *aL* registers gaps and the complementizer *aN* registers resumptive pronouns. The complementizers are morphonologically identical in the non-past form (see Table 6.1) but trigger different mutations on following words. The complementizer *aL* triggers a lenition mutation and the complementizer *aN* triggers a nasalization mutation. The corresponding suffixes *L* and *N* are therefore commonly used to differentiate the two complementizers. The neutral complementizer *go* is used when there is no unbounded dependency, in a sense to be made more precise shortly.

The basic patterns for one-clause cases are shown in (6.11) and (6.12) (McCloskey 1979, 1990, 2002).

(6.11) [$_{\text{CP}}$ *aL* ... __ ...]

a. an scríbhneoir a mholann na mic léinn __
the writer *aL* praise the students __
the writer whom the students praise
(McCloskey 1979:6, (6))

b. Céacu ceann a dhíol tú __ ?
which one *aL* sold you __
Which one did you sell?
(McCloskey 2002:189, (10a))

(6.12) [$_{\text{CP}}$ *aN* ... *Rpro* ...]

a. an scríbhneoir a molann na mic léinn <u>é</u>
the writer *aN* praise the students him
the writer whom the students praise (him)
(McCloskey 1979:6, (5))

b. Céacu ceann a bhfuil dúil agat <u>ann</u>?
which one *aN* is liking at.you in.it
Which one do you like?
(McCloskey 2002:189, (10b))

The resumptive pronoun need not be a free-standing pronoun. The pronominal information can be contributed by inflection on a head, as shown in (6.12b) (see section C of chapter 4).

The core multi-clausal patterns show an interesting divergence between the two unbounded dependency types. The filler-gap dependency is marked by an instance of *aL* on every clause from the filler to the gap. This is strong evidence for some kind of successive-cyclicity in the filler-gap dependency (McCloskey 1990, 2002), although it is not necessarily evidence of successive-cyclic *movement*, as demonstrated by Zaenen (1983) and Bouma et al. (2001), who offer non-transformational accounts of successive-cyclic unbounded dependency marking. By contrast, the common pattern for the binder-resumptive dependency marks only the top of the dependency (e.g., the first clause modifying a relative head). Intervening complementizer positions are marked by the neutral complementizer *go*. Thus, there is no evidence of successive cyclicity in binder-resumptive dependencies. The two patterns are shown here:

(6.13) $[_{\mathrm{CP}}\ aL \ldots [_{\mathrm{CP}}\ aL \ldots [_{\mathrm{CP}}\ aL \ldots \_\_ \ldots]]]$

a. an t-ainm a hinnseadh dúinn a bhi _ ar an áit
the name *aL* was-told to-us *aL* was _ the place
the name that we were told was on the place
(McCloskey 2002:190, (13a))

(6.14) $[_{\mathrm{CP}}\ aN \ldots [_{\mathrm{CP}}\ go \ldots [_{\mathrm{CP}}\ go \ldots\ Rpro \ldots]]]$

a. fir ar shíl Aturnae an Stáit go rabh siad díleas do'n Rí
men *aN* thought Attorney the State *go* were they loyal to-the King
men that the Attorney General thought were loyal to the King
(McCloskey 2002:190, (16))

These two patterns are the ones that any analysis of Irish unbounded dependencies must minimally explain.

However, McCloskey (2002) identifies three further multi-clausal patterns, which he calls "mixed chains". These are somehow peripheral but nevertheless part of the grammar of Irish, as clarified by the following quote from McCloskey (2002:195):

> Examples of both [core multi-clause] patterns turn up with great frequency in published texts and in speech, formal and informal. But many other examples turn up as well in written and oral usage. Many of these examples seem to represent only "noise" — errors of production, the consequence of ill-informed copy-editing, or nonce productions which aren't replicable. Others, however, represent patterns which recur and which can be investigated in a systematic way with native speaker consultants ... Although these

> constructions turn up in speech and writing, they are rarer than the two [core multi-clause patterns]. The patterns are real, but are liminal parts of the language, lying at the edge of people's competence and at the edge of their experience.

It is clear, then, that a fully explanatory account of Irish unbounded dependencies must extend to mixed chains, because they are real parts of the grammar, although peripheral. McCloskey (2002:195) goes on to note that:

> What the patterns have in common is that they all involve a resumptive pronoun, but they also have a "successive-cyclic" character in the sense that they involve distinctive morphosyntactic marking of intermediate positions.

I will follow McCloskey's (2002) usage and simply refer to the three mixed chain patterns as Patterns 1, 2, and 3.

Pattern 1 concerns the Complex NP Constraint. The key to understanding the pattern lies in the fact that complex NPs, unlike other islands, have an internal clause that can host an unbounded dependency. McCloskey (2002:195–196) notes that the "commonest way to realize" complex NPs is the core resumptive pattern (6.14):

(6.15) achan rud a rabh dóchas aca go dtiocfadh <u>sé</u>
every thing *aN* was hope at-them *go* come.COND it
everything that they hoped (that it) would come
(McCloskey 2002:196, (26a))

Pattern 1 is an alternative way to realize complex NPs, with *aL* marking the NP-internal complementizer, rather than *go*. This gives rise to the mixed chain shown in (6.16).[1]

(6.16) $[_{CP}$ *aN* $\ldots [_{NP}$ N $[_{CP}$ *aL* $\ldots$ __ $\ldots]]]$

a. rud a raibh coinne aige a choimhlíonfadh __ an aimsir
thing *aN* was expectation at-him *aL* fulfill.COND __ the time
something that he expected time would confirm
(McCloskey 2002:196, (28))

b. biseach ... a raibh súil agam a bhéarfá __
recovery *aN* was hope at-me *aL* get.COND.2SG __
a recovery that I hoped you would stage
(McCloskey 2002:196, (29))

[1]These examples and others that McCloskey (2002:196) gives are attested examples.

McCloskey (2002:196–197) notes that a filler-gap dependency internal to the complex NP, signalled by *aL*, is unsurprising. It arises through the normal filler-gap mechanism, since there is a filler position free within the embedded clause (SpecCP on both his theory and this theory) and there is no island constraint violation in relating a gap to a filler in this position. However, given that *aN* normally signals the presence of a resumptive pronoun, the question is: where is the resumptive pronoun (McCloskey 2002:197)?

Pattern 2 is the inverse of Pattern 1. In Pattern 2, a resumptive pronoun in the lower clause occurs in a position that is inaccessible to a filler-gap dependency (for independent reasons) and is signalled by the resumptive complementizer *aN*. The complementizer in the higher clause is the complementizer *aL*, which signals a filler-gap dependency:

(6.17) $[_{\text{CP}}$ *aL* ... $[_{\text{CP}}$ *aN* ... *Rpro* ...]]

a. aon duine a cheap sé a raibh ruainne tobac aige
any person *aL* thought he *aN* was scrap tobacco at-him
anyone that he thought had a scrap of tobacco
(McCloskey 2002:198, (34))

b. Cé is dóigh leat a bhfuil an t-airgead aige?
who *aL*.COP.PRES likely with-you *aN* is the money at-him
Who do you think has the money?
(McCloskey 2002:198, (35))

c. an galar a chuala mé ar cailleadh bunadh an oileáin leis
the disease *aL* heard I *aN* died people the island [GEN] by-it
the disease that I heard that the people of the island died of (it)
(McCloskey 2002:198, (36))

McCloskey (2002:198) notes that this pattern is explained (in the transformational terms he is working in) if there is binding of the resumptive by an operator in the lower SpecCP, with subsequent movement of the operator to the higher SpecCP, as suggested by Finer (1997) for similar Selayarese data. The lower dependency in the chain is a binder-resumptive dependency, while the higher dependency is a filler-gap dependency.

Pattern 3 is a mix of Patterns 1 and 2. Like in Pattern 2, a resumptive pronoun in the lower clause occurs in a position that is inaccessible to a filler-gap dependency and is signalled by the resumptive complementizer *aN*. But, like in Pattern 1, the higher clause is also introduced by the resumptive-sensitive complementizer:

(6.18) $[_{\mathrm{CP}}$ *aN* … $[_{\mathrm{CP}}$ *aN* … *Rpro* …]]

a. an bhean a raibh mé ag súil a bhfaighinn uaithi é
the woman *aN* was I hope.PROG *aN* get.COND.1SG from-her it
the woman that I was hoping that I would get it from (her)
(McCloskey 2002:199, (41))

b. san áit ar dúradh leis a bhfaigheadh sé Jim ann
in-the place *aN* was-told with-him *aN* find.COND he in-it
in the place where he was told that he would find Jim
(McCloskey 2002:199, (43))

c. na cuasáin thiorma ar shíl sé a mbeadh contúirt ar bith uirthi tuitim síos ionnta
the holes dry *aN* thought he *aN* would-be danger any on-her fall.[−FIN] down into-them
the dry holes that he thought there might be any danger of her falling down into them
(McCloskey 2002:199, (44))

It appears that there are two binders for the single resumptive pronoun. This is problematic for the resource logic account, since there is apparently only one pronominal resource and two consumers for it, but it is also problematic on an operator-binding approach such as McCloskey's (2002), for reasons that will be clarified in section 5.4 below. The basic question for both kinds of theory boils down to the same question that Pattern 1 raises: where's the (other) resumptive pronoun?

In the following two sections (6.3 and 6.4) I will show how the theory of resumptive pronouns presented in chapter 5 accounts for the data that we have seen in this section. The strategy is to start with the simple core patterns, extend to the core multi-clausal patterns, and then extend further to the mixed chains. The analysis accounts for all the data types presented here, as well as the descriptive characteristics presented in chapter 4. Considerations of the theoretical implications of the analysis, its further empirical predictions, and how it accounts for the descriptive characteristics of resumptive pronouns were presented in section 5.4 of chapter 5. Readers may wish to refer back to that section occasionally. The analysis of Irish is tightly constrained on the one hand by the dictates of the theory, in particular the hypothesis of Resource Sensitivity, and on the other hand by empirical observations and generalizations about the language. As befits a lexicalist theory, the heart of the analysis is in the lexical specifications for the complementizers. As the data that is accounted for becomes increasingly complex, the lexical specifications of the complementizers are increasingly fine-tuned.

6.3 Analysis: the core patterns

6.3.1 Filler-gap dependencies

Let us first consider a simple filler-gap dependency signalled by *aL*:

(6.19) $[_{\text{CP}}$ *aL* … _ … $]$

(6.20) an scríbhneoir a mholann na mic léinn _
the writer *aL* praise the students _
the writer whom the students praise
(McCloskey 1979:6, (6))

The crucial c-structure rules for the analysis of unbounded dependencies are the rules for CP and relative clause modifiers of nominals in (6.21) and (6.22):

(6.21)
$$\text{CP} \longrightarrow \left\{ \begin{array}{c} \text{XP} \\ (\uparrow \text{FOCUS}) = \downarrow \end{array} \;\middle|\; \begin{array}{c} \epsilon \\ (\uparrow \text{TOPIC PRED}) = \text{‘pro’} \\ \left(\begin{array}{c} (\text{ADJ} \in \uparrow) \\ REL_\sigma \end{array} \right) \end{array} \right\} \begin{array}{c} \text{C}' \\ \uparrow = \downarrow \end{array}$$

(6.22)
$$\text{NP} \longrightarrow \begin{array}{c} \text{NP} \\ \uparrow = \downarrow \end{array} \quad \begin{array}{c} \text{CP}^* \\ \downarrow \in (\uparrow \text{ADJUNCT}) \end{array}$$

The NP rule adjoins zero or more CPs to NP, as indicated by Kleene star on CP, and specifies that they are members of the nominal's ADJUNCT set. This treats relative clause modification as flat, multiple-branching in c-structure. Nothing much hinges on this though. A more articulated structure can be introduced by removing the Kleene star. This would generate binary branching NPs instead.[2]

The CP rule realizes SpecCP as one of two options.[3] If CP is a *wh*-question or cleft, SpecCP is realized as the left option, an XP that serves as the FOCUS of the clause. This XP will dominate

[2]This follows from the fact that all c-structure material is optional, which means that all c-structure rule elements are optional (Kroeger 1993, King 1995, Bresnan 2001, Dalrymple 2001; see section 2.1). An NP with no CP sister is generated by leaving out the CP, and each NP can only have one CP sister, yielding binary branching.

[3]Since all c-structure nodes are optional, it follows that a CP need not have a specifier at all. It is only when the specifier is present at all that it must be realized as one of these two options.

the *wh*-constituent or clefted material, which will add further information to the clause's functional structure through lexical specifications. If CP is a relative clause, SpecCP is not phonetically realized, signified by the empty string 'ϵ', since Irish systematically lacks relative pronouns. The rule specifies that the relative clause has a TOPIC with a PRED. This is analogous to the situation described for an English relative clause that lacks a relative pronoun in section 5.2.2 of chapter 5. The proposal is thus similar to McCloskey's (2002) proposal that the relative operator is itself a *pro*. However, there is no null constituent proposed, since ϵ is by definition not realized in c-structure. In addition, when the CP is a relative clause (i.e., it is an ADJUNCT) the rule contributes a meaning constructor, abbreviated as REL_σ. This meaning constructor performs the modification of the relative head, integrating the relative clause semantics (Dalrymple 2001:417–419). This semantic function would be performed by relative pronouns in languages where they are obligatory (see Dalrymple 2001 for an analysis of English, where the relative pronoun can be optional).[4]

The last ingredient for the analysis of simple filler-gap dependencies is the lexical entry for *aL* in (6.23):

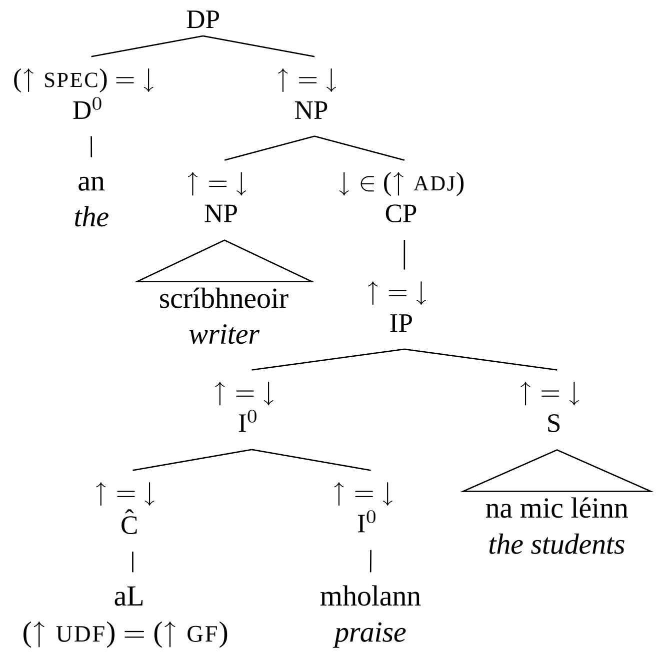
(6.23) *aL*: $\hat{\mathrm{C}}$ $(\uparrow \text{UDF}) = (\uparrow \text{GF})$

The lexical entry assigns the category $\hat{\mathrm{C}}$, a non-projecting complementizer, to *aL* (see section 6.1 above). The grammatical function UDF is mnemonic for *unbounded dependency function* and unpacks as either TOPIC or FOCUS (see page 154). The only f-structural information that *aL* specifies (so far) is that either the TOPIC or FOCUS of its clause is identified with some grammatical function in its clause.

The c-structure in (6.24) is constructed for the relative clause example (6.20). I have abbreviated irrelevant parts of the c-structure; see section 6.1 and the fragment in appendix B for further details.

[4] One could equivalently propose a null relative pronoun that contributes the PRED 'pro' and REL_σ (see the discussion in chapter 5, section 5.2.2).

(6.24)



Instantiating UDF and GF in the lexical entry for *aL* to TOPIC and OBJ constructs the following f-structure:

(6.25)

$$\begin{bmatrix} \text{PRED} & \text{‘writer’} \\ \text{SPEC} & \begin{bmatrix} \text{PRED} & \text{‘the’} \end{bmatrix} \\ \text{ADJ} & \left\{ \begin{bmatrix} \text{PRED} & \text{‘praise’} \\ \text{TOPIC} & \begin{bmatrix} \text{PRED} & \text{‘pro’} \end{bmatrix} \\ \text{SUBJ} & \begin{bmatrix} \text{“the students”} \end{bmatrix} \\ \text{OBJ} & \end{bmatrix} \right\} \end{bmatrix}$$

Notice the interplay between the CP rule (6.21) and the lexical entry for *aL*. The CP rule provides the PRED of the relative clause's TOPIC and the complementizer ensures that the TOPIC is integrated with the rest of the f-structure. The contribution of the complementizer ensures that the f-structure satisfies the Extended Coherence Condition (i.e., integration of the UDF at f-structure by functional equality). I will refer to this role of the complementizer *aL* as *filler grounding*, because it grounds the bottom of a filler-gap dependency by integrating it into the grammatical representation. The CP rule ensures that resulting shared TOPIC / OBJECT has a PRED value. If this were not the case, the f-structure of ‘praise’ would not meet the condition of completeness. Completeness requires that all arguments that are selected by a predicate must be realized in the predicate's f-structure and furthermore, that all semantic arguments (i.e., non-expletives) must have their own PRED. In sum, the relative clause formation rule and the entry for the complementizer *jointly* ensure the proper construction of the relative clause.

The role of filler grounding that *aL* performs directly explains the ungrammaticality of marking a filler-gap clause with *go*:

(6.26) *[$_{\text{CP}}$ *go* ... __ ...]

The neutral complementizer *go* only contributes information about mood (negation) and tense (past / non-past) to its clause. Without the contribution of *aL*, the relative clause is not well-formed, since the TOPIC is not integrated into the f-structure. This results in an Extended Coherence violation by the unintegrated TOPIC and a completeness violations by the OBJECT, since it must be identified with the TOPIC to receive a PRED.

A question might arise about ensuring that cleft and *wh*-question CPs cannot be substituted for the relative clause CP, resulting in an ungrammatical DP consisting of a relative head followed by a non-relative CP:

(6.27) * an scríbhneoir teach beag a cheannaigh muid
the writer house little *aL* bought we
* *the writer it was a little house that we bought*

In fact, nothing more needs to be said to block such ill-formed nominals. Their ungrammaticality follows from the resource logic itself. Clefts and *wh*-questions have sentential semantics and the linear logic proof of their semantics will terminate successfully in an atomic linear logic term. However, the resulting resource is not integrated into the semantics for the nominal and as a result the larger proof for a sentence containing the DP above will not terminate successfully, because the resource corresponding to the cleft or question will be left over. In other words, sentence (6.27) is ungrammatical because there is no successful proof of its semantics: it fails for reasons of semantic composition. The syntax does not need to repeat the work of the semantics and ensure that such sentences are blocked syntactically. The means to do so are there, but the resulting analysis would be less elegant.

Let us now turn to the core pattern for multi-clausal filler-gap dependencies:

(6.28) [$_{\text{CP}}$ *aL* ... [$_{\text{CP}}$ *aL* ... [$_{\text{CP}}$ *aL* ... __ ...]]]

(6.29)	an t-úrscéal	aL	mheas	mé	aL	thuig	mé ___
	the novel	*aL*	thought	I	*aL*	understood	I ___

the novel that I thought I understood
(McCloskey 1979:17, (42c))

The NP and CP rules above are sufficient for multi-clause cases. The embedded CP is a sentential complement (COMP) of the verb *mheas* (‘thought’).

It is instructive to see how what we already have fares with this sentence. As things stand now, each *aL* will contribute a filler-grounding equation, as shown schematically here:

(6.30)	an t-úrscéal [$_{CP}$	aL	mheas mé	aL	thuig mé ___
		$(\uparrow \text{UDF}) = (\uparrow \text{GF})$		$(\uparrow \text{UDF}) = (\uparrow \text{GF})$	

With the contributions of the NP and CP rules in (6.21) and (6.22) and other necessary rules, the following partial f-structure is constructed:

(6.31)
$$\left[\begin{array}{ll}
\text{PRED} & \text{‘novel’}\\
\text{SPEC} & \left[\text{PRED}\ \ \text{‘the’}\right]\\
\text{ADJ} & \left\{ t\left[\begin{array}{ll} \text{PRED} & \text{‘think’}\\ \text{TOPIC} & \left[\text{PRED}\ \ \text{‘pro’}\right]\\ \text{SUBJ} & \left[\begin{array}{ll}\text{PRED}&\text{‘pro’}\\ \text{PERS}&1\\ \text{NUM}&\text{sg}\end{array}\right]\\ \text{COMP} & u\left[\begin{array}{ll}\text{PRED}&\text{‘understand’}\\ \text{SUBJ}&\left[\text{“I”}\right]\\ \text{OBJ}&\left[\ \ \right]\end{array}\right]\end{array}\right]\right\}
\end{array}\right]$$

As things stand, this f-structure is ill-formed. The TOPIC of *t* is unintegrated and the OBJ of *u* does not have a PRED.

The information contributed by the two complementizers has not been added yet, but there is in fact no way to do this. The higher *aL* attempts to identify the TOPIC of its clause with some GF in its clause, but the only such GFs are SUBJ and COMP. Both of these GFs have their own PRED and, since each semantic form is unique, equating the TOPIC to either of them would result in a

Uniqueness violation (i.e., multiple specification of the same attribute). The lower *aL* can satisfy its equation by introducing a TOPIC into the COMP and equating it to the OBJ. However, the resulting structure would still lack a PRED.

Intuitively, the problem is that the filler is not being linked to its extraction site. The fact that *aL* marks each clause between the filler and the gap is strong indication that it is the complementizer that performs the integration (McCloskey 1990, 2002). The lexical entry for the complementizer is therefore refined as follows:

(6.32) aL: $\hat{\mathrm{C}}$ $\{\, (\uparrow \text{UDF}) = (\uparrow \text{COMP UDF}) \;\mid\; (\uparrow \text{UDF}) = (\uparrow \text{GF}) \,\}$

The revised lexical entry for *aL* now performs two roles. The right hand option performs filler grounding as before: it identifies a TOPIC or FOCUS with a GF in its f-structure. The left hand option performs *filler passing*: it identifies an unbounded dependency function in its clause with one in its complement clause.

The general pattern for multi-clause filler-gap dependencies in Irish will be marking of the CP containing the gap with *aL* in its filler *grounding* capacity and marking of each higher CP until the filler is reached with *aL* in its filler *passing* capacity. This is shown schematically in (6.33):

(6.33) $$[_{\text{CP}}\ \underbrace{aL\ \ldots\ [_{\text{CP}}\ aL}_{\text{pass}}\ \underbrace{\ldots\ [_{\text{CP}}\ aL}_{\text{pass}}\ \underbrace{\ldots\ \_\_}_{\text{ground}}\ \ldots]]]$$

Thus, on the current analysis the complementizer *aL* not only marks filler-gap dependencies, it is instrumental in relating the top of the dependency to the bottom.

Rather than the ill-formed f-structure in (6.31), the revised lexical entry for *aL* constructs the following well-formed f-structure for sentence (6.29):

(6.34) $$\left[\begin{array}{ll}
\text{PRED} & \text{`novel'} \\
\text{SPEC} & \left[\text{PRED}\ \ \text{`the'}\right] \\
\text{ADJ} & \left\{ t \left[\begin{array}{ll}
\text{PRED} & \text{`think'} \\
\text{TOPIC} & \left[\text{PRED}\ \ \text{`pro'}\right] \\
\text{SUBJ} & \left[\text{``I''}\right] \\
\text{COMP} & u \left[\begin{array}{ll}
\text{PRED} & \text{`understand'} \\
\text{TOPIC} & \rule{4em}{0.4pt} \\
\text{SUBJ} & \left[\text{``I''}\right] \\
\text{OBJ} & \rule{4em}{0.4pt}
\end{array}\right]
\end{array}\right] \right\}
\end{array}\right]$$

The CP rule introduces a TOPIC with PRED 'pro' into the f-structure marked by the top *aL*. The top *aL* equates the TOPIC of its f-structure (t) with that of its COMP (u). The bottom *aL* equates the TOPIC of its f-structure with the OBJECT corresponding to the gap. All constraints on f-structure well-formedness are therefore satisfied.

The implications of the analysis will be discussed further in section 6.6, but it is already evident that the analysis captures two key characteristics of Irish filler-gap dependencies. The first characteristic is the successive marking of CPs from the filler to the gap with the complementizer *aL*. This was achieved without postulating empty pronouns in c-structure, traces, or movement. The spirit of the analysis is close to that of Bouma et al. (2001), although the details are quite different. In particular, there is no postulation of a special kind of gap object (*gap-synsem*) and no special mechanism for passing of such objects (the DEPENDENTS list).

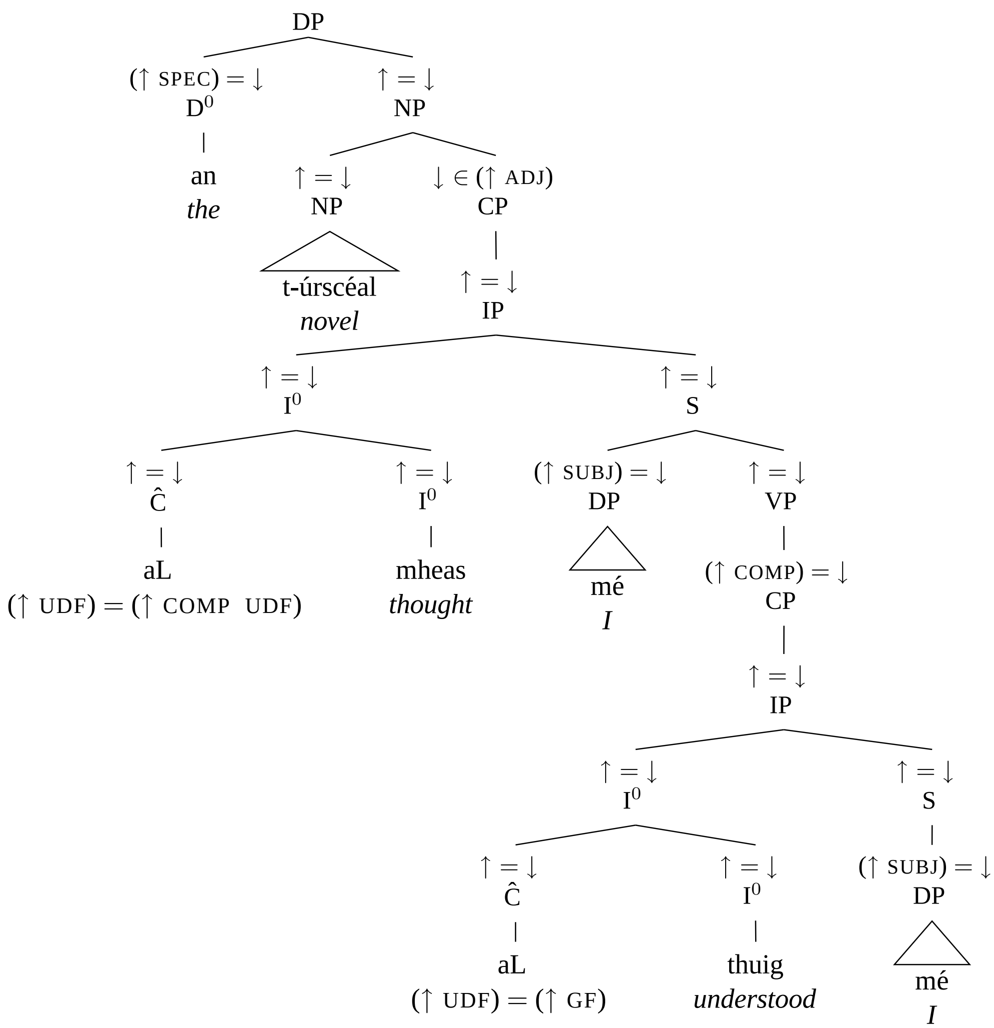
The analysis also already goes a long way to accounting for the island facts observed in section F of chapter 4. The Complex NP Constraint simply falls out of the equation for filler passing. The equation passes an unbounded dependency through a single COMP. A complex NP will necessarily be embedded in at least one further grammatical function, such as SUBJ or OBJ. The unbounded dependency would therefore stall in a non-COMP f-structure and could not be passed further. The result would be an f-structure that is ill-formed, for the reasons outlined in the discussion of (6.31) above. The *wh*-island constraint is also derivable from the analysis presented here, if reasonable auxiliary assumptions are made. This will be discussed in section 6.6.

In the remaining part of this section I want to bring the different threads together and show examples of relative clause and *wh*-question formation. I will present relevant parts of the c-structures and f-structures, but will abbreviate quite freely. More details can be found in appendix B. I will also present linear logic proofs of the semantic composition. This will be done in the usual manner: the premises contributed by the lexical items and c-structure rules will be listed and then proof trees will be constructed. However, to avoid unnecessary clutter, I will not present the meaning language side of the proofs. The meaning language side of the contributed meaning constructors are shown in appendix B and the operations on these meanings that correspond to proof rules follow from the Curry-Howard isomorphism (chapter 2, section 2.2). More detailed examples of the syntax and semantics of unbounded dependencies are given in chapter 2. Reference can also be made to the detailed presentation of relative clause formation in section 5.1 of chapter 5, so long as the meaning constructors contributed by resumptive pronouns and manager resources are left aside and the corresponding slight adjustments are made to the proofs.

Example (6.29), repeated here, serves as a relative clause example. Its c-structure and f-structure are shown in (6.36) and (6.37):

(6.35) an t-úrscéal aL mheas mé aL thuig mé _
the novel *aL* thought I *aL* understood I _
the novel that I thought I understood
(McCloskey 1979:17, (42c))

(6.36)



(6.37)
$$n\left[\begin{array}{ll}
\textsc{pred} & \text{'novel'} \\
\textsc{spec} & \left[\begin{array}{ll}\textsc{pred} & \text{'the'}\end{array}\right] \\
\textsc{adj} & \left\{ t\left[\begin{array}{ll}
\textsc{pred} & \text{'think'} \\
\textsc{topic} & p\left[\begin{array}{ll}\textsc{pred} & \text{'pro'}\end{array}\right] \\
\textsc{subj} & i1\left[\text{“I”}\right] \\
\textsc{comp} & u\left[\begin{array}{ll}
\textsc{pred} & \text{'understand'} \\
\textsc{topic} & \rule{3em}{0.4pt} \\
\textsc{subj} & i2\left[\text{“I”}\right] \\
\textsc{obj} & \rule{3em}{0.4pt}
\end{array}\right]
\end{array}\right] \right\}
\end{array}\right]$$

The CP rule (6.21) contributes the meaning constructor that composes the restrictive relative modifier with the relative head, abbreviated as REL_σ. The full version of this meaning constructor is as follows:

(6.38)
$$\begin{array}{l}
REL_\sigma := \\
\lambda P \lambda Q \lambda x. Q(x) \wedge P(x) : \\
\;[(\uparrow \textsc{topic})_\sigma \multimap \uparrow_\sigma] \multimap \\
\quad [[((\textsc{adj} \in \uparrow)_\sigma \textsc{ var}) \multimap ((\textsc{adj} \in \uparrow)_\sigma \textsc{ restr})] \multimap \\
\qquad [((\textsc{adj} \in \uparrow)_\sigma \textsc{ var}) \multimap ((\textsc{adj} \in \uparrow)_\sigma \textsc{ restr})]]
\end{array}$$

This is just the usual sort of meaning constructor for composing a restrictive relative clause with a relative head (see chapter 2, section 2.1.6; for a fuller exposition of relative clause composition in Glue Semantics, see Dalrymple 2001).

The f-structure (6.37) instantiates the lexically contributed meaning constructors for (6.35) and REL_σ as follows:[5]

---

[5] I assume that the first person pronoun always refers to a speaker index and therefore does not have a functional type like that of pronouns that pick up their reference from an antecedent. Second person pronouns similarly pick out the hearer index. Also, bear in mind that the dependency $v \multimap r$ comes from the s-structure projection of the common noun (VAR and RESTR).

(6.39)	1.	$(v \multimap r) \multimap \forall X.[(n \multimap X) \multimap X]$	Lex. **an (‘the’)**
	2.	$v \multimap r$	Lex. **t-úrscéal (‘novel’)**
	3.	$\mathit{i1} \multimap u \multimap t$	Lex. **mheas (‘thought’)**
	4.	$\mathit{i1}$	Lex. **mé (‘I’)**
	5.	$\mathit{i2} \multimap p \multimap u$	Lex. **thuig (‘understood’)**
	6.	$\mathit{i2}$	Lex. **mé (‘I’)**
	7.	$(p \multimap t) \multimap [(v \multimap r) \multimap (v \multimap r)]$	REL_σ

These premises construct the following proof for the relative clause. Notice that the proof terminates in a nominal type, not a sentential type, since it is a proof for a DP containing a relative clause modifier (i.e., the DP’s scope is yet to be provided).

(6.40)

$$
\begin{prooftree}
\AxiomC{$(v \multimap r) \multimap \forall X.[(n \multimap X) \multimap X]$}
\AxiomC{$\mathit{i2}$}
\AxiomC{$\mathit{i2} \multimap p \multimap u$}
\RightLabel{$\multimap_{\mathcal{E}}$}
\BinaryInfC{$p \multimap u$}
\AxiomC{$[p]^1$}
\RightLabel{$\multimap_{\mathcal{E}}$}
\BinaryInfC{u}
\AxiomC{$\mathit{i1}$}
\AxiomC{$\mathit{i1} \multimap u \multimap t$}
\RightLabel{$\multimap_{\mathcal{E}}$}
\BinaryInfC{$u \multimap t$}
\RightLabel{$\multimap_{\mathcal{E}}$}
\BinaryInfC{t}
\RightLabel{$\multimap_{\mathcal{I},1}$}
\UnaryInfC{$p \multimap t$}
\AxiomC{$(p \multimap t) \multimap [(v \multimap r) \multimap (v \multimap r)]$}
\RightLabel{$\multimap_{\mathcal{E}}$}
\BinaryInfC{$(v \multimap r) \multimap (v \multimap r)$}
\AxiomC{$v \multimap r$}
\RightLabel{$\multimap_{\mathcal{E}}$}
\BinaryInfC{$v \multimap r$}
\RightLabel{$\multimap_{\mathcal{E}}$}
\BinaryInfC{$\lambda S.\mathit{the}(x,\ \mathit{novel}(x)\ \wedge\ \mathit{think}(s,\ \mathit{understand}(s,\ x)),\ S(x)) : \forall X.[(n \multimap X) \multimap X]$}
\end{prooftree}
$$

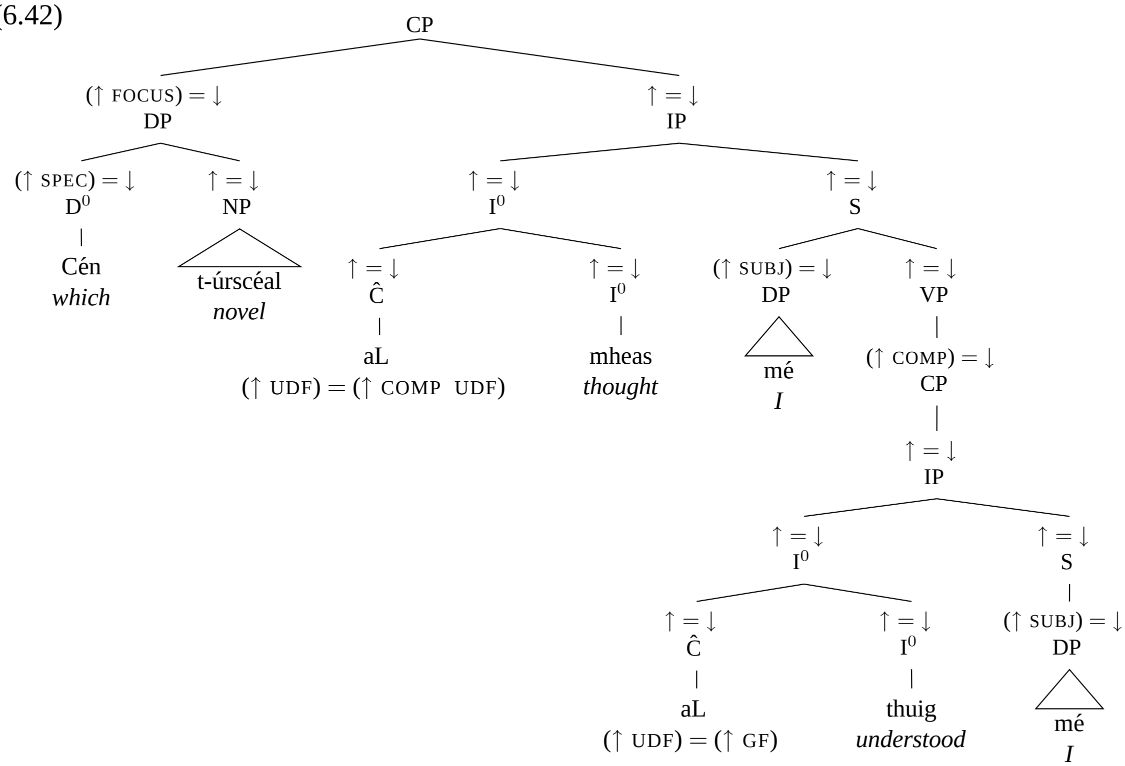
The complementizer *aL* does not play a direct role in the semantics in terms of contributing a meaning constructor. However, the filler grounding and passing role it fulfills is instrumental in the well-formedness of the linear logic proof. In other words, the role that *aL* plays in the syntax is necessary for proper semantic composition. In particular, the TOPIC of the relative clause must be identified with the gapped object of *thuig* (‘understood’). The dependency that *thuig* forms on the s-structure node corresponding to the shared TOPIC / OBJ is satisfied by assumption of the corresponding resource. This assumption is subsequently discharged to form the relative clause predicate on *mheas* (‘thought’). The dependency is then consumed by the modifier premise REL_σ. It is therefore vital that the resource corresponding to the gapped OBJ and the TOPIC be identical. Otherwise there would be no way to integrate the relative clause. The premise REL_σ would be left over and the proof would fail, since all resources must be consumed.

Now let us look at a closely related *wh*-question, shown in (6.41). Its c-structure and f-structure are shown in (6.42) and (6.43):

(6.41)	Cén	t-úrscéal	aL mheas	mé	aL thuig	mé	__
	which	novel	*aL* thought	I	*aL* understood	I	__

Which novel did I think I understood?
(McCloskey 1979:54, ∼(10))

(6.42)



(6.43)

$$t\begin{bmatrix} \text{PRED} & \text{‘think’} \\ \text{FOCUS} & n\begin{bmatrix} \text{PRED} & \text{‘novel’} \\ \text{SPEC} & \begin{bmatrix} \text{PRED} & \text{‘which’} \end{bmatrix} \end{bmatrix} \\ \text{SUBJ} & i1\begin{bmatrix} \text{“I”} \end{bmatrix} \\ \text{COMP} & u\begin{bmatrix} \text{PRED} & \text{‘understand’} \\ \text{FOCUS} & \rule{4em}{0.4pt} \\ \text{SUBJ} & i2\begin{bmatrix} \text{“I”} \end{bmatrix} \\ \text{OBJ} & \rule{4em}{0.4pt} \end{bmatrix} \end{bmatrix}$$

The presence of an XP in SpecCP means that the CP must be realized in its left (FOCUS) option. It does not contribute any TOPIC information or a REL_σ meaning constructor. The rule is repeated here:

(6.44) $$\text{CP} \longrightarrow \left\{ \begin{array}{c} \text{XP} \\ (\uparrow \text{FOCUS}) = \downarrow \end{array} \middle| \begin{array}{c} \epsilon \\ (\uparrow \text{TOPIC PRED}) = \text{`pro'} \\ \left(\begin{array}{c} (\text{ADJ} \in \uparrow) \\ REL_\sigma \end{array} \right) \end{array} \right\} \begin{array}{c} \text{C}' \\ \uparrow = \downarrow \end{array}$$

The fact that the XP is the FOCUS of its clause, as determined by the left option of the CP rule, means that *aL* must pass a FOCUS from its COMP, where it is grounded. If the lower COMP had a UDF grounded by *aL* as a TOPIC, then the upper UDF would also be a TOPIC. But the rule specifies that an XP in SpecCP is a FOCUS. The result would be an f-structure with a TOPIC in the COMP that is passed to the outer f-structure by *aL*. There would also be a FOCUS in the outer f-structure due to material in SpecCP. Since *aL* has by hypothesis performed its filler-passing role by integrating a TOPIC, the FOCUS remains unintegrated. The resulting structure is ruled out by the Extended Coherence Condition. In sum, *aL* does not determine which UDF it passes, but independent aspects of the theory — namely the interplay of the CP rule and the ECC — have the result that *aL* passes a FOCUS in question and cleft formation and a TOPIC in relative clause formation.

The *wh*-determiner contributes a meaning constructor that has a question operator in the meaning language, as shown in (6.45). The question operator takes the determiner's noun as its restriction and finds its scope by consuming a dependency on the noun (see section 2.2). The linear logic term for the *wh*-determiner is therefore like that of a quantificational determiner.

(6.45) *cén*: $$\begin{array}{l} \lambda R \lambda S.Qu(x, R(x), S(x)) : \\ [((\text{SPEC} \uparrow)_\sigma \text{ VAR}) \multimap ((\text{SPEC} \uparrow)_\sigma \text{ RESTR})] \multimap \\ \quad \forall X.[((\text{SPEC} \uparrow)_\sigma \multimap X) \multimap X] \end{array}$$

The essential thing is that the *wh*-phrase is a scope taking element.

The f-structure (6.43) instantiates the lexically contributed meaning constructors for (6.41) as follows (I have taken a shortcut by combining the *wh*-determiner with its noun):

(6.46)
1. $\forall X.[(n \multimap X) \multimap X]$ Lex. **Cén t-úrscéal ('which novel')**
2. $i1 \multimap u \multimap t$ Lex. **mheas ('thought')**
3. $i1$ Lex. **mé ('I')**
4. $i2 \multimap n \multimap u$ Lex. **thuig ('understood')**
5. $i2$ Lex. **mé ('I')**

These premises construct the following proof of the *wh*-question's semantics:

(6.47)

$$\dfrac{\forall X.[(n \multimap X) \multimap X] \qquad \dfrac{\dfrac{\dfrac{\dfrac{\dfrac{i2 \quad i2 \multimap n \multimap u}{n \multimap u}\multimap_{\mathcal{E}} \quad [n]^1}{u}\multimap_{\mathcal{E}} \qquad \dfrac{i1 \quad i1 \multimap u \multimap t}{u \multimap t}\multimap_{\mathcal{E}}}{t}\multimap_{\mathcal{E}}}{n \multimap t}\multimap_{\mathcal{I},1}}{}}{Qu(x,\ novel(x),\ think(s,\ understand(s,\ x))) : t}\multimap_{\mathcal{E}}, [t/X]$$

Again the role of *aL* in linking the head of the unbounded dependency to the gap site is instrumental. By identifying the f-structure of the *wh*-phrase with that of the embedded OBJECT, *aL* allows the *wh*-phrase to find its scope.

Summary The lexical entry of the filler-gap complementizer *aL* is repeated here:

(6.48) *aL*: Ĉ { (↑ UDF) = (↑ COMP UDF) | (↑ UDF) = (↑ GF) }

The complementizer does not contribute any premises to the proof, but its *filler grounding* and *filler passing* roles are crucial to proper integration of the filler into the grammatical representation and hence proper semantic composition. The mechanism for both filler passing and grounding is functional equality. The filler passing role accounts for the strongly successive cyclic nature of filler-gap marking in Irish and derives the Complex NP Constraint on Irish filler-gap dependencies. Table 6.2 summarizes the contribution of *aL*.

	Role Relative to Position			
	Not bottom	**Bottom**	**Method**	**Cyclic?**
aL	passing	grounding	Functional equality	Yes

Table 6.2: The role of the Irish complementizer *aL* in filler-gap dependencies

6.3.2 Binder-resumptive dependencies

The core single-clause pattern for a binder-resumptive dependency is marked by the complementizer *aN*:

(6.49) [$_{\text{CP}}$ *aN* . . . *Rpro* . . .]

(6.50) an scríbhneoir a molann na mic léinn <u>é</u>
the writer *aN* praise the students him
the writer whom the students praise (him)
(McCloskey 1979:6, (5))

The core multi-clause pattern reveals that only the highest complementizer needs to be realized as *aN*. Lower complementizers are realized as the neutral complementizer *go*:

(6.51) $[_{\mathrm{CP}}$ *aN* ... $[_{\mathrm{CP}}$ *go* ... $[_{\mathrm{CP}}$ *go* ... *Rpro* ...]]]

(6.52) fir ar shíl Aturnae an Stáit go rabh siad díleas do'n Rí
men *aN* thought Attorney the State *go* were they loyal to-the King
men that the Attorney General thought were loyal to the King
(McCloskey 2002:190, (16))

This pattern of marking indicates that the binder-resumptive dependency is not successive-cyclic (McCloskey 2002). This is explained if the binder-resumptive relationship is just normal pronominal binding, since such binding is never successive-cyclic.

The complementizer *aN* plays a similar role to the complementizer *aL* in integrating the TOPIC or FOCUS into the grammatical representation. The Extended Coherence Condition allows for two methods of doing this: functional equality or anaphoric binding. The ordinary pronoun theory of resumption presented here entails that the method for integrating a resumptive pronoun must be anaphoric binding, as discussed at the end of section 5.2.2 in chapter 5. The complementizer *aN* is the licenser of the resumptive pronoun and it specifies that a UDF in its clause is the ANTECEDENT of the resumptive at s-structure, anaphorically binding it. The lexical entry for *aN*, which will shortly be revised, is therefore as follows:

(6.53) *aN*: $\hat{\mathrm{C}}$ $(\uparrow \text{UDF})_\sigma = ((\uparrow \text{GF}^+)_\sigma \text{ ANTECEDENT})$

Like the entry for *aL*, the entry for *aN* depends on the introduction of the PRED of its UDF via material in SpecCP or via the CP rule itself. The entry states that there is a UDF in *aN*'s f-structure that anaphorically binds a grammatical function, which will be the resumptive pronoun. The grammatical function is found by following a path of grammatical functions of length one or longer (indicated by Kleene plus). Thus, the TOPIC or FOCUS of *aN*'s clause binds (is the ANTECEDENT of) a grammatical function that is an unlimited distance away. The binding is accomplished in one step (it is not successive-cyclic) and is unbounded. The binder-resumptive dependency is an unbounded dependency, but the mechanism of integrating the head of the dependency with the foot is a) anaphoric, and b) distinct from the filler-gap mechanism. Since *aN* integrates a UDF without passing it steadily through successive intervening clauses, any clauses occurring between the *aN*-marked clause and the resumptive can be marked by the neutral complementizer *go*.

I will refer to the integration of the UDF that *aN* performs via anaphoric binding as *binder grounding*. Thus, both *aL* and *aN* have a role in grounding an unbounded dependency. *AL* grounds the filler in a filler-gap dependency through functional equality. *AN* grounds the binder in a binder-resumptive dependency through anaphoric binding. Each complementizer is instrumental in integrating a UDF and satisfying the ECC. The mechanisms of functional equality and anaphoric binding are precisely those that have been independently postulated for ECC satisfaction by Bresnan and Mchombo (1987). The fact that *aN* performs binder grounding through anaphoric binding — which is the only option that the theory allows — and the fact that anaphoric binding is a non-local, unbounded process account for the multi-clausal marking pattern with a single *aN* at the top of the binder-resumptive dependency and successive neutral *go*-marking to the resumptive.

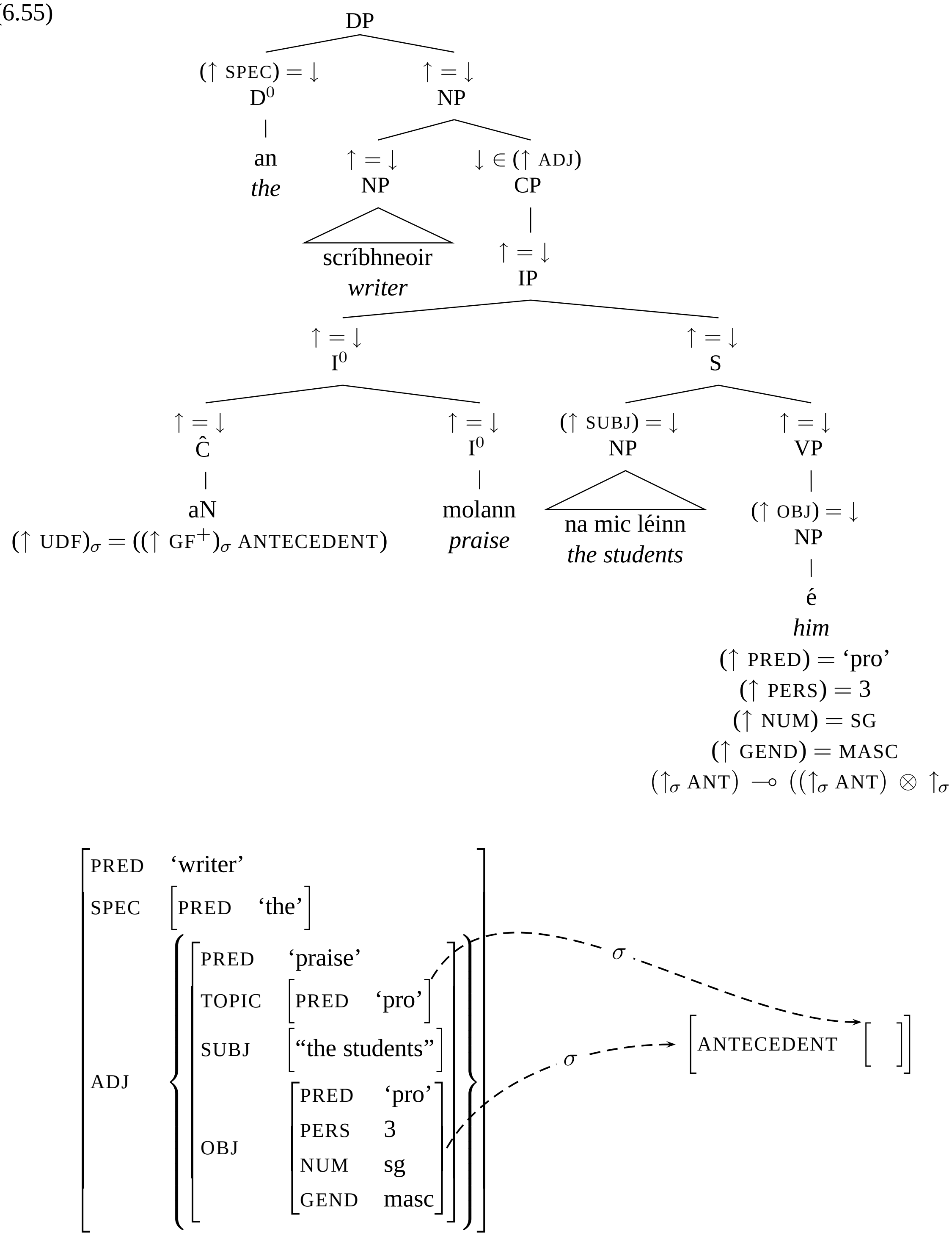
Before turning to a multi-clause example, let us quickly see how the analysis handles a single-clause case like (6.50), which I repeat here:

(6.54)	an scríbhneoir	a	molann	na mic léinn	<u>é</u>	
	the writer	*aN*	praise	the students	him	

the writer whom the students praise (him)

The relevant parts of the c-structure, f-structure, and s-structure for (6.50), as constructed by the rules in (6.21) and (6.22) and the lexical entry for *aN* in (6.53), are as follows:

(6.55)



The TOPIC is integrated by anaphoric binding. The binding is mediated by the complementizer *aN*.

The multi-clause pattern exemplified by (6.52) is sketched here:

(6.56) fir [$_{\text{CP}}$ ar shíl Aturnae an Stáit [$_{\text{CP}}$ go rabh <u>siad</u> díleas do'n Rí]]

$$\begin{array}{c}\text{ar}\\ (\uparrow \textsc{udf})_\sigma = \\ ((\uparrow \textsc{gf}^+)_\sigma\ \textsc{ant})\end{array}$$

The relevant parts of the f-structure and s-structure of this example are shown in (6.57). I have made the simplifying assumption that the copula is providing only tense and agreement information and that the head of the subordinate S is the AP. It may be that the relationship is better analyzed as the copula taking the AP as an XCOMP, but this complication does not affect the main point at hand (the analysis of the binder-resumptive dependency).

(6.57)

$$\left[\begin{array}{ll}
\textsc{pred} & \text{`man'} \\
\textsc{num} & \text{pl} \\
\textsc{adj} & \left\{\left[\begin{array}{ll}
\textsc{pred} & \text{`think'} \\
\textsc{tense} & \text{past} \\
\textsc{topic} & \left[\textsc{pred}\ \ \text{`pro'}\right] \\
\textsc{subj} & [\text{“Attorney General”}] \\
\textsc{comp} & \left[\begin{array}{ll}
\textsc{pred} & \text{`loyal'} \\
\textsc{subj} & \left[\begin{array}{ll}\textsc{pred} & \text{`pro'} \\ \textsc{pers} & 3 \\ \textsc{num} & \text{pl}\end{array}\right] \\
\textsc{obl} & \left[\text{“to the King”}\right]
\end{array}\right]
\end{array}\right]\right\}
\end{array}\right]
\qquad
\left[\textsc{antecedent}\ \left[\ \right]\right]$$

The path GF$^+$ in the lexical entry for *aN* is set to COMP SUBJ in this case. The TOPIC is integrated into the grammatical representation through anaphoric binding at s-structure.

The lexical entry we have for *aN* is so far doing its job in integrating the unbounded dependency into the grammatical representation. However, we have been avoiding the elephant in the room — the resumptive pronoun. On the present theory, resumptive pronouns are just ordinary pronouns and therefore make the lexical contribution of ordinary, referential pronouns. In particular, they contribute pronominal meaning constructors, as shown in the c-structure in (6.55). The lexical entry for *aN* so far does nothing about this. As things stand, the meaning constructor for the resumptive pronoun will result in resource failure, as shown in Figure 5.1 on page 143.

The licensing mechanism for resumptive pronouns is an extra pronominal consumer — a manager resource. Therefore, a manager resource needs to be added to the lexical entry for *aN*. In addition, a meaning constructor for relabelling the resumptive dependency is contributed, as discussed in section 5.2.3 of chapter 5. The lexical entry for *aN* is revised as follows:

(6.58) *aN*: $\hat{\mathrm{C}}$ $(\uparrow \textsc{udf})_\sigma = ((\uparrow \textsc{gf}^+)_\sigma\ \textsc{antecedent})$

$\lambda P \lambda y.y$:
$[(\uparrow \textsc{udf})_\sigma \multimap ((\uparrow \textsc{udf})_\sigma \otimes (\uparrow \textsc{gf}^+)_\sigma)] \multimap ((\uparrow \textsc{udf})_\sigma \multimap (\uparrow \textsc{udf})_\sigma)$

$\lambda P.P : ((\uparrow \textsc{gf}^+)_\sigma \multimap \uparrow_\sigma) \multimap ((\uparrow \textsc{udf})_\sigma \multimap \uparrow_\sigma)$

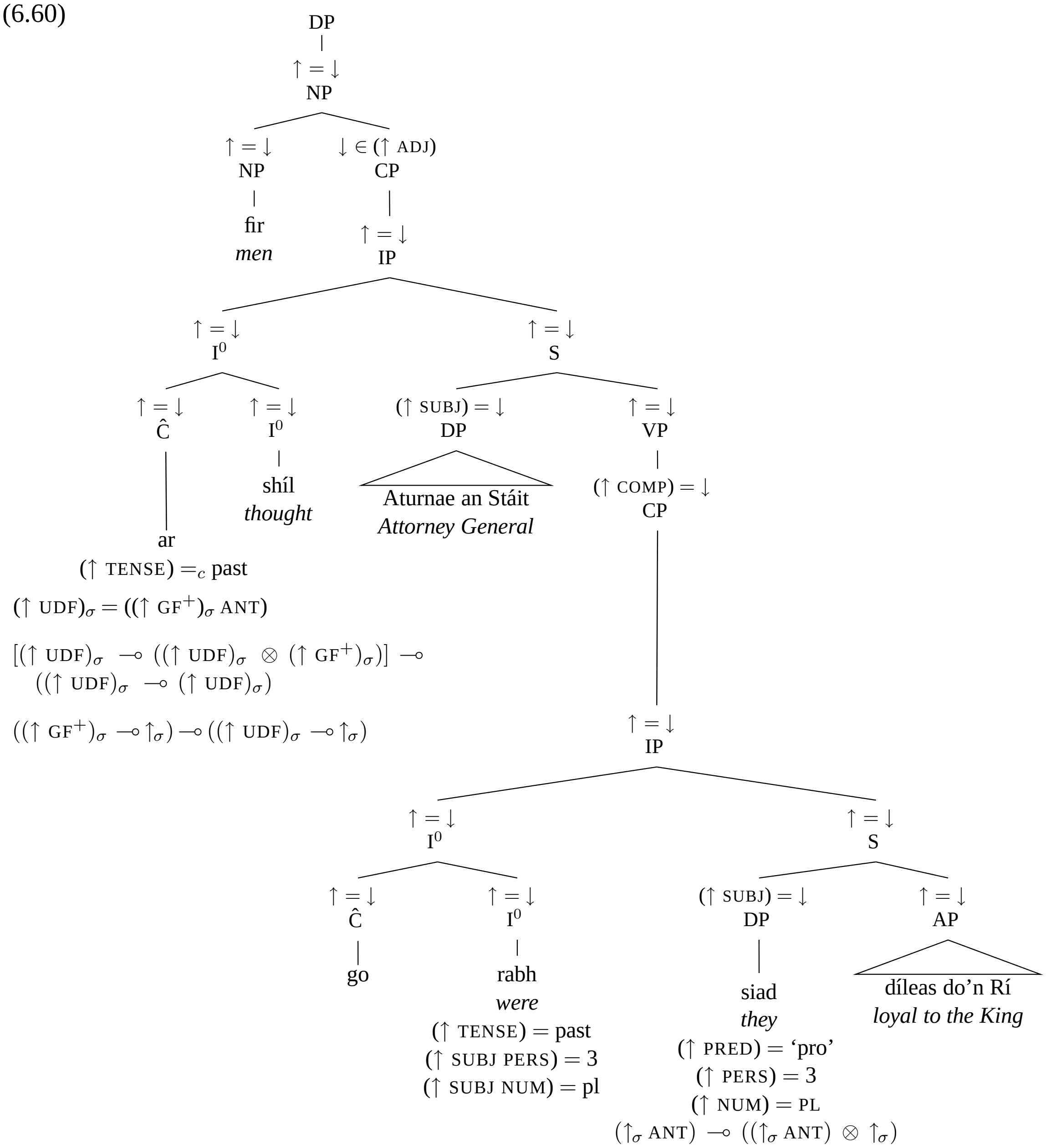
With the addition of a manager resource, *aN* now licenses a resumptive pronoun.

Let us look at how the analysis deals with the relative clause example (6.52), repeated here:

(6.59) fir ar shíl Aturnae an Stáit go rabh siad díleas do'n Rí
men *aN* thought Attorney the State *go* were they loyal to-the King
men that the Attorney General thought were loyal to the King
(McCloskey 2002:190, (16))

The c-structure for this example, shown in (6.60) holds no surprises. In its gross structure it is very similar to the c-structure in (6.36) for the multi-clause filler-gap relative (6.35). The key differences are in the embedded S. The predicate of the embedded S is an AP, not a VP, and it has a resumptive pronoun embedded subject. Recall that I have made the simplifying assumption that the copula just provides tense and agreement information. Note that the complementizer *ar*, the inflected version of *aN*, bears a constraining equation that checks for past tense in its f-structure, but which does not add this information itself.

(6.60)


DP
↑ = ↓
NP
↑ = ↓
NP
fir
men
↓ ∈ (↑ ADJ)
CP
↑ = ↓
IP
↑ = ↓
I0
↑ = ↓
Ĉ
ar
(↑ TENSE) =c past
(↑ UDF)σ = ((↑ GF+)σ ANT)
[(↑ UDF)σ ⊸ ((↑ UDF)σ ⊗ (↑ GF+)σ)] ⊸
((↑ UDF)σ ⊸ (↑ UDF)σ)
((↑ GF+)σ ⊸ ↑σ) ⊸ ((↑ UDF)σ ⊸ ↑σ)
↑ = ↓
I0
shíl
thought
↑ = ↓
S
(↑ SUBJ) = ↓
DP
Aturnae an Stáit
Attorney General
↑ = ↓
VP
(↑ COMP) = ↓
CP
↑ = ↓
IP
↑ = ↓
I0
↑ = ↓
Ĉ
go
↑ = ↓
I0
rabh
were
(↑ TENSE) = past
(↑ SUBJ PERS) = 3
(↑ SUBJ NUM) = pl
↑ = ↓
S
(↑ SUBJ) = ↓
DP
siad
they
(↑ PRED) = 'pro'
(↑ PERS) = 3
(↑ NUM) = PL
(↑σ ANT) ⊸ ((↑σ ANT) ⊗ ↑σ)
↑ = ↓
AP
díleas do'n Rí
loyal to the King

The f-structure and s-structure for (6.59) are repeated here with appropriate labels:

(6.61)

$$m\left[\begin{array}{ll} \text{PRED} & \text{‘man’} \\ \text{NUM} & \text{pl} \\ \text{ADJ} & \left\{ t\left[\begin{array}{ll} \text{PRED} & \text{‘think’}\\ \text{TENSE} & \text{past}\\ \text{TOPIC} & a\left[\text{PRED}\quad \text{‘pro’}\right]\\ \text{SUBJ} & g[\text{“Attorney General”}]\\ \text{COMP} & l\left[\begin{array}{ll}\text{PRED} & \text{‘loyal’}\\ \text{SUBJ} & p\left[\begin{array}{ll}\text{PRED}&\text{‘pro’}\\ \text{PERS}&3\\ \text{NUM}&\text{pl}\end{array}\right]\\ \text{OBL} & k\left[\text{“to the King”}\right]\end{array}\right]\end{array}\right]\right\}\end{array}\right] \qquad p_\sigma\left[\text{ANT}\quad a_\sigma\left[\ \right]\right]$$

The TOPIC for the relative clause is contributed by the CP rule, which specifies that the TOPIC's PRED is ‘pro’ and also contributes the relative clause meaning constructor REL_σ. The complementizer *aN* does three things. First, it integrates the TOPIC through anaphoric binding. The complementizer specifies that its f-structure's UDF — the TOPIC of f-structure *t* in this case — is the s-structure ANTECEDENT of a grammatical function in its clause or in an embedded clause (GF^+). In this case GF^+ is (t COMP SUBJ). The description $(\uparrow\ \text{UDF})_\sigma$ in *aN*'s lexical entry is therefore instantiated to the same resource as $(\uparrow\ \text{ANTECEDENT})_\sigma$ in the generalized meaning constructor for the pronoun, repeated in (6.62). The instantiated version is shown in (6.63), with labels from the structures above.

(6.62) $(\uparrow_\sigma \text{ANTECEDENT}) \multimap ((\uparrow_\sigma \text{ANTECEDENT}) \otimes \uparrow_\sigma)$

(6.63) $a_\sigma \multimap (a_\sigma \otimes p_\sigma)$

In binding the resumptive to the UDF in its clause, the complementizer *grounds* the binder in the binder-resumptive dependency. Second, the complementizer contributes a manager resource that licenses the resumptive pronoun by removing its surplus resource. Notice that the manager resource is specified in local terms using the complementizer's UDF. Since the complementizer has identifed its UDF as the binder of the resumptive, the pronoun's ANTECEDENT is the UDF. Third, the complementizer relabels the dependency vacated by the pronoun in terms of the resumptive's binder.

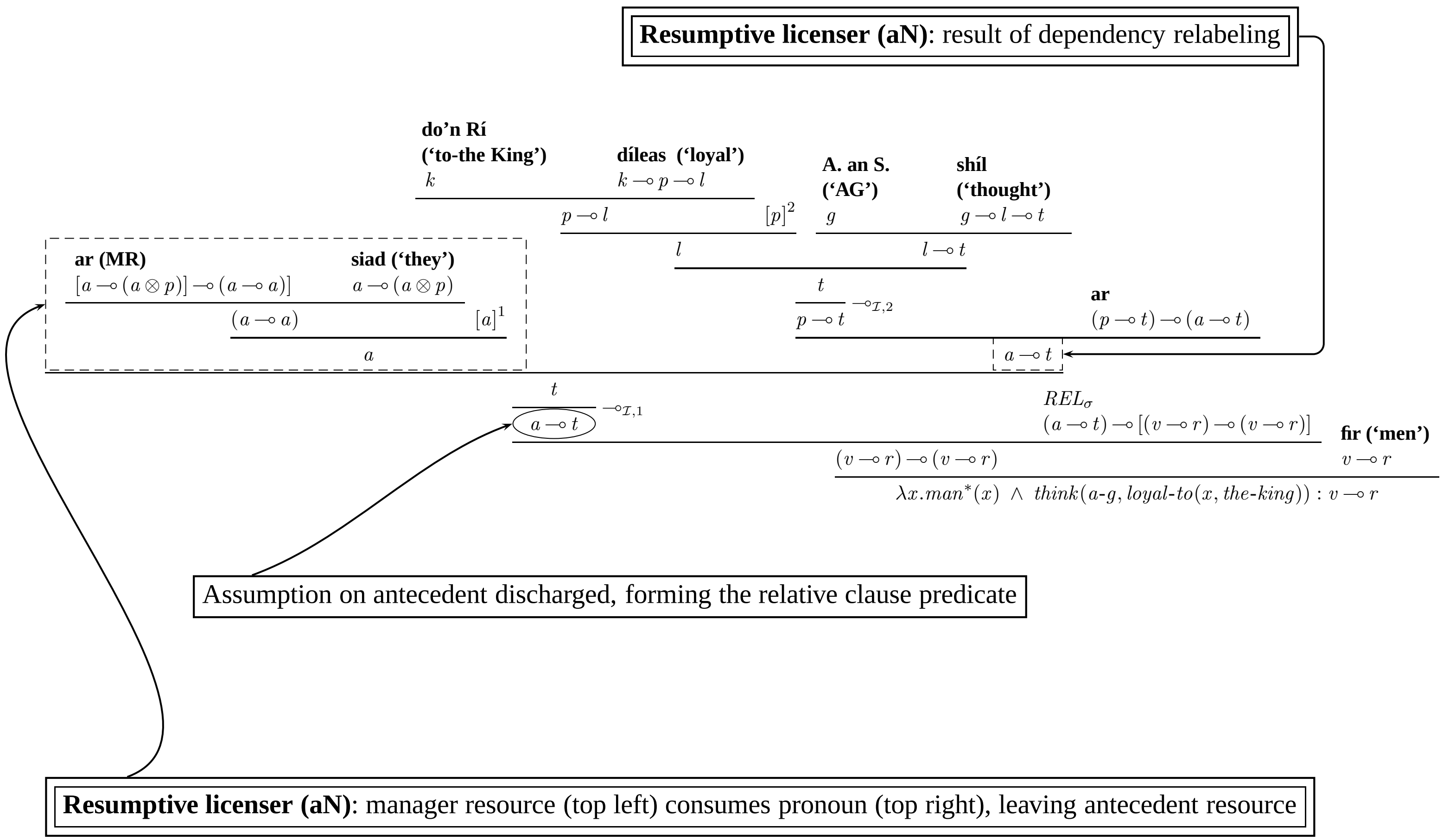
The lexically contributed premises for (6.59) and the relative clause premise REL_σ that is contributed by SpecCP are shown in (6.64). I have made the simplifying assumption that the OBLIQUE *díleas do'n Rí* ('to the King') just contributes a type e resource (i.e., the predicate *díleas* ('loyal') is translated as $loyal\text{-}to$).

(6.64)	1.	$v \multimap r$	Lex. **fir ('men')**
	2.	$(a \multimap t) \multimap [(v \multimap r) \multimap (v \multimap r)]$	REL_σ
	3.	$[a \multimap (a \otimes p)] \multimap (a \multimap a)]$	Lex. **ar (aN)**
	4.	$(p \multimap t) \multimap (a \multimap t)$	Lex. **ar (aN)**
	5.	$g \multimap l \multimap t$	Lex. **shíl ('thought')**
	6.	g	Lex. **Aturnae an Stáit ('Attorney General')**
	7.	$a \multimap (a \multimap p)$	Lex. **siad ('they')**
	8.	$k \multimap p \multimap l$	Lex. **díleas ('loyal')**
	9.	k	Lex. **do'n Rí ('to-the King')**

Figure 6.1 shows a succesful proof for (6.52), given the lexical entry for *aN* in (6.58) and the premises in (6.64).[6] The manager resource contributed by the complementizer solves the resource surplus problem that the resumptive pronoun poses by consuming the resumptive. The second meaning constructor contributed by the complementizer relabels the dependency on the pronoun so that it is instead a dependency on the complementizer's unbounded dependency. With these adjustments made, the proof goes through just as if the resumptive pronoun had not been there. The meaning language follows by the Curry-Howard isomorphism, but is also presented in appendix B. Like *aL*, the resumptive-sensitive complementizer *aN* is instrumental in grounding the unbounded dependency. Unlike *aL*, *aN* uses the mechanism of anaphoric binding to do this.

[6]Notice that man^* is the denotation of the plural common noun *fir* ('men').

Figure 6.1: Proof for a core multi-clausal Irish binder-resumptive dependency



The crucial thing in licensing the resumptive pronoun is the contribution of the manager resource. Without this contribution, the pronoun will result in failure of the linear logic proof due to its resource being left over. The analysis predicts the impossibility of a resumptive pattern without the complementizer *aN*:

(6.65) $*[_{\mathrm{CP}}$ go … *Rpro* …]

(6.66) $*[_{\mathrm{CP}}$ aL … *Rpro* …]

Neither the lexical entry for *go* nor the one for *aL* contributes a manager resource and these complementizers therefore do not license resumptives.

However, as it is the analysis does not predict the possibility of patterns 1 or 3 of the mixed chains:

(6.67) Pattern 1
$[_{\mathrm{CP}}$ *aN* … $[_{\mathrm{NP}}$ N $[_{\mathrm{CP}}$ *aL* … __ …]]]

(6.68) Pattern 3
$[_{\mathrm{CP}}$ *aN* … $[_{\mathrm{CP}}$ *aN* … *Rpro* …]]

Pattern 1 has an instance of *aN*, which contributes a manager resource, but there is no resumptive pronoun to be consumed. In this case, it is the manager resource that would not be discharged, resulting in proof failure. Pattern 3 has two instance of *aN* but only one resumptive pronoun. One of the two manager resources that the complementizers contribute will be satisfied, but the other one will necessarily be left over, since the resumptive has been consumed by the first manager resource, and there will once again be proof failure.

The solution to this problem is shown in the next section. It involves adding a kind of binder passing capacity to the entry for *aN*. The result is an appealing symmetry between the lexical entries for the filler-gap complementizer *aL* and the binder-resumptive complementizer *aN* along independently motivated theoretical dimensions. Both complementizers engage in unbounded dependency passing and grounding, but *aL* does it through functional identity, whereas *aN* does it through anaphoric binding. Both of these mechanisms are independently motivated in the grammatical theory in general and in the analysis of unbounded dependencies in particular.

6.4 Analysis: mixed chains

6.4.1 Pattern 2

Let us first look at Pattern 2 of the mixed chains, because the theory already successfully deals with this:

(6.69) Pattern 2
$[_{\text{CP}}$ *aL* ... $[_{\text{CP}}$ *aN* ... *Rpro* ...]]

(6.70) aon duine a cheap sé a raibh ruainne tobac aige
any person *aL* thought he *aN* was scrap tobacco at-him
anyone that he thought had a scrap of tobacco
(McCloskey 2002:198, (34))

(6.71) Cé is dóigh leat a bhfuil an t-airgead aige?
who *aL*.COP.PRES likely with-you *aN* is the money at-him
Who do you think has the money?
(McCloskey 2002:198, (35))

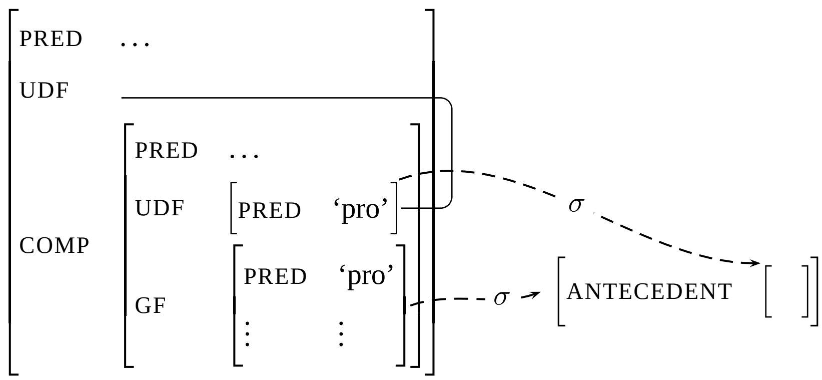
This pattern is analyzed as an instance of binder grounding by *aN* and filler passing by *aL*.

The CP rule, which is repeated in (6.72), specifies that SpecCP contributes the UDF at the top of the "mixed chain".

(6.72)
$$\text{CP} \longrightarrow \left\{ \begin{array}{c} \text{XP} \\ (\uparrow \text{FOCUS}) = \downarrow \end{array} \middle| \begin{array}{c} \epsilon \\ (\uparrow \text{TOPIC PRED}) = \text{‘pro’} \\ \left(\begin{array}{c} (\text{ADJ} \in \uparrow) \\ REL_\sigma \end{array} \right) \end{array} \right\} \begin{array}{c} \text{C}' \\ \uparrow = \downarrow \end{array}$$

In the particular case of (6.70) both the TOPIC and its PRED are contributed by the right SpecCP option of the CP rule. In the case of (6.71) the *wh*-word that realizes the left option of SpecCP is the FOCUS of the outermost f-structure. The complementizer *aL* in its filler passing role equates this FOCUS with the FOCUS of its COMP. Notice that there is no directionality to the passing. The result is just two UDFs that are functionally equated. There is no sense in which the UDF is either "passed up" or "passed down". The result is that the UDF that is introduced through SpecCP occurs in the COMP. This subordinate f-structure is the one which *aN* contributes to. The lower complementizer performs the same functions as we saw in the previous section. It integrates the shared UDF by anaphoric binding of the resumptive pronoun, thus grounding the binder-resumptive dependency. It also licenses the resumptive through contribution of a manager resource and relabels the resumptive's dependency appropriately. The overall analysis of a Pattern 2 mixed chain is shown schematically in (6.73), where GF is the resumptive pronoun:

(6.73)



Pattern 2 is thus licensed by binder grounding by the lower complementizer *aN* and filler passing by the higher complementizer *aL*. The only mechanisms necessary are the ones that explained the core multi-clausal patterns.

This may seem counterintuitive, since there is in fact no filler for *aL* to pass. However, "filler" is just a convenient descriptive term and is not reified in the analysis. All *aL* really needs to do in its filler passing capacity is to identify the unbounded dependency function in its clause with an unbounded dependency function in the complement of its clause (COMP). *AL* does not actually distinguish the case where the embedded UDF is functionally equated to a gap (i.e., the embedded UDF is a filler) and the case where the embedded UDF anaphorically binds a resumptive (i.e., the embedded UDF is a binder). *AL* just functionally equates its UDF with that of its COMP. In order for the complementizer to accomplish this in a well-formed way, there must be some ultimately grounded UDF in the COMP. Such a function is introduced by the lower complementizer *aN* and grounded by anaphoric binding of the resumptive pronoun.

In sum, Pattern 2 follows from the analysis developed for core multi-clausal unbounded dependencies. Although the notion of "chain" and hence the notion of "mixed chain" has no theoretical status in this theory, it is interesting to note that there is a certain parallel here. The bottom of the dependency is grounded via anaphoric binding and then passed by functional equality. Both of these mechanisms are independently motivated in the theory of LFG at large and in the particular theory of Irish unbounded dependencies developed here. The result is mixed handling of the unbounded dependency. There is thus some theoretical convergence between this analysis and the analysis of McCloskey (2002) despite the fact that the analyses are based on radically different assumptions and come at the problem from distinct directions. Both analyses require mixed mechanisms.

6.4.2 Patterns 1 and 3

Pattern 1 is the inverse of Pattern 2 in terms of complementizer marking. The higher complementizer is the binder-resumptive complementizer *aN* and the lower complementizer is the filler-gap complementizer *aL*:

(6.74) [$_{\text{CP}}$ *aN* … [$_{\text{NP}}$ N [$_{\text{CP}}$ *aL* … _ …]]]

(6.75) rud a raibh coinne agam a choimhlíonfadh _ an aimsir
thing *aN* was expectation at-me *aL* fulfill.COND _ the time
something that I expected time would confirm
(McCloskey 2002:196, ∼(28))

This mixed chain is one possibility for marking an unbounded dependency out of a complex NP. The more common realization is the standard multi-clausal resumptive pattern: *aN* … *go* … *Rpro*. McCloskey (2002:195–197) notes that the *aL*-marking of the CP inside the NP is to be expected, given that that this CP can host a filler-gap dependency within the NP. The thing that is surprising about the pattern is the presence of the resumptive complementizer in the upper CP, because there is no resumptive pronoun for it to bind.

Pattern 3 shares aspects of Patterns 1 and 2. The lower clause is marked by the resumptive complementizer *aN*, as in Pattern 2. But, the higher clause is also marked by the resumptive-sensitive complementizer, as in Pattern 1:

(6.76) [$_{\text{CP}}$ *aN* … [$_{\text{CP}}$ *aN* … *Rpro* …]]

(6.77) na cuasáin thiorma ar shíl sé a mbeadh contúirt ar bith uirthi tuitim síos <u>ionnta</u>
the holes dry *aN* thought he *aN* would-be danger any on-her fall.[−FIN] down into-them
the dry holes that he thought there might be any danger of her falling down into them
(McCloskey 2002:199, (44))

The resumptive pronoun in the lower clause once again occurs in a position that is inaccessible to a filler-gap dependency, as in Pattern 1. Notice in particular that the resumptive site in example (6.77) is in a kind of complex NP, but one with a prepositional complement. This NP does not have an inner CP to host a filler-gap dependency.

The crucial feature that Patterns 1 and 3 have in common in terms of the resource management theory of resumption is that each pattern contains more instances of *aN* than there are resumptive pronouns. Pattern 1 contains one *aN* and no resumptive and Pattern 3 contains two *aN*s but only one resumptive. I propose to extend the lexical entry of *aN* in a way that addresses this commonality and thus simultaneously explains both patterns. The result of the extension is further similarity between the roles of *aL* and *aN* in licensing Irish unbounded dependencies.

The proposal is to add a *binder passing* specification to the lexical entry for *aN*, on a par with the *filler passing* specification in the entry for *aL*. The binder passing specification is the following anaphoric binding equation:

(6.78) $(\uparrow \text{UDF})_\sigma = ((\uparrow \text{GF}^+ \text{ UDF})_\sigma \text{ ANTECEDENT})$

The complementizer thus fulfills both its binder passing and grounding roles through anaphoric binding. This anaphoric binding can occur non-locally, just as it does in *aN*'s binder grounding guise (see (6.58) above). In both cases there is an unbounded path of length 1 or more specified by GF^+. However, the binder passing requires the path to eventually terminate in a UDF. The result is that the binder passing option for *aN* is realizable only if there is an unbounded dependency below the complementizer. This lower unbounded dependency must in turn be licensed either by *aL* or *aN*. The binder passing *aN* is thus an integral part of a larger unbounded dependency. It does not itself provide a meaning constructor and add a resource to the proof, but it serves an important function in semantic composition: to connect the top of the unbounded dependency to the bottom. If it did not fulfill this function, then compositional semantics would fail. In sum, *aN* in its binder passing role is integral to semantic composition, despite not contributing a semantic resource itself.

The crucial aspect of the analysis is that the binder passing *aN* does not contribute a manager resource. In *passing* a dependency, *aN* needs to rely on it being ground further down. It is the binder grounding guise of *aN* that therefore licenses a resumptive pronoun through the contribution of a manager resource. The revised and final lexical entry for *aN* is as follows:

(6.79) *aN*: Ĉ

$$\left\{ \begin{array}{l} (\uparrow \text{UDF})_\sigma = ((\uparrow \text{GF}^+ \text{ UDF})_\sigma \ \text{ANTECEDENT}) \\ \lambda P.P : ((\uparrow \text{GF}^+ \text{UDF})_\sigma \multimap \uparrow_\sigma) \multimap ((\uparrow \text{UDF})_\sigma \multimap \uparrow_\sigma)] \end{array} \right| $$

$$\left. \begin{array}{l} (\uparrow \text{UDF})_\sigma = ((\uparrow \text{GF}^+)_\sigma \ \text{ANTECEDENT}) \\ \lambda P \lambda y.y : \\ [(\uparrow \text{UDF})_\sigma \multimap ((\uparrow \text{UDF})_\sigma \otimes (\uparrow \text{GF}^+)_\sigma)] \multimap ((\uparrow \text{UDF})_\sigma \multimap (\uparrow \text{UDF})_\sigma) \\ \lambda P.P : ((\uparrow \text{GF}^+)_\sigma \multimap \uparrow_\sigma) \multimap ((\uparrow \text{UDF})_\sigma \multimap \uparrow_\sigma) \end{array} \right\}$$

Notice that the binder passing version of *aN* needs to contribute a meaning constructor for relabeling the resumptive dependency that it passes. Each instance of a binder is realized with its own PRED and contributes its own resource label. This will become more obvious shortly.

The lexical entry in (6.79) may seem forbidding, but the way it functions is quite easy to understand at an intuitive level. The intuitions behind the analysis of *aN* are shown in the following schematization of the lexical entry that substitutes for each equation its function:

(6.80) *aN*: Ĉ

$$\left\{ \begin{array}{l|l} \text{Binder passing} & \text{Binder grounding} \\ \text{Resumptive dependency relabeling} & \text{Resumptive licensing} \\ & \text{Resumptive dep. relabeling} \end{array} \right\}$$

The picture that emerges for *aL* and *aN* in two-clause cases is the following:

(6.81) a. [$_{\text{CP}}$ *aL* … [$_{\text{CP}}$ *aL* … __ …]]] Core *aL* multi-clause
└– – – pass – – –┘ └ ground ┘

b. [$_{\text{CP}}$ *aN* … [$_{\text{CP}}$ *aL* … __ …]]] Pattern 1
└– – – pass – – –┘ └ ground ┘

c. [$_{\text{CP}}$ *aL* … [$_{\text{CP}}$ *aN* … *Rpro* …]]] Pattern 2
└– – – pass – – –┘ └ ground ┘

d. [$_{\text{CP}}$ *aN* … [$_{\text{CP}}$ *aN* … *Rpro* …]]] Pattern 3
└– – – pass – – –┘ └ ground ┘

Longer mixed chains are hard to find, since they test the limits of speakers' competence. The predictions of the theory for longer mixed chains are discussed in section 6.6.

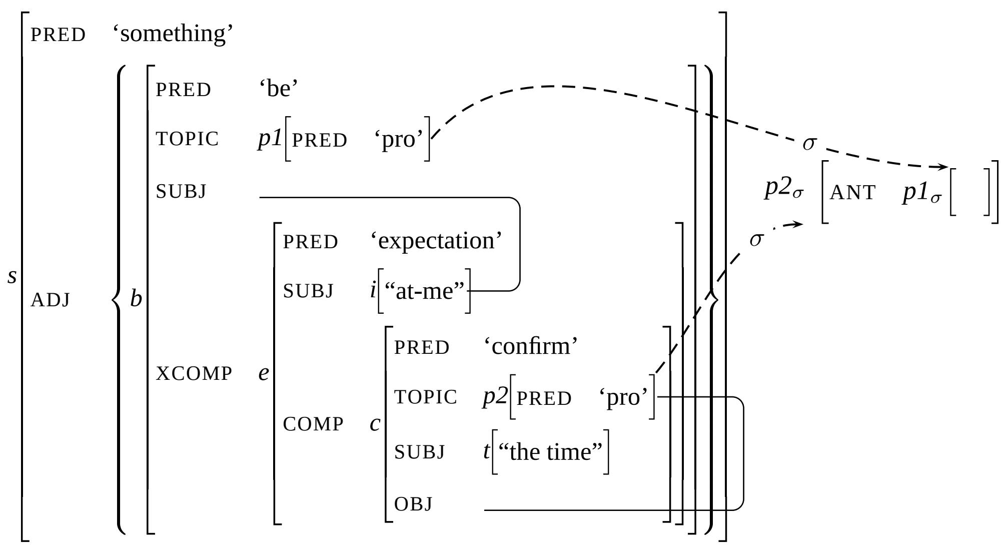
I want to close out this section by showing in a little more detail how the theory accounts for Patterns 1 and 3. I will leave out the c-structures and present only the relevant parts of the f-structures and s-structures.

Consider first the following Pattern 1 example:

(6.82) rud a raibh coinne agam a choimhlíonfadh _ an aimsir
thing *aN* was expectation at-me *aL* fulfill.COND _ the time
something that I expected time would confirm
(McCloskey 2002:196, ∼(28))

The relevant parts of the f-structure and s-structure for this example are as follows:[7]

(6.83)



The lower SpecCP contributes the embedded TOPIC and its PRED. The complementizer *aL* grounds this filler to the object gap through functional equality. This integrates the TOPIC, satisfying the ECC, and gives the OBJ a PRED, satisfying completeness. The lower SpecCP does not contribute the meaning constructor REL_σ, though, because this CP is not in a relative clause and therefore not in an ADJUNCT set. The upper SpecCP similarly contributes a TOPIC with PRED 'pro'. This cannot be a FILLER that is passed by *aL*, because *aL* can only functionally equate its UDF with that of its COMP. The lower TOPIC is too far embedded for *aL* to pass it up — hence the Complex NP Island. The upper complementizer can be realized as *aN* in its binder passing capacity. *AN* integrates the

[7] I have been fairly free in my assumption about the internal structure of the complex NP and the role of the copula, because these considerations are quite peripheral to the point at hand. I have also assumed that the inflected PP *agam* ('at-me') is the SUBJ of *coinne* ('expectation'). Again, this matter is peripheral to the main concern.

upper TOPIC by anaphorically binding the lower TOPIC, thus “passing” it from the lower clause to the upper clause.

Example (6.82) contributes the following meaning constructors, instantiated to (6.83):

(6.84)

1. $(v \multimap r) \multimap \forall X.[(s \multimap X) \multimap X]$ Lex. **rud (‘thing’)**
2. $v \multimap r$ Lex. **rud (‘thing’)**
3. $(p1 \multimap b) \multimap [(v \multimap r) \multimap (v \multimap r)]$ REL_{σ}
4. $(p2 \multimap b) \multimap (p1 \multimap b)]$ Lex. **a (‘aN’)**
5. $e \multimap b$ Lex. **raibh (‘was’)**
6. $i \multimap c \multimap e$ Lex. **coinne (‘expectation’)**
7. i Lex. **agam (‘at-me’)**
8. $t \multimap p2 \multimap c$ Lex. **choimhlíonfadh (‘confirm’)**
9. t Lex. **an aimsir (‘the time’)**

These premises construct the the proof in Figure 6.2 for the relative clause (6.82).

$$
\dfrac{
\begin{array}{l}\textbf{rud (‘thing’)}\\ (v \multimap r) \multimap \forall X.[(s \multimap X) \multimap X]\end{array}
\quad
\dfrac{
\dfrac{
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\dfrac{
\dfrac{
\dfrac{
\begin{array}{l}\textbf{an aimsir}\\ \textbf{(‘the time’)}\\ t\end{array}
\quad
\begin{array}{l}\textbf{choimhlíonfadh}\\ \textbf{(‘confirm’)}\\ t \multimap \mathit{p2} \multimap c\end{array}
}{\mathit{p2} \multimap c}
\quad [\mathit{p2}]^1
}{c}
\quad
\dfrac{
\begin{array}{l}\textbf{coinne}\\ \textbf{(‘expectation’)}\\ i \multimap c \multimap e\end{array}
\quad
\begin{array}{l}\textbf{agam}\\ \textbf{(‘at-me’)}\\ i\end{array}
}{c \multimap e}
}{e}
\quad
\begin{array}{l}\textbf{raibh}\\ \textbf{(‘was’)}\\ e \multimap b\end{array}
}{b}
}{\mathit{p2} \multimap b}\multimap_{\mathcal{I},1}
\quad
\begin{array}{l}\textbf{aN}\\ (\mathit{p2} \multimap b) \multimap (\mathit{p1} \multimap b)\end{array}
}{\mathit{p1} \multimap b}
\quad
\begin{array}{l}\mathit{REL}_\sigma\\ (\mathit{p1} \multimap b) \multimap [(v \multimap r) \multimap (v \multimap r)]\end{array}
}{(v \multimap r) \multimap (v \multimap r)}
\quad
\begin{array}{l}\textbf{rud (‘thing’)}\\ v \multimap r\end{array}
}{v \multimap r}
}{\lambda S.\mathit{some}(x,\ \mathit{thing}(x)\ \wedge\ \mathit{be}(\mathit{expectation}(s,\ \mathit{confirm}(\mathit{the\text{-}time},\ x))),\ S(x)) : \forall X.[(s \multimap X) \multimap X]}
$$

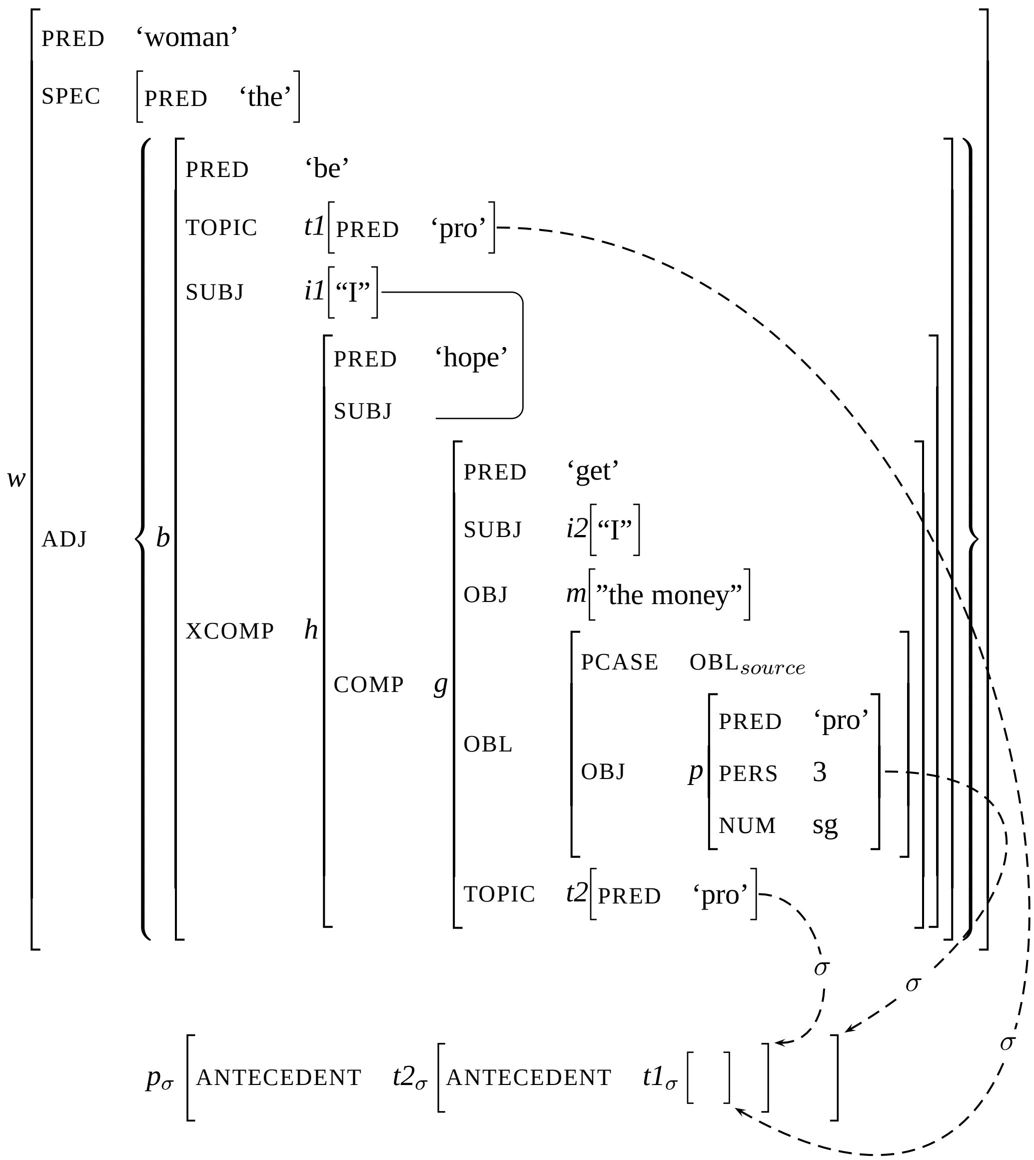
Figure 6.2: Irish Pattern 1 proof

Lastly, consider the following Pattern 3 example:

(6.85) an bhean a raibh mé ag súil a bhfaighinn an t-airgead <u>uaithi</u>
the woman *aN* was I hope.PROG *aN* get.COND.1SG the money from-her
the woman that I was hoping that I would get the money from (her)
(McCloskey 2002:199, ∼(41))

The relevant parts of the f-structure and s-structure for this example are as follows:[8]

(6.86)



[8]I have assumed that the preposition that incorporates the resumptive pronoun as its OBJ is just a case-marking preposition. This allows simplification of the proof, but the analysis does not depend on this assumption.

The lower SpecCP contributes the lower TOPIC and its PRED ‘pro’. Again, the lower SpecCP does not contribute the meaning constructor REL_σ, because the lower CP is not a relative clause and therefore not in an ADJUNCT set. The lower TOPIC is grounded by *aN* in its binder grounding capacity. The lower TOPIC anaphorically binds the resumptive pronoun OBJECT at s-structure. The higher SpecCP contributes the higher TOPIC and also the relative clause meaning constructor REL_σ, since this CP does occur in relative clause formation. The higher TOPIC is integrated by *aN*, but this time in its binder passing capacity. Notice that *aL* is again ruled out at the top of this mixed chain, because the lower TOPIC is too far embedded (in XCOMP COMP) for it to be integrated by *aL* in its filler passing capacity.

The following meaning constructors, instantiated to (6.86), are contributed for example (6.85):

(6.87)

1.	$(v \multimap r) \multimap \forall X.[(w \multimap X) \multimap X]$	Lex. **an (‘the’)**
2.	$v \multimap r$	Lex. **bhean (‘woman’)**
3.	$(t1 \multimap b) \multimap [(v \multimap r) \multimap (v \multimap r)]$	REL_σ
4.	$(t2 \multimap b) \multimap (t1 \multimap b)]$	Lex. **a (‘aN’)**
5.	$h \multimap b$	Lex. **raibh (‘was’)**
6.	$i1$	Lex. **mé (‘I’)**
7.	$i1 \multimap g \multimap h$	Lex. **ag súil (‘hope’)**
8.	$(p \multimap g) \multimap (t2 \multimap g)$	Lex. **a (‘aN’)**
9.	$[t2 \multimap (t2 \otimes p)] \multimap (t2 \multimap t2)$	Lex. **a (‘aN’)**
10.	$i2 \multimap m \multimap p \multimap g$	Lex. **bhfaighinn (‘get’)**
11.	$i2$	Lex. **bhfaighinn (‘get’)**
12.	m	Lex. **an t-airgead (‘the money’)**
13.	$t2 \multimap (t2 \otimes p)$	Lex. **uaithi (‘from-her’)**

These premises construct the long but successful proof shown in Figure 6.3. The lower *aN* anaphorically binds the pronoun, thus grounding the binder-resumptive dependency, and contributes a premise for relabeling the resumptive’s dependency, shown in the small dashed box. The lower *aN* crucially also contributes a manager resource to license the resumptive. The effects of the manager resource are shown in the larger dashed box. The higher *aN* anaphorically binds the lower TOPIC, thus passing the binder-resumptive dependency, and contributes a dependency relabeling premise for the bound TOPIC. The higher *aN*’s relabeling premise is shown in the small solid box.

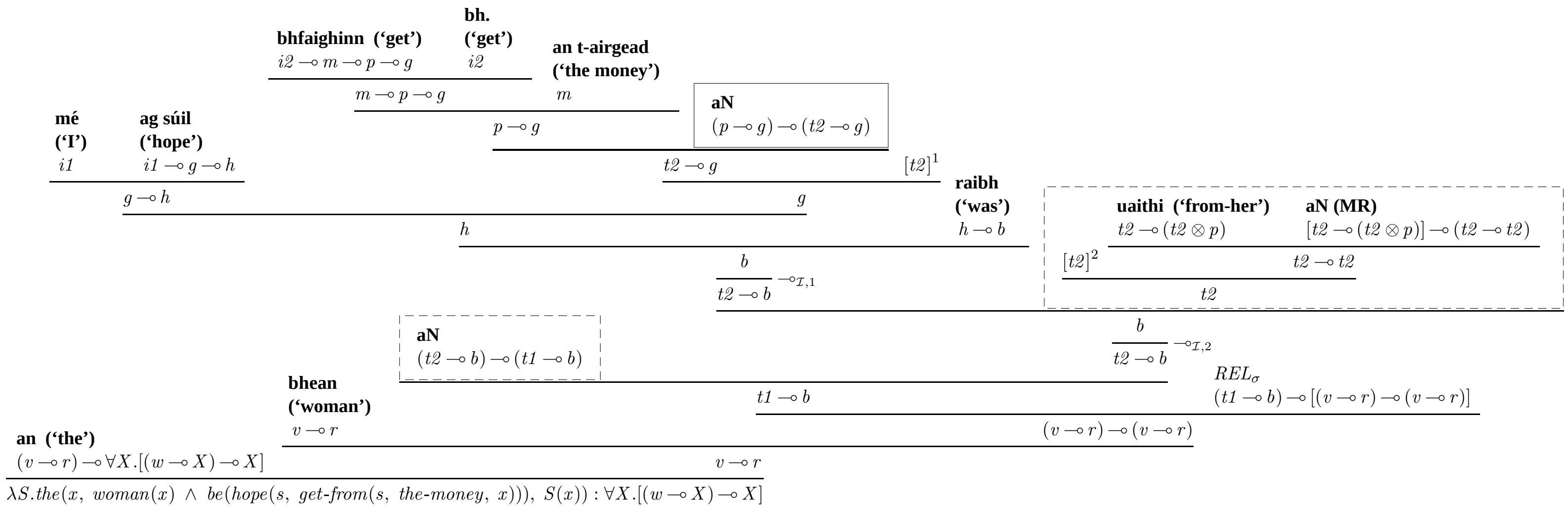


Figure 6.3: Irish Pattern 3 proof

6.5 Summary

In this section I have presented a detailed application of the resource managent theory of resumption in an analysis of Irish unbounded dependencies that has accounted for both filler-gap and binder-resumptive dependencies.

In addition to the general theory of resumption developed in chapter 5, the analysis of Irish was built around three key ingredients: the rule for CP formation and lexical entries for the complementizers *aL* and *aN*. These are repeated here:

(6.88) $$\mathrm{CP} \longrightarrow \left\{ \begin{array}{c} \mathrm{XP} \\ (\uparrow \textsc{focus}) = \downarrow \end{array} \middle| \begin{array}{c} \epsilon \\ (\uparrow \textsc{topic pred}) = \text{‘pro’} \\ \left(\begin{array}{c} (\textsc{adj} \in \uparrow) \\ REL_\sigma \end{array} \right) \end{array} \right\} \begin{array}{c} \mathrm{C}' \\ \uparrow = \downarrow \end{array}$$

(6.89) *aL*: $\hat{\mathrm{C}}$ $\{ (\uparrow \textsc{udf}) = (\uparrow \textsc{comp udf}) \mid (\uparrow \textsc{udf}) = (\uparrow \textsc{gf}) \}$

(6.90) *aN*: $\hat{\mathrm{C}}$

$$\left\{ \begin{array}{l} (\uparrow \textsc{udf})_\sigma = ((\uparrow \textsc{gf}^+ \textsc{udf})_\sigma \ \textsc{antecedent}) \\ \lambda P.P : ((\uparrow \textsc{gf}^+ \textsc{udf})_\sigma \multimap \uparrow_\sigma) \multimap ((\uparrow \textsc{udf})_\sigma \multimap \uparrow_\sigma)] \end{array} \right|$$

$$\left. \begin{array}{l} (\uparrow \textsc{udf})_\sigma = ((\uparrow \textsc{gf}^+)_\sigma \ \textsc{antecedent}) \\ \lambda P \lambda y.y : \\ [(\uparrow \textsc{udf})_\sigma \multimap ((\uparrow \textsc{udf})_\sigma \otimes (\uparrow \textsc{gf}^+)_\sigma)] \multimap ((\uparrow \textsc{udf})_\sigma \multimap (\uparrow \textsc{udf})_\sigma) \\ \lambda P.P : ((\uparrow \textsc{gf}^+)_\sigma \multimap \uparrow_\sigma) \multimap ((\uparrow \textsc{udf})_\sigma \multimap \uparrow_\sigma) \end{array} \right\}$$

The analysis not only explains the core Irish data, it also explains the difficult "mixed chains", Patterns 1, 2 and 3.

The basic generalization that emerges about the Irish unbounded dependency complementizers *aL* and *aN* is that they are instrumental in integrating unbounded dependencies into the grammatical representation. They share the fundamental role of satisfying the Extended Coherence Condition. Two methods for integrating unbounded dependencies and satifying the ECC have been independently proposed in the LFG literature (Zaenen 1980, Bresnan and Mchombo 1987, Bresnan 2001, Dalrymple 2001): functional equality and anaphoric binding. These are precisely the methods used by *aL* (functional equality) and *aN* (anaphoric binding). The complementizers further share the twin roles of *passing* and *grounding* unbounded dependencies. *AL* performs filler passing and filler grounding via functional equality. *AN* performs binder-passing and binder-grounding via anaphoric binding. The different mechanisms explains why filler-gap dependencies are marked successive-cyclically by *aL* in the core case, whereas binder-resumptive dependencies are not cyclic, since anaphoric binding is not cyclic. The complementizer system is summarized in Table 6.3.

	Role Relative to Position			
	Not bottom	**Bottom**	**Method**	**Cyclic?**
aL	Passing	Grounding	Functional equality	Yes
aN	Passing	Grounding Resumptive licensing	Anaphoric binding	No

Table 6.3: The role of the Irish complementizers *aL* and *aN* in unbounded dependencies

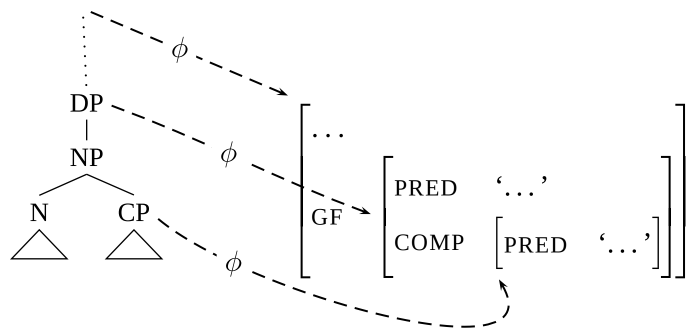
6.6 Discussion

In this section I discuss some further predictions of this theory with respect to Irish and some directions for future work. I also compare the analysis presented here to the recent Minimalist analysis of (McCloskey 2002).

6.6.1 Predictions and directions for future work

I mentioned in section 6.3.1 that the Complex NP Island facts are derived from the analysis of *aL* and the Extended Coherence Condition. The complementizer *aL* either grounds a filler to a GF in its clause or it passes the filler by identifying the UDF in its clause with that of its COMP. The complex NP will correspond to an f-structure that is itself the value of a grammatical function other than COMP. This is sketched here:

(6.91)



There is thus no way for the filler-gap complementizer to pass information out of a complex NP, because the filler will be trapped in the complex NP's GF. This is a direct result of the functional equalities in the complementizer's lexical entry.

The very same reasoning accounts for the impossibility of gaps in various other positions. McCloskey (1979:8) notes that gaps are not licensed in prepositional objects, possessive NPs and objects of comparison. All of these positions are further embedded in some grammatical function. A PP maps to grammatical functions such as OBL, ADJ, and SUBJ. Its object will necessarily be too far removed for the paths in *aL*'s equations to reach. Possessive NPs and objects of comparison will likewise map to grammatical functions inside other NPs. The outer nominal will again trap the filler.

It therefore seems that if we take the successive cyclicity of *aL*-marking seriously then many of the facts about gap distribution in Irish follow. No auxiliary statements about the inability of prepositions to properly govern or otherwise license gaps seem necessary (Sells 1984, McCloskey 1990). The aspect of the analysis that captures the successive cyclicity is filler grounding and passing by functional equality. It may be that the paths specified in the particular lexical entry for *aL* that I have presented are not quite right (i.e., it wrongly excludes or includes some cases), but the general strategy seems promising. A direction for future work is to examine the distribution of gaps in Irish carefully in light of this kind of analysis. One particular adjustment that seems likely to be neccessary is to allow *aL* to pass a filler through an open complement XCOMP as well as a closed COMP.

The fact that path specifications in the lexical entry for *aL* (and *aN*) can capture some of the distributional facts about gaps and pronouns does not mean that they must capture all of them. Some distributional facts might be better stated separately. For example, embedded questions are also islands for filler-gap dependencies in Irish (McCloskey 1979). One way to capture this would be to add an off-path constraint to the filler-passing capacity of *aL* that states that the COMP that is passed through cannot have interrogative mood:

(6.92) *aL*: $\hat{\mathrm{C}}$ $$\{\, (\uparrow \mathrm{UDF}) = (\uparrow \underset{(\rightarrow\ \mathrm{MOOD}) \neq \text{interrog}}{\mathrm{COMP}}\ \mathrm{UDF}) \mid (\uparrow \mathrm{UDF}) = (\uparrow \mathrm{GF}) \,\}$$

The off-path meta-variable $\rightarrow$ picks out the value of the f-structure attribute with which it is associated on the path, in this case COMP. The equation states that the COMP that *aL* passes the UDF through cannot be a question. The means are therefore there to capture the embedded question constraint in *aL*'s lexical entry.

Alternatively, we could hold off on complicating *aL*'s lexical entry in this manner and depend on a general theory of *wh*-islands to account for the facts instead. It may be that the ultimate theory makes use of path equalities too. For example, it could state that the a UDF path cannot terminate in a question clause:

(6.93) $$(\uparrow \mathrm{MOOD}) = \text{interrogative} \;\Rightarrow\; ((\mathrm{GF}^{+}\ \uparrow)\ \mathrm{UDF}) \neq (\uparrow\ \mathrm{GF})$$

The equation on the right hand side is similar to the equations used in LFG's binding theory (Dalrymple 1993, 2001, Bresnan 2001). It states that there cannot be an f-structure g that is found by going out one or more f-structures from $\uparrow$ such that g's UDF is functionally equated with a grammatical function in $\uparrow$.

Another independent constraint is the Highest Subject Restriction (McCloskey 1990), which blocks a resumptive pronoun from the highest subject of an unbounded dependency (e.g., the subject in the clause immediately following the relative head). Only a gap may appear in this position. One possibility is to adopt McCloskey's (1990) position that there is an anti-locality effect on anaphoric binding of a subject resumptive pronoun by a UDF in its own clause. The restriction can be stated as follows:

(6.94) $$(\uparrow_{\sigma}\ \mathrm{ANTECEDENT}) \neq ((\mathrm{SUBJ}\ \uparrow)\ \mathrm{UDF})_{\sigma}$$

This equation means that a subject (SUBJ) cannot be locally bound by an unbounded dependency function (UDF) in its clause. It is stated in terms of the binding equations used in LFG for binding theory (see chapter 2, section 2.1.5). This formulation of the HSR is therefore a binding-theoretic formulation, like McCloskey's.

As it stands, the equation makes a certain prediction about Patterns 2 and 3. In each of these patterns there is binder grounding of a UDF by *aN* in an embedded clause. This is done through anaphoric binding. The HSR equation above therefore predicts that even in an embedded clause the subject cannot be locally grounded by *aN*. That is, the restrictions sketched here hold as well as the HSR:

(6.95) *[$_{\text{CP}}$ *aL* . . . [$_{\text{CP}}$ *aN* . . . SUBJ . . .]]] Pattern 2
pass * ground

(6.96) *[$_{\text{CP}}$ *aN* . . . [$_{\text{CP}}$ *aN* . . . SUBJ . . .]]] Pattern 3
pass * ground

The prediction in (6.96) is correct. McCloskey (1990:219) notes that despite speakers' "uncertainty and insecurity" about judgements for Pattern 3 in general, they share the firm intuition that a resumptive in the subject of a lower CP marked by *aN* is ungrammatical (also see McCloskey 1979:168 and McCloskey 2002:202):

(6.97) * an fear ar shíl mé a raibh sé breoite
the man *aN* thought I *aN* was he ill
the man that I thought (he) was ill
(McCloskey 1990:219, (54))

It remains to be seen what the status of the embedded subject is in the Pattern 2 example (6.95). The theory predicts that it will be equally ungrammatical.

Finally, let us turn back to mixed chains. The analysis makes predictions about longer instances of these. The predictions are hard to verify, since the mixed chains test the limits of speakers' competence, but the predictions are there nonetheless. The first prediction is that the bottom of Patterns 2 and 3, which are grounded by *aN*, can be extended as per the core multi-clausal patterns for binder-resumptive dependencies:

(6.98) *aL* . . . *aN* . . . *go* . . . *go* . . . *Rpro* Pattern 2

(6.99) *aN* . . . *aN* . . . *go* . . . *go* . . . *Rpro* Pattern 3

The binder grounding function of *aN* anaphorically binds the resumptive and is therefore non-local. The binder passing function of *aN* is similarly non-local, but requires a subordinate UDF to bind. The prediction is that the top of Pattern 1 and 3 can also be stretched out with intervening *go*, so long as there is an *aL* or *aN* below:

(6.100) *aN* . . . *go* . . . *go* . . . *aL* . . . __ Pattern 1

(6.101) *aN* . . . *go* . . . *go* . . . *aN* . . . *Rpro* Pattern 3

Lastly, the *aL*-marking can also be stretched out successive cyclically, so long as the general conditions on filler passing can be satisfied:

(6.102) *aN* ... *aL* ... *aL* ... _ Pattern 1

(6.103) *aL* ... *aL* ... *aN* ... *Rpro* Pattern 2

As mentioned throughout this chapter, mixed chains are hard to come by (see the quote from McCloskey 2002 on page 177). Jim McCloskey (p.c.; 17/10/03) has informed me that he has previously collected examples like the following, which are of the extended-*aL* Pattern 2 form in (6.103):

(6.104) an fear a dúirt tú a shíl siad a raibh saibhreas mór aige
the man *aL* said you *aL* thought they *aN* was wealth great at-him
the man that you said they thought was very wealthy

6.6.2 A comparison to another recent analysis

McCloskey's latest analysis of the unbounded dependency system of Irish (McCloskey 2002) is formulated in terms of recent work in the Minimalist Program (Chomsky 2000, 2001). The analysis is simple and elegant and explains a wide array of data. It sets a real benchmark for analyses of Irish unbounded dependencies, which I have attempted to meet in this chapter. However, the Achilles heel of McCloskey's analysis is that it has trouble ensuring proper semantic composition, a problem that McCloskey (2002:219) acknowledges. The present analysis derives the entire licensing mechanism for resumptives from considerations of semantic composition and therefore unsurprisingly does not have this problem.

Rather than turning directly to the problem of semantic composition, I want to go through how McCloskey (2002) arrives at his analysis, because there are relevant points of convergence and divergence between the theories that emerge. McCloskey (2002) starts out by revisiting his previous analysis of Irish unbounded dependencies (McCloskey 1990) and showing that certain assumptions in the earlier system are problematic. In McCloskey (1990) it is assumed that successive-cyclic wh-movement to SpecCP results in *aL*-marking of each CP. Binder-resumptive dependencies are licensed by a null operator in the highest SpecCP that anaphorically binds the resumptive. There is no successive-cyclic movement through intermediate SpecCPs and therefore no marking of the intermediate CPs (which are marked by *go*). The crucial assumption that allows the analysis to predict the form of the complementizers is that the operator that licenses resumptives must have distinct properties from the *wh*-operator that determines *aL*-marking. Furthermore, whatever these properties are, they must be such that the complementizer can be sensitive to them (McCloskey 2002:192). McCloskey proposes and explores two options (McCloskey 2002:192, (i–ii)):

(6.105)
1. There is an intrinsic, lexically-specified difference between the element that determines the form *aL* and the element which determines the form *aN*.
2. The operator that binds resumptives inherits features from the resumptive pronoun that are distinct from features of the *wh*-operator that determines the form *aL*.

The second option is basically the one taken by McCloskey (1990).

The first option seems at first to be equivalent to what happens in the resource management theory of resumptives presented here. However, this is a spurious similarity. Option 1 is about lexically specified differences between the element that determines the form *aL* and *aN* — that is, lexically-specified differences between the two kinds of *operators*. The equivalent on the present theory, I suppose, would be if the mechanism of functional equality or anaphoric binding were to determine the form of the complementizer. This is not what happens though: it is lexical differences between the complementizers themselves that determines their form.

McCloskey (2002:192–193) presents two arguments against the second option of feature inheritance from resumptives to *aN*-marking operators. The first concerns the lack of viable features to make the distinction, and the second concerns the non-locality of the mooted feature-inheritance.

The feature in question cannot be a feature associated with pronouns in their resumptive capacity, because this would distinctively mark resumptive pronouns as "special" pronouns. McCloskey (2002:192) notes that resumptive pronouns are overwhelmingly morphologically realized like ordinary pronouns and he wants to maintain an ordinary pronoun theory of resumption (see chapter 4, section C). The question then becomes whether some of the normal formal features that mark pronouns (e.g., person, number, gender) can be inherited by the resumptive-binding operator. McCloskey concludes that this is unlikely, based on data that shows non-agreement between the relative head and the resumptive pronoun:

(6.106) A Alec, tusa a bhfuil an Béarla <u>aige</u>
you *aN* is the English at-him
Hey, Alec — you that know(s) English
(McCloskey 2002:192, (20a))

(6.107) Is sinne an bheirt ghasúr a-r dhíol tú <u>ár</u> lóistín.
COP.PRES we the two boy *aN*-PAST paid you our lodging
We are the two boys that you paid our lodging.

McCloskey (2002:193) notes that the agreement features on these resumptives "fail to match the person-number features of their (ultimate) binders. If person-number features are inherited from bound pronouns by the elements which bind them, such mismatches are unexpected." Notice that McCloskey is making a claim about *inheritance* of features from a resumptive pronoun by the null operator in SpecCP that binds the resumptive, not just about agreement between a binder and the element that it binds.

The agreement itself is interesting, though. It is worth taking a slight detour at this point to see how the current theory fares with the data above. The binder of the resumptive pronoun in relative clauses such as the ones above is a TOPIC that has PRED 'pro', i.e. a kind of null pronominal. This null pronominal does not have inherent person–number–gender features, although it is the right sort of element to enter into agreement relations. The TOPIC is the ANTECEDENT of the resumptive at semantic structure. The distribution of agreement features is explained if the TOPIC itself has an ANTECEDENT which is found elsewhere in the sentence. This is in most cases the relative head itself, but it can also be something else — *Alec* in (6.106) and *sinne* ('we') in (6.107). Based on the usual assumption that there must be agreement between an antecedent and the element it is the antecedent of, there is agreement between the element outside the relative clause and the TOPIC and in turn agreement between the TOPIC and the resumptive. By transitivity of agreement, the resumptive agrees with the element outside the relative clause. The theory does not require the relative head to agree with the TOPIC in the relative clause, though, so it is left out of the loop. Normally there is no opportunity to observe any potential mismatch, since the TOPIC is a null pronominal, but in this case we do get to observe the lack of agreement, albeit indirectly. So the agreement possibilities above are predicted by the current theory, at least for relative clauses. In FOCUS constructions there is no wiggle room, since there is no equivalent of the relative head: the binder of the resumptive pronoun must agree with the pronoun, where such featural distinctions occur (e.g., the binder may be underspecified for the relevant agreement features).

I noted above that the claim is actually about inheritance of features, not just agreement. The second argument that McCloskey (2002) gives against such an inheritance mechanism is that it would have to be completely non-local, potentially reaching into all kinds of sentential nooks and crannies, such as positions inside PPs, possessors, islands, and deeply embedded clauses, to mention a few. Furthermore, the search for the pronoun to inherit from can skip several closer, potentially more accessible pronouns. McCloskey (2002:193) notes that such non-local inheritance of morphosyntactic features would be unprecedented. He therefore rejects option 2 in (6.105).

The remaining option is that the lexical specification in the operator in SpecCP determines the form of the complementizer (option 1). McCloskey rejects this option based on the mixed chain patterns. The basic reasoning goes like this. Assume that the operator that undergoes successive-cyclic movement to SpecCP (marked by *aL*) is itself a null pronominal, following earlier work (Browning 1987). Now consider what happens in Pattern 1, which consists of *aL*-marking of a CP inside a complex NP and *aN* marking of the CP that contains the complex NP. If the *wh*-operator that determines movement is itself a pronominal, then it can move to the lower SpecCP and then be bound by the upper SpecCP as a resumptive (McCloskey 2002:197, (32)):

(6.108) $[_{\mathrm{CP}}$ XP_j *aN* $[_{\mathrm{TP}}$ ... $[_{\mathrm{DP}}$ (D) $[_{\mathrm{NP}}$ N $[_{\mathrm{CP}}$ pro_j *aL* $[_{\mathrm{TP}}$ ... t_j ...]]]]]]

The crux of the problem is that the lower SpecCP needs to have certain features that determine *aL*, but it needs to pass up to the higher SpecCP features that determine *aN*. These are features which the lower SpecCP itself does not bear (since it determines *aL*).

Now consider Pattern 2, which is the inverse of Pattern 1 (*aL* ... *aN* ... *Rpro* ...). McCloskey (2002:198) notes that this pattern can be understood if the operator in the lower SpecCP that binds the resumptive and results in *aN*-marking subsequently moves to the higher SpecCP, resulting in *aL*-marking. The problem is clear: the very same element must through its featural properties determine *aN*-marking in the lower CP and *aL*-marking in the higher SpecCP.

Based on these considerations, McCloskey (2002) rejects the option of having the lexical specifications of the operator in SpecCP determine the realization of C as *aL* or *aN*. McCloskey (2002:201) suggests instead that the assumption that *aL* is associated with *wh*-movement and that *aN* signals the absence of movement leads to a hypothesis based on the independently-postulated tree-formation mechanisms of the Minimalist Program (Chomsky 1993). The effect of the proposal is the following (McCloskey 2002:201, (47)):

(6.109) C whose specifier is filled by Move is realized as *aL*.
C whose specifier is filled by Merge is realized as *aN*.
C whose specifier is not filled is realized as *go*.

It would be quite a novel proposal if the mode of introduction of syntactic material where to affect its morphological exponence, but this is just the effect of the proposal, not the actual proposal.

What McCloskey (2002:203, (50)) actually proposes is the following, based on the theory of phases and feature-checking of Chomsky (2000, 2001):

(6.110) C which bears both the *Op*-feature and the EPP-feature is realized as *aL*.
C which bears only the EPP-feature is realized as *aN*.
C which bears neither the *Op*-feature nor the EPP-feature is realized as *go*.

The "*Op*-feature" is assumed as a feature that identifies operators. It is assumed to appear on both *wh*-operators and null pronominal operators. It is interpretable, meaning that it has a semantic effect and need not be erased from the derivation to prevent Crash.

The *Op*-feature also occurs on C, to check the matching feature of the operator in SpecCP. The complementizer *aL* has the *Op*-feature and enters into an agreement relation with a null pronominal *pro* operator bearing the *Op*-feature. *AL* also bears the EPP-feature, which means that its specifier must be filled (Chomsky 2001). The EPP-feature of *aL* can be checked by Merge of the null operator into its SpecCP. However, independent aspects of the theory entail that the *Op*-feature on C cannot be checked by Merge. The *Op*-feature on C is assumed to be uninterpretable (unlike the *Op*-feature on the operator, which is interpretable) and the derivation would crash. Thus, the *Op*-feature and EPP-feature on C jointly force the null pronominal operator to Move to SpecCP of *aL*'s CP. *AL* realizes C with an *Op*-feature and an EPP-feature and therefore marks *wh*-movement.

AN realizes a C with the EPP-feature, but with no *Op*-feature. The EPP-feature means that SpecCP of C must be filled to check the feature. This could happen by either Move or Merge, but economy conditions of the theory dictate that it must be Merge, since Move is considered to be more complex than Merge. *AN* is therefore associated with Merge and the absence of movement. McCloskey (2002:204–205) shows that the mixed chains follow if at each point a local decision is made to either Move or Merge.

Despite their quite different theoretical assumptions and mechanisms, several points of convergence can be identified between McCloskey's (2002) theory and the resource management theory:

1. Both theories postulate a null pronominal in unbounded dependencies. In McCloskey's theory, the null pronominal operator is present in all unbounded dependencies. In the resource management theory, the null pronominal occurs only in the absence of overt syntactic material.

2. Both theories account for successive cyclicity or lack thereof in a locally blind manner. In McCloskey's theory this arises from local application of Move or Merge. In the present theory this arises from local application of filler or binder grounding at the bottom of the dependency and local application of filler or binder passing in each intermediate position.

3. Both theories treat resumptive pronouns as ordinary pronouns and derive distinctions between resumptives and gaps from this assumption.

4. Both theories are strongly lexicalist. It is the presence of an item that bears the relevant lexical information borne by *aN* — the EPP-feature but no *Op*-feature in McCloskey's theory

> or a manager resource in the present theory — that "distinguishes languages which have a productive and grammaticized resumptive pronoun strategy from those which do not" (McCloskey 2002:205). As McCloskey (2002) notes, the difference between languages that have resumptive pronouns and those that do not reduces to the availability of a particular lexical item.

This much convergence is heartening. The two theories are based on quite different assumptions and employ quite different mechanisms. Any convergence between them is therefore indicative of true progress.

This is not to say that there are no points of divergence, though. One key difference between the two theories is that the present theory ties the presence of *aN* to a resumptive pronoun in a way that McCloskey's theory does not. McCloskey (2002:205) notes that "A third feature of the proposal is that it does not in any direct way force the appearance of a resumptive pronoun within a clause headed by *aN*." Any material that is Merged into SpecCP of *aN* can potentially check its EPP-feature.

The pattern of complementizer marking in adjunct unbounded dependencies is relevant to this point. McCloskey (2002:206–212) shows that adjunct extraction often results in *aN*-marking, even though there is no overt resumptive:

(6.111) Siúd an áit a bhfuair mé é
that the place *aN* got I it
that's the place that I got it
(McCloskey 2002:208, (60b))

Based on data from dialect variation, McCloskey (2002:207) shows that this is the same *aN* as in binder-resumptive dependencies. He shows that for locatives, manner adverbials and temporals, there is free alternation between *aL*- and *aN*-marking. McCloskey (2002:209) argues that there is reason to believe that there are pronominal elements corresponding to temporal and locative adverbials and that given the general availability of null pronominals / incorporated pronominal information in Irish it is reasonable to assume that there are null pronominals corresponding to these adverbials. The proposal is therefore that *aN*-marked temporal, locative, and manner unbounded dependencies contain null resumptive pronouns. If I am granted the same assumptions, then *aN*-marking also follows in this theory. *AL*-marking is also possible, on the assumption that the null adverbial pronominal is not obligatory (and there is no indication that it is), because ADJ is a GF and *aL* can ground the filler appropriately. McCloskey (2002:208–209) notes that frequency and durative adverbials can only be marked by *aL* and assumes that there are no null pronouns corresponding to these adverbials. The lack of *aN*-marking follows on both theories.

The crucial case has to do with reason adverbials. These can *only* occur with *aN*-marking:

(6.112) Cén fáth a-r dhúirt tú sin?
what reason *aN*-PAST said you that
Why did you say that?
(McCloskey 2002:209, (67a))

(6.113) * Cén fáth a dúirt tú sin?
what reason *aL* said you that
Why did you say that?
(McCloskey 2002:209, (67b))

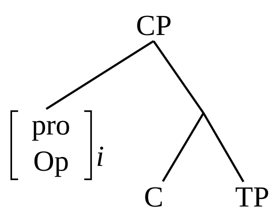
McCloskey (2002:210) follows Rizzi (1990, 1996) in treating the interrogative form of reason adverbials as being base-generated in SpecCP. It then follows that the only C that can appear is *aN*, the one that has only the EPP-feature and whose SpecCP must be filled by Merge.

This is certainly a neat result that stems from the fact that *aN* on McCloskey's theory signals filling of SpecCP by Merge rather than presence of a resumptive pronoun. By contrast, on the theory presented here *aN*-marking is strongly tied to the presence of a resumptive pronoun, except where there is an embedded unbounded dependency that undergoes binder passing. There is no such UDF in the example above, though. I would have to postulate an obligatory null resumptive pronoun for reason adverbials or else argue that it is not the same *aN*, in which case the pattern of dialect variation would be hard to account for. I will leave this as an open problem for the resource management theory, but I want to make a couple of final observations about adjunct extractions.

The reason that McCloskey (2002:209) gives for positing null pronouns for temporal and locative adverbials is that they are fairly easily extracted from weak islands and such extraction has been connected to the availability of corresponding pronouns (often null). However, manner adverbials in Irish also allow *aN*-marking but these are notoriously difficult to extract from even weak islands and tend not to have corresponding pronominal forms. Thus, whatever it is that allows manner adverbials to have null pronominals cannot be justified in the same terms as temporal and locative adverbials. If manner adverbials can help themselves to null pronouns — for a reason that is basically unknown at this point — then perhaps reason adverbials can, too. Whatever the ultimate explanation is, it must also explain why manner adverbial extraction is only optionally *aN*-marked whereas reason adverbial extraction is obligatorily *aN*-marked. The only proposal that I can make at this point is an explanatorily unsatisfactory but descriptively adequate one: manner adverbials optionally contribute a null pronominal, whereas reason adverbials obligatorily do so. However, I will argue shortly that McCloskey's proposal for *aN* leads to problems with semantic composition in the reason adverbial case and therefore ultimately fails to explain the facts.

This brings us to semantic composition, which is the second key difference between the two theories, where the resource management theory arguably fares better than McCloskey's theory. McCloskey (2002:205–206) proposes that the *Op*-feature on an operator in SpecCP is interpretable and that the effect on semantics of the null operator is Functional Abstraction (i.e., lambda abstraction) over the variable that it binds. The variable in question is either a resumptive pronoun or the trace of the null pronominal operator *pro*. McCloskey (2002:206) assumes that the tree below has the semantic effect indicated (based on the theory of Heim and Kratzer 1998):

(6.114)



$[\![\mathrm{CP}]\!] \; = \; \lambda v_i^e [\![\mathrm{TP}]\!]$

The operator results in abstraction over the ***i***-th variable of type e, which is coindexed with the operator. The operator thus forms a predicate out of the clause that it is attached to, allowing it to serve as a scope or a relative clause predicate.

McCloskey (2002:219) notes the problem for semantic composition that this causes:

> This operation will apply appropriately at the "top" of A′–dependencies. But if it applies in intermediate positions, the result will be uninterpretable (the embedded CP will denote a predicate, rather than the proposition which the embedding verb expects to encounter in its complement position).

Application of the operation at intermediate positions will lead to improper variable-binding, resulting in the wrong intepretation. Consider a case where there is successive-cyclic movement of an operator through two complementizer positions. The resulting structure is sketched here:

(6.115) $[_{\mathrm{CP}}\ \mathit{Op}_i \quad \mathit{aL} \quad \ldots \ [_{\mathrm{CP}}\ \cancel{\mathit{Op}}_i \quad \mathit{aL} \quad \ldots \quad \mathrm{t}_i\ ]]$

The lower operator performs abstraction over its variable, as specified by (6.114), and results in the lower CP denoting a predicate. The upper operator then needs to perform the same operation. There are two potential variables for it to bind: the lower operator and the trace at the foot of the chain. The lower operator binds performs lambda abstraction over a type e variable and must therefore be a function type on e. Therefore, the lower operator cannot itself be a type e variable. It is then the wrong type to be bound by the upper operator. This means that the upper operator must attempt to bind the trace. However, this variable is already bound by the lower operator and is no longer free for binding. The lower operator has thus rendered predicate abstraction at the top of the chain impossible. Thus, the intermediate position is apparently problematic.

The problem of intermediate positions has been the focus of a recent criticism of McCloskey (2002) by Levine and Sag (2003:25–26), as part of a larger critique of *wh*-movement theories. After citing McCloskey's (2002) discussion of the problem of intermediate trace interpretation, Levine and Sag (2003:26) note:

> The problem, of course, is that the intermediate traces left by successive-cylic movement in the transformational analysis of extraction UDCs do no work at all that would justify having them in the representation.

It could be argued that this criticism misses the mark. The intermediate traces are a necessary effect of what *determines* the successive-cyclic effects. Although the traces themselves may not be doing any work, their place in the representation is justified by the mechanism that does the work of successive *aL*-marking, according to the theory being criticized.

The force of the criticism also depends on how one feels about the mechanisms in place in transformational grammar to deal with intermediate traces through deletion (Lasnik and Saito 1984, 1992, Chomsky 1991). In fact, if such mechanisms are assumed, the intermediate copies / traces do not cause a problem in McCloskey's (2002) analysis at all. In the core filler-gap pattern, a single null pronominal operator is Merged into the syntactic position corresponding to the gap. The operator is then moved successive cyclically from SpecCP to SpecCP (leaving traces). The operator ends up at the top of the unbounded dependency and performs abstraction over the variable at the base position. This results in the correct predicate for semantic composition. Similarly, in the core binder-resumptive pattern, a single operator is Merged into the uppermost SpecCP and performs abstraction over the resumptive pronoun that it binds (intermediate Cs are filled by neutral *go*). On the assumption that intermediate traces or copies are deleted and therefore not interpreted, the core patterns are not problematic on McCloskey's (2002) analysis.

The mixed chains are still problematic, however. In mixed chains there are invariably multiple instances of abstraction, and some of them will, as McCloskey observes, lead to uninterpretability, for the reasons discussed above. Consider Pattern 1 (*aN* ... *aL* ... __). An operator Moves to the lower SpecCP and an operator is Merged into the higher SpecCP. The lower operator performs abstraction over its variable and results in the complement CP in the complex NP denoting a predicate, rather than a proposition. Meanwhile, the upper SpecCP binds the null pronominal operator in the lower SpecCP. However, if the lower SpecCP is an operator, it cannot also be a type e variable. The upper operator's predicate abstraction should therefore fail due to a type mismatch. Furthermore, even if somehow binding of an operator could be made to follow, the wrong variable would be abstracted over. The upper operator needs to abstract over the variable that the lower operator binds. But the variable is within the scope of and is bound by the lower SpecCP operator. The upper SpecCP operator therefore cannot bind the requisite variable because it is not free within the scope of the upper operator. The other two mixed chain patterns give rise to exactly the same set of problems.

The problem is that the predicate abstraction mechanism is necessary for proper integration of the core cases and works for these cases if some kind of deletion mechanism is assumed, but it cannot successfully handle the mixed chains. McCloskey (2002:219) speculates tentatively about three possible solutions, but they are either implausible, as McCloskey himself notes about the first one, or they will not work. First, he proposes and rejects the possibility of Functional Abstraction being optional. He notes that "the concept of 'optional' rules of semantic composition is not obviously a coherent one" (McCloskey 2002:219). The second solution considered is that perhaps "the offending element is deleted by some mechanism from the structures that semantic composition operates on" (McCloskey 2002:219). One question that arises is how to ensure deletion of only the lower complementizers. A second potential problem is the resulting complication in the feature theory of the Minimalist Program. What does it mean for something to be Merged in or Moved to SpecCP for reasons of interpretation (and checking of an interpretable feature) only to be deleted for reasons of interpretation? The third problem, which McCloskey (2002:223 ,fn.29) notes, is that the theory would then lose its explanation of why the Highest Subject Restriction applies to an embedded subject if it is in a clause introduced by *aN* (see McCloskey 2002:202). The third solution proposed is that perhaps some kind of Cooper storage (Cooper 1975, 1983) can be used to postpone interpretation of the operator until a point at which it can be successfully integrated. But there is no such point: no matter where integration of the "extra" operator is attempted composition will fail for reasons discussed in the previous paragraph.

By contrast, on the resource management theory semantic composition is not problematic, as has been demonstrated throughout this chapter. The manager resources that license resumptive pronouns do so precisely by addressing the problem of composition. The points of similarity between the two theories are numerous and show a welcome theoretical convergence. The two key differences between the theories have to do with the semantic composition, where the resource management theory is to be preferred, and certain adjunct extractions, where the feature-checking theory initially seems to be preferable.

However, the problem of semantic composition also unfortunately undermines McCloskey's appealing account of reason adverbials. The account was based on the assumption that there is no resumptive pronoun in this case and that the *aN* marking arises due to Merge of the interrogative form of the reason adverbial into SpecCP. This means that an operator is Merged into SpecCP. The operator performs Functional Abstraction and there must therefore be a variable in the clause in which the reason adverbial is interpreted. This variable cannot be a trace, because then the reason adverbial would have had to Move to SpecCP, wrongly predicting *aL*-marking, which is completely ungrammatical, as shown in (6.113) above (see McCloskey 2002:209, (67b), (68b)). The only option is for there to be a null resumptive pronoun to serve as the variable. Therefore, based on its assumptions about semantic interpretation, McCloskey's (2002) theory also needs to have a null resumptive pronoun in these cases and thus fares no better than the present theory, which ties *aN*-marking to the presence of a resumptive.

Conclusion

The resource management theory of resumption has been applied to a detailed analysis of resumptive pronouns in Irish. The analysis was driven by lexical properties of the Irish complementizers, as summarized in Table 6.3, which is repeated here.

	Role Relative to Position			
	Not bottom	**Bottom**	**Method**	**Cyclic?**
aL	Passing	Grounding	Functional equality	Yes
aN	Passing	Grounding Resumptive licensing	Anaphoric binding	No

The role of the Irish complementizers *aL* and *aN* in unbounded dependencies

The lowest instance of the complementizer *aL* performs filler grounding at the bottom of the filler-gap dependency. Higher instances of *aL* perform successive filler passing from the bottom to the top of the dependency. *AL* performs its filler passing and grounding roles through functional equality. This explains the successive-cyclic marking of *aL* and derives a large part of the distribution of gaps in Irish. The lowest instance of the complementizer *aN* performs binder grounding, analogously to the filler grounding of *aL*. However, the mechanism used is anaphoric binding and the binder grounding is therefore unbounded, not successive-cyclic. Higher instances of *aN* perform binder passing, again through anaphoric binding. Thus, each complementizer performs unbounded dependency passing and grounding using the mechanisms of functional equality and anaphoric binding, which have independently been proposed (Bresnan and Mchombo 1987) as the two ways to satisfy LFG's condition on unbounded dependency integration, the Extended Coherence Condition. I showed that the analysis not only deals with the core Irish unbounded dependencies, but also extends to the difficult mixed chain cases recently discussed by McCloskey (2002). The analysis was shown to make several further predictions and suggests various directions for future work. A detailed comparison was made to McCloskey's (2002) analysis, which is couched in the Minimalist Program. There were several points of theoretical convergence, which is heartening given the radically different starting points of the analyses. A key point of divergence, though, had to do with ensuring proper behaviour at the syntax–semantics interface, in particular proper interpretation. I showed that McCloskey's (2002) theory has problems ensuring proper interpretation, especially in the mixed chain cases, whereas the resource management theory does not have such problems. The resource management theory of resumption is ultimately founded on a solution to the problem of resumptive pronouns as surplus resources for semantic composition. Ensuring proper composition and interpretation forms the heart of the theory.

Chapter 7

Resumptives in Swedish and Hebrew

Introduction

In this chapter I show how the resource management theory of resumption can be extended to analyses of Swedish and Hebrew. The result is especially significant in the case of Swedish, because it has previously been assumed that Swedish resumptive pronouns constitute a fundamentally different sort of grammatical phenomenon from the sort of resumptive pronouns found in Irish and Hebrew (McCloskey 1990:235–236). The resource management theory enables a unified theory of Irish, Hebrew, and Swedish resumptives that localizes differences between the different languages in their lexical inventories, particularly in the category of the resumptive-licensing complementizers and in the specification of the manager resources.

Section 7.1 presents the analysis of Swedish. Following Engdahl (1982), I set aside certain apparent cases of resumptive pronouns in Swedish as processing effects rather than true grammaticized resumptives. I return to these in section 8.1.2.3 of the next chapter. I first propose a structural analysis of Swedish resumptives (section 7.1.1), but ultimately reject this account in favour of a lexical analysis (section 7.1.2). The lexical account allows a theoretical understanding of Swedish resumptives that brings them together with Irish and Hebrew resumptives, while the structural account arguably does not. In section 7.1.3 I present data from a Swedish dialect that casts strong doubt on the empirical adequacy of Last Resort theories of resumption (Shlonsky 1992, Aoun et al. 2001). I finish the section on Swedish by considering various predictions of the theory with respect to weak crossover, reconstruction, parasitic gaps, and across-the-board extraction. In section G of chapter 4 I presented data from the latter three phenomena as potential evidence for an underlying gap-like status for resumptive pronouns. I argue that the theory makes the correct predictions for these phenomena, despite the fact that it assumes that Swedish resumptive pronouns are not gaps but rather ordinary pronouns, just like Irish and Hebrew resumptives.

Section 7.2 presents a brief analysis of the principal resumptive patterns in Hebrew. In section 7.2.1 I discuss how the theory can account for dialectal variation in Hebrew for resumptive pronouns in *wh*-questions.

The chapter concludes with a general argument from interpretation against treating resumptive pronouns as underlying gaps. The argument is also specifically applied to Swedish, which has constituted the best support for an underlying gap theory. I show that the interpretation argument applies equally well to Swedish and that there is therefore scant evidence for resumptives as underlying gaps.

7.1 Resumptive pronouns in Swedish

7.1.1 A structural account

It has been claimed that Swedish resumptive pronouns occur in four environments (Engdahl 1982, 1985, Maling and Zaenen 1982:235–239, Sells 1984:55–57), which I list here with relevant examples.

1. Sentential subjects

(7.1) [Vilken skådespelare]$_i$ var det att publiken inte kände igen __$_i$ / honom$_i$ ganska
which actor was it that audience.DEF not recognize __ / him rather
konstigt?
strange
(Which actor was the fact that the audience did not recognize (him) rather strange?)
(Engdahl 1982:165, (58))

2. Crossing dependencies

(7.2) [Den här presenten]$_i$ kan du säkert aldrig komma på vem$_j$ jag fick den$_i$ / * __$_i$
this here present.DEF can you surely never come on who I got it / __
av __$_j$.
from __
(This present you'll never guess who I got (it) from.)
(Maling and Zaenen 1982:236, ∼(13a))

3. Deep embedding (at least two clauses)

(7.3) I går såg jag [en film]$_i$ [$_{CP}$ som jag undrar om någon minns [$_{CP}$ vem som
yesterday saw I a film that I wonder if anyone remembers who that
regisserat __$_i$ / den$_i$]].
directed __ / it.
Yesterday I saw a film that I wonder if anyone knows who directed (it).
(Engdahl 1982:154, ∼(12))

4. Following material at the left periphery of CP

(7.4) [Vilket ord]$_i$ visste ingen [$_{CP}$ [hur många *M*]$_j$ [$_{C'}$ <u>det</u>$_i$ stavas med __$_j$]]?
which word knew nobody how many *M*s it is.spelled with __
Which word did nobody know how many Ms *(it) is spelled with?*
(Engdahl 1985:8, ∼(11))

(7.5) [Vilket ord]$_i$ visste ingen [$_{CP}$ [$_{C'}$ om <u>det</u>$_i$ stavas med ett *M*]]?
which word knew nobody if it is.spelled with an *M*
Which word did nobody know if (it) is spelled with an M*?*
(Engdahl 1985:8, ∼(11))

Engdahl (1982) argues that the putative resumptives found in the first three environments are either governed by processing constraints (environments 2 and 3) or are problematic for other reasons (environment 1). I will return to the first three environments in chapter 8, where I will argue that they should be separated from true resumptives in Swedish, which are those found in the fourth environment.

Engdahl (1982) offers the following generalization about resumptives in Swedish, which sets aside all but the fourth kind (Engdahl 1982:154, (18)):[1]

(7.6) Associate a preposed WH phrase with a pronoun which agrees in number, gender and person in the context $\underset{[+\text{LEX}]}{\text{COMP}}$ __ .

The relatively standard theoretical assumption at the time that Engdahl offered her generalization was that both *wh*-phrases and complementizers occurred in COMP. Her generalization therefore

[1] I have left out the part of this rule that concerns gaps and slightly modified the wording of the remainder as a result of the omission.

effectively captured the necessity (in the “standard” Swedish spoken in Sweden)[2] of a resumptive pronoun after lexical material at the left periphery of a clause, whether the material is a *wh*-phrase, as in (7.4), or a complementizer, as in (7.5).

Given more recent assumptions about the category COMP and in particular the adoption of the functional category of C^0 within an X-bar structure, Engdahl’s generalization must be updated slightly. It is not an option to make the claim about COMP a claim about C^0 instead, such that a resumptive occurs after an overt complementizer. This would wrongly exclude *wh*-phrases as in (7.4), since these constitute material in SpecCP, not in C^0. The descriptive content of Engdahl’s generalization is still accurate, though: if the bottom of an unbounded dependency immediately follows overt material in the left periphery of CP, then a resumptive pronoun is required. The upshot of the generalization, given general structural facts about Swedish grammar, is that an unbounded dependency into a subject position that immediately follows overt material at the left periphery of CP must be a binder-resumptive dependency terminating in a resumptive pronoun.

Now that the basic generalization is in place, it needs to be captured in the resource management theory of resumptives developed in chapter 5. The two fundamental questions are what licenses the resumptive pronoun — i.e., what contributes the manager resource — and how are the functional equations in the manager resource’s meaning constructor specified. The answer to the second question is naturally contingent on the answer to the first. There are a number of options that present themselves.

First, we could associate the manager resource with the binder in the binder-resumptive dependency. One could imagine doing this through a lexical redundancy rule that adds a manager resource to Swedish complementizers and *wh*-words. There is a key piece of evidence that renders this option unworkable, though. As in English, many propositional complement verbs in Swedish, such as *säga* (‘say’) and *tro* (‘think / believe’), can take a bare clausal complement that lacks a complementizer. The subject of a bare complement cannot be realized as a resumptive pronoun:

(7.7) [Vilken elev]$_i$ trodde ingen __$_i$ skulle fuska?
which student thought no one __ would cheat
Which student did no one think would cheat?
(Engdahl 1982:166, ∼(65a))

[2] I hesitate in using the term standard here, because it would seem to imply that the dialect of Swedish spoken in Finland is somehow sub-standard or that Fenno-Swedes treat the Swedish spoken in Sweden as the standard. Neither is the case. Nevertheless, calling the dialect “Swedish Swedish” sounds strange.

(7.8) * [Vilken elev]$_i$ trodde ingen han$_i$ skulle fuska?
which student thought no one he would cheat
Which student did no one think (he) would cheat?
(Engdahl 1982:166, ∼(65b))

These verbs can take a full complement with a complementizer, and then a resumptive is necessary (in standard Swedish):

(7.9) [Vilken elev]$_i$ trodde ingen att han$_i$ skulle fuska?
which student thought no one that he would cheat
Which student did no one think that (he) would cheat?
(Engdahl 1982:166, ∼(65c))

The basic problem for associating the manager resource with the binder in the binder-resumptive dependency is that there is no way for the binder to tell whether there is lexical material at the left periphery of the clause that contains the resumptive, which is an unbounded distance away. In particular, there is no principled way in the theory for the binder to check whether there is a complementizer or SpecCP material present in the clause with the resumptive. The check cannot be performed through c-structure and the only way to do it through f-structure would be if there were some feature that only the complementizer adds to the f-structure or to use the inverse of the ϕ-mapping from c-structure to f-structure to check that there is a CP node pointing at the f-structure that contains the resumptive SUBJECT. These options would still not access *wh*-material in SpecCP, though. Furthermore, both of these options are unviable for locality reasons. As McCloskey (2002) has argued, we would like the licensing mechanism for resumption to be as local in its application as possible. The sort of checking proposed would give up the local account of manager resources that was developed in chapter 5. Manager resources in general need to find a resumptive pronoun an unbounded distance away. This much non-locality can be allowed, since a binder-resumptive dependency involves anaphoric binding. However, although the anaphoric binding that the manager resource is involved in allows it to identify a non-local resumptive, anaphoric binding does not in any way sanction performing checks on the surrounding syntactic material of the bound resumptive from an unbounded distance away. Any such checks must be performed locally to the structure being checked. The data in (7.7)–(7.9) therefore strongly indicate that the licenser of a resumptive pronoun in Swedish must be local to the resumptive, because only a local licenser could be restricted in the right manner and only a local licenser could perform the requisite check on the syntactic material local to the resumptive.

One straightforward method for capturing Engdahl's generalization in the grammar is to encode it structurally: SpecCP and C^0 are allowed to license resumptives by directly adding manager resources to the relevant c-structure rules. The result is shown schematically here:

(7.10) $$\text{CP} \longrightarrow \begin{array}{cc} \text{SpecCP} & \text{C}' \\ (\uparrow \text{UDF}) = \downarrow & \uparrow = \downarrow \\ (\textbf{Manager resource}) & \\ \vdots & \end{array}$$

(7.11) $$\text{C}' \longrightarrow \begin{array}{cc} \text{C}^0 & \text{IP} \\ \uparrow = \downarrow & \uparrow = \downarrow \\ (\textbf{Manager resource}) & \\ \vdots & \end{array}$$

The manager resource must be optional, because the relevant rule elements are involved in non-resumptive cases, too:

(7.12) Jag undrar [$_{\text{CP}}$ hur ofta [$_{\text{C}'}$ Pelle / han fuskar]].
I wonder how often Pelle / he cheats
I wonder how often Pelle / he cheats.

(7.13) Jag undrar [$_{\text{CP}}$ [$_{\text{C}'}$ om Pelle / han fuskar]].
I wonder if Pelle / he cheats
I wonder if Pelle / he cheats.

Next the lexical specification of the manager resource must be given. We know that it removes a local subject pronoun. The specification therefore looks like this:

(7.14) $$[((\uparrow \text{SUBJ})_\sigma \ \text{ANTECEDENT}) \multimap [((\uparrow \text{SUBJ})_\sigma \ \text{ANT}) \otimes (\uparrow \text{SUBJ})_\sigma]] \multimap \\ [((\uparrow \text{SUBJ})_\sigma \ \text{ANT}) \multimap ((\uparrow \text{SUBJ})_\sigma \ \text{ANT})]$$

Using local names, we can further compact this as follows:

(7.15) $$\%\text{RP} = (\uparrow \text{SUBJ})$$

$$[(\%\text{RP}_\sigma \ \text{ANTECEDENT}) \multimap ((\%\text{RP}_\sigma \ \text{ANT}) \otimes \%\text{RP}_\sigma)] \multimap \\ [(\%\text{RP}_\sigma \ \text{ANT}) \multimap (\%\text{RP}_\sigma \ \text{ANT})]$$

The specification of the manager resource is slightly different in Swedish from what we saw for Irish in the previous chapter, which looked like this:

(7.16) $[(\uparrow \text{UDF})_\sigma \multimap ((\uparrow \text{UDF})_\sigma \otimes (\uparrow \text{GF}^+)_\sigma)] \multimap [(\uparrow \text{UDF})_\sigma \multimap (\uparrow \text{UDF})_\sigma]$

The final result is the same in both cases, though: a resource of schematic form $(A \multimap (A \otimes P)) \multimap (A \multimap A)$. The difference in specification has to do with how the rest of the binder-resumptive dependency works and with the requirement of locality. I will come back to it shortly.

There are two other components to the binder-resumptive dependency that we need to consider. The first is the actual equation whereby the binder in the dependency binds the resumptive pronoun and thus satisfies the Extended Coherence Condition by anaphoric binding. The second is the premise for dependency relabeling that allows the dependency vacated by the resumptive pronoun to be relabeled such that the binder can compose with it. In the analysis of Irish binder resumptive dependencies, these two pieces of information and the resumptive-licensing manager resource were all part of the lexical entry for the complementizer *aN* (in its binder-grounding capacity), as shown in (6.80) of the previous chapter and repeated here (see (6.79) for further details):

(7.17) *aN*: Ĉ Binder grounding (anaphoric binding)
Resumptive licensing (manager resource)
Resumptive dependency relabeling

There are three motivating factors for treating Irish resumptive licensing like this. The first has to do with the fact that in the core multi-clausal case of binder-resumptive dependencies in Irish the occurrence of *aN* is at the *top* of the unbounded dependency, as shown here:[3]

(7.18) [$_{\text{CP}}$ *aN* ... *go** ... *Rpro* ...]

(7.19) fir ar shíl Aturnae an Stáit go rabh siad díleas do'n Rí
men *aN* thought Attorney the State *go* were they loyal to-the King
men that the Attorney General thought were loyal to the King
(McCloskey 2002:190, (16))

This second motivating factor is that the complementizer *aN* is necessary for a resumptive pronoun to be licensed: every Irish resumptive occurs under at least one *aN*. The third motivating factor has to do with the filler-gap complementizer *aL* and the fact that it is necessary for a gap to be licensed. The last two factors indicate that the top of an unbounded dependency in Irish is incapable of integrating itself into the grammatical representation. In other words, the filler or binder in an

[3] The basic point here holds even for the mixed chains, because the prediction of the theory developed in the last chapter is that the bottom of the mixed resumptive patterns (Patterns 2 and 3) could be stretched out like (7.18). The existence of the pattern is hard to confirm, given the liminal nature of the mixed chains (McCloskey 2002:195); see section 6.6 of the previous chapter.

unbounded dependency, e.g. a *wh*-phrase, cannot undertake the functional equality or anaphoric binding that satisfies the Extended Coherence Condition. It is the complementizers *aL* and *aN* that perform this function and this explains why they must necessarily be present. The fact that these complementizers occur at the *top* of the dependency means that they can access the necessary unbounded dependency functions in a local manner in order to perform the necessary integration. In sum, the complementizer-marking pattern of Irish indicates two things. First, the top of the dependency is incapable of integrating itself into the grammatical representation and depends on the complementizer for this. Second, the complementizers perform integration via functional equality in the case of *aL* and via anaphoric binding in the case of *aN*. This is why the anaphoric binding and associated dependency relabeling must be associated with *aN*. The fact that *aN* occurs at the top of a core multi-clausal dependency adds further corroboration. By occurring at the top of the dependency, the complementizer can access the unbounded dependency locally. This local access leads to the kind of manager resource specification shown in (7.16).

By contrast, I have argued that the resumptive-licensing manager resource in Swedish must occur not locally to the unbounded dependency function that serves as the binder in the binder-resumptive dependency, but rather locally to the resumptive pronoun. This means that in order to access the binder in the binder-resumptive dependency the Swedish licenser would have to search outwards from its f-structure for an appropriate unbounded dependency function. This kind of non-local search is warranted for anaphoric binding, but the element under discussion is not the resumptive pronoun itself, but rather the *licenser* of the resumptive pronoun. The licenser is not itself an anaphor. General locality considerations would seem to dictate that the three pieces of information that are specified together in the lexical entry for the Irish complementizer *aN* should be separated in Swedish. In particular, the manager resource is specified at the bottom of the binder-resumptive dependency, locally to the resumptive pronoun, but the anaphoric binding equation and the dependency-relabeling premise are specified at the top of the binder-resumptive dependency, locally to the binder. The situation is shown schematically here:

(7.20)	*Binder*	... [$_{CP}$	*Lexical material*	*Rpro*	...]
	Anaphoric binding Resumptive dep. relabeling		Manager resource		

I have purposefully displayed *Binder* in (7.20) to the left of the relevant material. The reason why will become clear in section 7.1.2.

The manager resources in Irish and Swedish occur at the top and bottom of the binder-resumptive dependency respectively and this leads to differences in specification based on the locality desideratum. The details of the anaphoric binding equation and the dependency relabeling premise in Swedish and Irish are identical, though, since in both cases these occur at the top of the dependency, locally to the binder of the resumptive pronoun. The full specification in the grammars of both languages for the anaphoric binding equation is:

(7.21) $$(\uparrow \ \text{UDF})_\sigma = ((\uparrow \ \text{GF}^+)_\sigma \ \text{ANTECEDENT})$$

Similarly, the full specification for dependency relabeling in both grammars is:

(7.22) $$((\uparrow \ \text{GF}^+)_\sigma \multimap \uparrow_\sigma) \multimap ((\uparrow \ \text{UDF})_\sigma \multimap \uparrow_\sigma)$$

It is only the specification of the manager resource that differs between the two grammars, and this has to with the fact that in Irish the manager resource occurs at the top of the dependency, whereas in Swedish it occurs at the bottom.

If the anaphoric binding equation and the dependency relabeling premise are to occur locally to the binder, then they can be added to information in SpecCP. This information must be optional, though, since material in SpecCP can either be associated with the filler in a filler-gap dependency or with the binder in a binder-resumptive dependency. SpecCP will therefore have three kinds of information associated with it: filler information at the top of a filler-gap dependency, binder information at the top of a binder-resumptive dependency, and a manager resource at the bottom of a binder-resumptive dependency:

(7.23) $$\begin{array}{lcc} \text{CP} \longrightarrow & \text{SpecCP} & \text{C}' \\ & (\uparrow \ \text{UDF}) = \downarrow & \uparrow = \downarrow \\ & \text{(Filler info)} & \\ & \left(\text{Binder info:} \ \begin{array}{l} \textbf{Anaphoric binding} \\ \textbf{Resumptive dependency relabeling} \end{array} \right) & \\ & (\textbf{Manager resource}) & \end{array}$$

The C′ rule remains as in (7.11). I am going to leave aside how Swedish filler-gap dependencies should be handled in LFG and concentrate on the binder-resumptive dependencies. The analysis of English filler-gap dependencies given by Dalrymple (2001:390–415) can be extended to Swedish with minor modifications.

Summary

I have shown how Engdahl's generalization can be captured structurally by adding (optional) manager resources to SpecCP and C^0. I argued that the manager resources must be contributed locally to the resumptive pronoun in order to distinguish between grammatical cases where material in SpecCP or C^0 licenses a resumptive pronoun from ungrammatical cases where there is no lexical material in SpecCP or C^0 and a resumptive pronoun is impossible. The basis of the argument was that some check needs to be done to ensure that there is lexical material at the left periphery CP and that this check can only be done locally to the CP in question. The other material associated with binder-resumptive dependencies is the anaphoric binding equation that integrates the binder and the dependency relabeling premise that allows the binder to be inserted at the resumption site. Specifying the resumptive licenser locally to the resumptive pronoun meant that this other material must be separated from the resumptive licenser, unlike in Irish, and must be associated with the top of the dependency. This move was motivated based on differences between the two languages and the desire to keep everything completely local.

The result is a structural analysis of Swedish resumptives where all the action is in the rules that construct CP and its daughters. Bringing together the various pieces of grammatical information, the rules in somewhat fuller form than they have been given thus far are as follows:

(7.24) $$\text{CP} \longrightarrow \left\{ \begin{array}{c|c} \text{XP} & \epsilon \\ (\uparrow \text{UDF}) = \downarrow & (\uparrow \text{TOPIC PRED}) = \text{‘pro’} \end{array} \right\} \quad \begin{array}{c} \text{C}' \\ \uparrow = \downarrow \end{array}$$

(Manager resource)

$\left(\begin{array}{c}\textbf{Anaphoric binding} \\ \textbf{Resumptive dependency relabeling}\end{array}\right)$

(7.25) $$\text{C}' \longrightarrow \begin{array}{c} \text{C}^0 \\ \uparrow = \downarrow \end{array} \quad \begin{array}{c} \text{IP} \\ \uparrow = \downarrow \end{array}$$

(Manager resource)

SpecCP is occupied by an unbounded dependency function. In the absence of a relative pronoun, the TOPIC's PRED is set to 'pro' (see section 2.1.6 of chapter 2 and section 5.2.2 of chapter 5). In either case, the material in bold is optionally contributed.

The details of the anaphoric binding, dependency relabeling, and manager resource are reiterated here:

(7.26) **Anaphoric binding**

$$(\uparrow \text{ UDF})_\sigma = ((\uparrow \text{ GF}^+)_\sigma \text{ ANTECEDENT})$$

(7.27) **Resumptive dependency relabeling**

$$((\uparrow\ \textsc{gf}^{+})_\sigma \multimap \uparrow_\sigma) \multimap ((\uparrow\ \textsc{udf})_\sigma \multimap \uparrow_\sigma)$$

(7.28) **Manager resource**

$$[((\uparrow\ \textsc{subj})_\sigma\ \textsc{ant}) \multimap [((\uparrow\ \textsc{subj})_\sigma\ \textsc{ant}) \otimes (\uparrow\ \textsc{subj})_\sigma]] \multimap$$
$$[((\uparrow\ \textsc{subj})_\sigma\ \textsc{ant}) \multimap ((\uparrow\ \textsc{subj})_\sigma\ \textsc{ant})]$$

The structural encoding of Swedish resumptive licensing captures Engdahl's generalization that Swedish resumptive pronoun occur as subjects following material at the left periphery of CP. However, there is reason to pursue an alternative, lexical solution. This is the subject of the next section.

7.1.2 A lexical solution

In section 6.6 of the last chapter, one of the points of convergence that was identified between the resource management theory of Irish binder-resumptive dependencies and the Minimalist theory presented by McCloskey (2002) was that both theories are *lexicalist*. In particular, both theories depend on lexical specification of the complementizer *aN* to drive resumptive-licensing in Irish. The analysis of Swedish given in the previous section departs from a strictly lexicalist theory in associating crucial aspects of resumptive-licensing in Swedish with *structural* aspects of Swedish grammar, namely c-structure nodes. It is true that the same overall grammatical information is present in both Irish and Swedish, but in the former it is housed in the lexicon and in the latter it is housed in the rule system. In this section I want to pursue a conjecture that McCloskey makes at the end of his 2002 paper, because it forms the basis for a promising hypothesis about why some languages have productive resumptive strategies and others do not. The conjecture will lead to a purely lexical analysis of Swedish resumptive pronouns, rather than the structural analysis suggested above.

The conjecture that McCloskey (2002:205) makes is the following:

> [W]e might assume that the presence of a lexical form corresponding to the Irish complementizer *aN* is the property which distinguishes languages which have a productive and grammaticized resumptive pronoun strategy from those which do not. Irish, Hebrew, Arabic and so on would possess such a lexical item; English would not. This is surely too crude a proposal as it stands (more distinctions are required than are provided by this simple binary choice), but it might be a place to start. It has the advantage of letting us understand what is otherwise a truly mysterious difference among languages

> (whether or not they deploy resumptive pronouns as a grammatical device) in terms of the availability or unavailability of a particular morphosyntactic form. The proposal thus assimilates this parametric difference to others which have yielded to similar kinds of understanding.

I will henceforth refer to this as *McCloskey's (lexical) conjecture* or *the (lexical) conjecture*.

The key proposal is that the difference between grammars that allow resumptive pronouns and those that do not is a matter of lexical inventories. A language that has a lexical item (or lexical items) that corresponds in its specifications to the Irish complementizer *aN* — in a relevant manner to be determined — will have a resumptive pronoun strategy, while a language that lacks the requisite lexical item will not. There are two quite appealing aspects to the proposal. The most important aspect is that it attempts to reduce variation with respect to resumptive pronoun licensing to lexical variation. In the current state of linguistic theory, lexical variation is an irreducible feature of our theoretical understanding of language. It is hard to even imagine what it would mean to claim that all languages have the same lexicon. Theories as otherwise disparate as Lexical Functional Grammar, Head-Driven Phrase Structure Grammar, Principles and Parameters Theory and Categorial Grammar have converged on the desirability of locating language variation in the lexicon to the greatest extent possible.The Minimalist Program approach that stems from P&P has the yet more ambitious aim of reducing all language variation to the lexicon.

The second appealing aspect of the conjecture is related to the first and concerns the notion of "parametric difference". There are theory-independent and theory-dependent notions of parameter that need to be separated here and the conjecture implicitly concerns them both. The theory-independent notion of parameter is some specific dimension of variation among languages, however it is captured, that has a finite range of options. In this case, the "parameter" that is identified is binary (as McCloskey notes) and is basically just whether a language has a lexical item or not. As discussed in the previous paragraph, this is a notion that makes sense cross-theoretically. The theory-dependent notion of parameter is the one postulated in Principles and Parameters Theory. In that sense, possession of a lexical item is not really a "parameter". However, part of the theory-internal import of McCloskey's conjecture is that there has been a signal failure within P&P Theory to identify a "resumptive pronoun parameter". One of the main arguments of Sells (1984, 1987) is that there is no single parameter that can be identified as governing resumptive pronouns and there has been no P&P account in the intervening time that successfully refutes his conclusion. Indeed, when considered in modern terms, Sells's analysis basically postulates that languages differ with respect to lexical properties of their resumptive-licensing operators and their pronouns.

Given the central, cross-theoretical importance of lexical information in current linguistic theory, it is worthwhile to pursue the conjecture in the theory outlined here, rather than simply stopping with the structural solution at hand. The lexical solution is particularly promising in another respect. Swedish has long held out as a recalcitrant case among resumptive pronoun languages. Its resumptive pronoun system is undoubtedly one that McCloskey (2002) has in mind when he writes that "more distinctions are required than are provided by this simple binary choice." If the Swedish resumptives we looked at in the last section can be unified with the Irish resumptives in the last chapter and the Hebrew resumptives in the next section, it would be promising theoretical progress.

The question is what could be the equivalent of the lexical item *aN* in Swedish. There is no "particular morphosyntactic form" that would seem to be an ideal candidate. In particular, there is no single complementizer whose presence strongly correlates with resumption. Instead, any of the complementizers in Swedish can serve the resumptive-licensing role served by the single complementizer *aN* in Irish. This does not necessarily undermine the lexicalist conjecture. First, resumptive-licensing is still associated with specific lexical items. Second, the class of complementizers is a small, closed class. The apparently simplest way to proceed is to add the required manager resources to the relevant lexical entries, as indicated here for the three principal complementizers:

(7.29) *att*: C^0 $\vdots$
(**Manager resource**)

(7.30) *om*: C^0 $\vdots$
(**Manager resource**)

(7.31) *som*: C^0 $\vdots$
(**Manager resource**)

In each case the manager resource is optional, since the complementizers are not necessarily associated with resumption. The motivation for including *som* here may not be immediately obvious, but it will be explained shortly.

The lexical analysis thus generates examples like (7.5) and (7.9), which are repeated below. Rather than licensing the resumptive through structural annotation on the category C^0 (see (7.25) above), the resumptive is licensed by the complementizers through their lexical specifications, as in Irish.

(7.32) Vilket ord$_i$ visste ingen om det$_i$ stavas med ett *M*?
which word knew nobody if it is.spelled with an *M*
Which word did nobody know if (it) is spelled with an M*?*

(7.33) Vilken elev$_i$ trodde ingen att han$_i$ skulle fuska?
which student thought no one that he would cheat
Which student did no one think that (he) would cheat?

The anaphoric binding and dependency relabeling parts of the binder-resumptive dependency are still associated with the top of the dependency, as in (7.24) above, rather than with the resumptive-licensing complementizers at the bottom of the dependency. The arguments in section 7.1.1 for the separation of the manager resource from the anaphoric binding and dependency relabeling information carry over to the present analysis.

The inclusion of the complementizer *som* has to do with a kind of example that we have not yet seen. In colloquial speech it is possible for the complementizer *som* to co-occur with material in SpecCP. Alongside sentence like (7.34) we find ones like (7.35):

(7.34) Jag undrar hur ofta Pelle fuskar.
I wonder how often Pelle cheats
I wonder how often Pelle cheats.

(7.35) Jag undrar hur ofta som Pelle fuskar.
I wonder how often that Pelle cheats
I wonder how often Pelle cheats.

Some speakers have prescriptive biases against *wh*-material in SpecCP of *som*, but such examples are nevertheless quite common and other speakers are comfortable with them.

In some dialects, the complementizer *att* can occur in the same position:

(7.36) % Jag undrar hur ofta att Pelle fuskar.
I wonder how often that Pelle cheats
I wonder how often Pelle cheats.

Notice that these examples indicate that, unlike colloquial English (at least most varieties), colloquial Swedish does not disallow the co-occurrence of material in SpecCP with an overt complementizer (cf. the *Doubly-filled COMP Filter*; Chomsky and Lasnik 1977, Chomsky 1981). This will be discussed further shortly. The relevant point at the moment is that *som* licenses a resumptive pronoun:

(7.37) Vem undrar du hur ofta som han fuskar?
Who wonder you how often that he cheats?
Who do you wonder how often (he) cheats?

The complementizer *som* must therefore have an optional manager resource in its lexical specification.

The introduction of a manager resource by *som* leads to potential problems, since this complementizer also occurs in relative clauses but the relevant position in a relative clause cannot host a resumptive pronoun:

(7.38) * Jag känner mannen som han sjunger.
I know man.DEF that he sings.
(I know the man that he sings.)

However, it would be a mistake to construe the ungrammaticality of (7.38) as stemming from *som*. It is actually a general property of Swedish subject resumptives that they cannot occur in unembedded clauses. A *wh*-question with a matrix subject resumptive is likewise ungrammatical:

(7.39) * Vilken man han sjunger?
which man he sings.
(Which man he sings?)

This data shows that Swedish only allows embedded resumptives. One possibility that suggests itself is to restrict resumptives by associating the manager resources with the existential equation (COMP ↑), which would require the complementizer contributing the manager resource to be in a complement CP.

This option fails to make an obvious connection between the grammar of Swedish and those of Irish, Welsh, Hebrew, and Arabic, though. The latter languages exhibit the Highest Subject Restriction (McCloskey 1990, Shlonsky 1992, Willis 2000), which bars a resumptive pronoun from occurring in the highest subject of a clause. The effect of the HSR is particularly conspicuous in Irish, since the highest subject is the *only* position from which a resumptive pronoun is blocked (McCloskey 1990) and in Palestinian Arabic, since the highest object is not just the only position from which a resumptive pronoun is blocked but also the only position in which a gap rather than a resumptive is allowed (Shlonsky 1992). If Swedish only has subject resumptive pronouns, as I have been assuming following Engdahl (1982), then the distribution above is explained if the HSR holds in Swedish as well.

In section 6.6 of the previous chapter, I adopted McCloskey's (1990) proposal that there is an anti-locality effect on anaphoric binding of a subject resumptive pronoun by a UDF in its own clause. The restriction was stated as follows:

(7.40) $(\uparrow_\sigma \text{ ANTECEDENT}) \neq ((\text{SUBJ} \uparrow) \text{ UDF})_\sigma$

The equation has the effect that a subject (SUBJ) cannot be locally bound by an unbounded dependency function (UDF) in its clause. Capturing the necessity of embedding for Swedish via the HSR is preferable to a direct statement about COMP — even though both statements are descriptively adequate — because a property of Swedish is then connected to the same property in Irish, Hebrew, Welsh, and Arabic, whatever its ultimate explanation.

The question remains of how to handle resumptive pronouns whose presence is licensed by material in SpecCP, as in (7.4) repeated here:

(7.41) Vilket ord$_i$ visste ingen hur många *M*$_j$ det$_i$ stavas med _$_j$?
which word knew nobody how many *M*s it is.spelled with _
Which word did nobody know how many Ms *(it) is spelled with?*

This case was handled in the structural solution by adding a manager resource to SpecCP in the CP rule (see (7.24) above). Accommodation of this case will result in a general revision to the lexical analysis, whereby the complementizers do not directly contribute resumptive-licensing manager resources.

One possible lexical solution for the SpecCP cases might be to associate the manager resource with the *wh*-phrase that immediately precedes the resumptive, presumably with the *wh*-word in particular. This solution is problematic for a number of reasons, though. First, *wh*-words can be embedded in a variety of ways inside the *wh*-phrase and in general reflect many of the complexities of noun phrase syntax. This means that in order to access the SUBJ of its CP, as required to state the manager resource in (7.14), the *wh*-word will have to reach outside the constituent in which it occurs. For example, the *wh*-determiner *vilken* ('which') would require a specification like $((\text{GF SPEC} \uparrow) \text{ SUBJ})$ to access the SUBJECT of the clause that it occurs in. Furthermore, there will be no single kind of equation that can be used for all *wh*-words and there would be considerable heterogeneity in how the manager resources are specified. For example, *vilken*, *vem* ('who'), and *hur* ('how') would all require different sorts of equations. There would thus be no real uniformity in the statement of Swedish manager resources and the resulting analysis would be quite cumbersome and inelegant. Second, on a related note, the manager resources contributed by *wh*-words would be quite different from those contributed by complementizers, because the latter are contributed by a (functional) head that maps to the main f-structure for the clause and can be specified straightforwardly in terms of ($\uparrow$ SUBJECT). Third, a manager resource contributed by a *wh*-word would result in a situation in which an argument or an adjunct (the *wh*-phrase) affects another argument and arguably the highest argument (the SUBJECT). This sort of grammatical constraint would be quite peculiar, since it is normally the head that governs / affects its arguments. Fourth, it was shown above that the manager resource must be local to the subject resumptive pronoun that it licenses. However, a *wh*-phrase will be involved in a filler-gap dependency captured in terms of functional equality and will therefore be present in two local f-structures simultaneously (the f-structure corresponding to the top of the dependency and the one corresponding to the bottom). There would thus be a potential lack of control and a danger of the *wh*-phrase removing the SUBJECT at the *bottom* of its unbounded dependency, rather than the one at the top. Fifth, due to the heterogeneity of the putative equations with which the different kinds of *wh*-words would specify their manager resources, the prospects seem slim for adding the manager resources to the lexical entries for *wh*-words via lexical redundancy rules. The manager resources would have to be added to lexical entries for individual *wh*-words. But this makes an incorrect empirical prediction. If manager resources are associated with the lexical entries for individual *wh*-words (or perhaps classes of *wh*-words), then there could be variation among dialects as to which lexical entries for *wh*-words have manager resources. Dialect A might have a lexical item for *vilken* that has a manager resource, while Dialect B has a lexical item for *vilken* that lacks a manager resource. Dialect A would allow a resumptive pronoun after a fronted *vilken*-phrase, while Dialect B would not. As far as I am aware, no such dialect variation exists.

These arguments indicate that it is not an option to uphold the lexical conjecture by specifying manager resources on *wh*-phrases. The only other lexical solution that presents itself is to posit a null complementizer. Null categories are to a great extent anathema to monostratal theories like LFG, HPSG and Categorial Grammar, but this has been partly a side effect of distinguishing these theories from transformational theories. In the latter theories, null categories play such a central role in movement transformations that their use elsewhere is easily justified on at least theory-internal grounds. However, I think even in monostratal theories there are general grounds for accepting the possibility of null categories. In monostratal and transformational theories alike, a lexical item is essentially an association of a form with a meaning (mediated by a category in the case of the monostratal theories mentioned). The theories allow for a form with no meaning (e.g., expletives, *do*-support) and a complementizer is in fact a prime candidate for a form with no meaning, since complementizers often make no semantic contribution. It seems that the opposite situation of a meaning without a form should be theoretically possible and that at present it could only be excluded by fiat.

Turning to LFG in particular, the null categories that are typically rejected are syntactic arguments. In particular, the "big PRO" and "little *pro*" of Principles and Parameters Theory are not theoretical postulates of LFG. The null pronoun represented by *pro* is not present in c-structure but is rather represented at f-structure. The null pronominal information is added by the head that bears the pronominal inflection. The cases covered by PRO are either handled through functional equality (the classic treatment is Bresnan 1982a) or anaphoric binding of pronominal information represented at f-structure (arbitrary control and also obligatory control in some analyses; e.g. Zec 1987, Dalrymple 2001). Some LFG analyses have postulated traces to mark the bottom of filler-gap dependencies (Bresnan 1995, 2001, Falk 2001). However, possible occurrences of traces are tightly controlled by Economy of Expression in these analyses (Bresnan 2001:90–94). In general, null elements that represent subcategorized arguments are absent from the theory.

A null complementizer is a completely different proposition, though. First, it is a c-structure co-head (bearing $\uparrow = \downarrow$) and not an argument. Second, it is a functional category, not a lexical category. LFG does not treat the two sorts of category in a uniform manner (Bresnan 2001). The c-structure to f-structure mapping theories postulated by Bresnan (2001) and Toivonen (2003) distinguish functional categories from lexical categories. In particular, c-structure complements of functional categories are co-heads, whereas c-structure complements of lexical categories are argument functions (Bresnan 2001:102). The theoretical considerations that allow elimination of null syntactic arguments (i.e., null lexical categories) in c-structure therefore do not readily extend to null functional categories. The theory in fact anticipates the possibility of null functional categories. Occam's razor obviously still applies, though: null functional categories should only be postulated where they are theoretically motivated. The basic theoretical motivation in this case is an attempt to uphold the lexical conjecture, which promises to explain variation for resumption. Further motivating factors will be discussed below.

The null complementizer lexical entry is as follows:

(7.42) $\emptyset$: C^0 **Manager resource**

$(\uparrow \textsc{udf})$

There are two distinguishing characteristics of the null complementizer that bear mentioning. First, there is an existential equation that requires the complementizer to co-occur with an unbounded dependency function. Since the UDF is contributed through SpecCP, this ensures that the null complementizer occurs with material in SpecCP. Second, this complementizer obligatorily, rather than optionally, contributes a manager resource, since it only occurs in a resumptive-licensing environment.

Let us stop to take stock. Theoretical and empirical considerations have led to the postulation of a null C^0 for the subject resumptives licensed by a *wh*-phrase in SpecCP. On the other hand, complementizer-licensed resumptives have led to the postulation of optional manager resources for the complementizers *att*, *om*, and *som*. As things stand, then, manager resources are contributed optionally by the overt complementizers and obligatorily by the null complementizer. The analysis is lexical, and therefore upholds the lexical conjecture. However, we should ask ourselves if it is possible to generalize the theory even further. In particular, is it possible to postulate a single lexical form that obligatorily contributes a manager resource, covering both the SpecCP-licensed resumptives and the complementizer-licensed resumptives and is this empirically motivated? If a single resumptive-licensing lexical entry could be posited — a Swedish correlate of Irish *aN* — the lexical conjecture would be upheld in a very strong form.

Even in the absence of a single lexical entry that covers both resumptives licensed by material in SpecCP and those licensed by complementizers, it is desirable to posit a single lexical entry that generalizes across the complementizers. There are three reasons for this. First, having each complementizer optionally contribute a manager resource predicts that there should be dialectal variation in lexical inventories. We would expect to find dialects were only a subset of complementizers license resumptive pronouns. I know of no such dialectal data. Second, the lexical conjecture is still upheld in a strong form if we can posit two related lexical entries, one for the SpecCP-licensed resumptives and one for the complementizer-licensed resumptives. Third, although Engdahl's (1982) original observation about the distribution of Swedish resumptives generalizes across both SpecCP and C^0 as COMP, with the adoption of CP and the separation of COMP into SpecCP and C^0 our theory leads us to expect that lexical items should be sensitive to the SpecCP / C^0 distinction.

Let us first proceed to define a single lexical entry for a resumptive-licensing complementizer. The basis for the single lexical entry to be posited comes from Toivonen's (2003) X-bar theory and theory of non-projecting words. We have already seen this theory at play in the previous chapter, where the Irish complementizers were treated as non-projecting $\hat{C}$ categories. Toivonen (2003:22) generalizes over non-projecting $\hat{X}$ ("X-roof") categories and projecting X^0 ("X-zero") categories with a plain X category. The category X is theoretically justified based on the fact that both projecting and non-projecting categories are terminal nodes that dominate lexical material (Toivonen 2003:64). It is empirically justified based on lexical items that behave like both projecting and non-projecting words (Toivonen 2003:22ff.; see chapter 2, section 2.1.2).

We can take a first step towards a single lexical entry if we assume that the category of the null complementizer that licenses subject resumptives is C, not C^0. The null complementizer can therefore be realized either as a projecting category C^0, like in (7.42), or as a non-projecting $\hat{C}$ which adjoins to the regular, overt complementizers. The basic details of the lexical entry are as follows (to be amended slightly below):

(7.43) $\emptyset$: C **Manager resource**

The non-projecting version of the complementizer requires a rule for adjunction to C^0:

$$(7.44)\quad C^0 \longrightarrow \underset{\uparrow = \downarrow}{C^0} \quad \underset{\uparrow = \downarrow}{\hat{C}}$$

The generalized, non-projecting / projecting category C and the requisite rule for the introduction of its $\hat{C}$ realization are justified on grounds internal to Swedish, based on Toivonen's demonstration that the Swedish particle system requires non-projecting words. As mentioned above, there are lexical items with this sort of category. Further justification for the proposal comes from the grammar of Irish, which I have argued has non-projecting complementizers (Asudeh 2002b; also see chapter 6, section 6.1). Still further justification comes from the grammar of Hebrew. I argue in section 7.2 below, following the analysis of Borer (1984), that Hebrew also has a non-projecting complementizer that is introduced by a rule similar to (7.44).

The lexical entry (7.43) is not quite enough, because the C^0 version of the null complementizer needs to be constrained to avoid generating ungrammatical sentences like (7.8), repeated here:

(7.45) * [Vilken elev]$_i$ trodde ingen [$_{CP}$ $\emptyset$ han$_i$ skulle fuska?]
which student thought no one he would cheat
Which student did no one think (he) would cheat?

This sentence does not have material at the left periphery of CP: there is nothing in SpecCP and there is no overt complementizer.

The lexical entry is therefore amended as follows:

(7.46) $\emptyset$: C **Manager resource**
$\{\ (\uparrow \text{UDF} \ \mid\ (\uparrow \text{COMPFORM})\ \}$

The expression $\{\ (\uparrow \text{UDF} \ \mid\ (\uparrow \text{COMPFORM})\ \}$ is a disjunction that requires that either there is a UDF (contributed by SpecCP), just like in (7.42), or that there is a feature COMPFORM with some value.

The feature COMPFORM is used in LFG for placing restrictions on complementizer selection (Dalrymple 2001:28, 111–116). COMPFORM is a member of a general class of LFG FORM features (Butt et al. 1999, Dalrymple 2001:28). It is used, for example, in stating that, in many dialects, the English verb *justify* cannot take a CP introduced by *if* (Dalrymple 2001:111, ∼(73b)):

(7.47) You have to justify whether / that / * if your journey is really necessary.

The feature would also be used to state the restriction that English sentential subjects must be CPs introduced by *that* (Dalrymple 2001).

The disjunction in (7.46) has the following effect. It requires the null C to occur in either a CP with material in SpecCP contributing a UDF or a CP with an overt complementizer that has a value for COMPFORM. This is admittedly an inelegant solution. What is really required to capture Engdahl's generalization is to identify something that SpecCP and an overt complementizer have in common. For Engdahl (1982) this was occurrence in COMP. With the otherwise motivated separation of COMP into SpecCP and C^0 (see, e.g., Bresnan 2001:133), we have lost the ability to state certain generalizations over the two. Kathol (2000:118) has recently proposed the *Marking Constraint*, whereby a clause is marked with a feature if its left periphery is either a *wh*-phrase or a complementizer. The Marking Constraint thus regains the ability to generalize over SpecCP and C^0.

However, there is Swedish dialectal data that suggests that separate lexical entries are motivated for the SpecCP and C^0 cases. Some speakers of the *Ålandssvenska* dialect of Swedish spoken on the Åland Islands (see section 7.1.3) have obligatory resumptive pronouns after material in SpecCP but either only optionally allow them after overt complementizers or do not allow them in that position at all:

(7.48) Vilken elev undrar du hur ofta <u>hon</u> / * __ fuskar?
which student wonder you how often she / __ cheats?
Which student do you wonder how often (she) cheats?

(7.49) a. * Vilken elev trodde ingen att <u>hon</u> fuskar?
which student thought no one that she cheats?
Which student did no one think that (she) cheats?

b. * Vilken elev undrar du om <u>hon</u> fuskar?
which student wonder you if she cheats?
Which student do you wonder if (she) cheats?

This dialectal data thus lends further support to the separation of COMP into SpecCP and C^0, since resumptives in this dialect are sensitive to a distinction between the two positions. We may still want to generalize over the two positions for other reasons, perhaps using Kathol's proposal.

Rather than a single entry, we have the two lexical entries shown here:

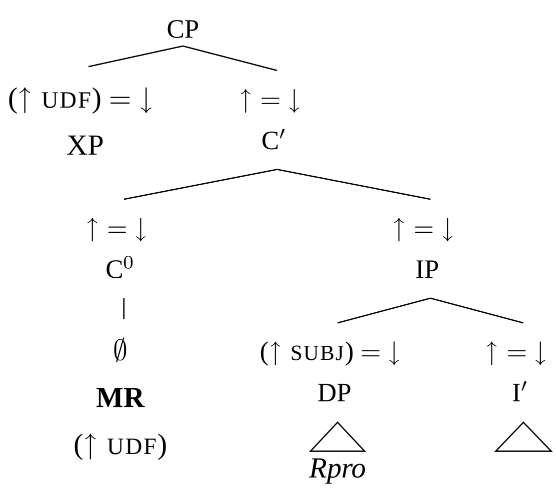
(7.50) $\emptyset$: C^0 **Manager resource**
$(\uparrow \text{UDF})$

(7.51) $\emptyset$: $\hat{C}$ **Manager resource**

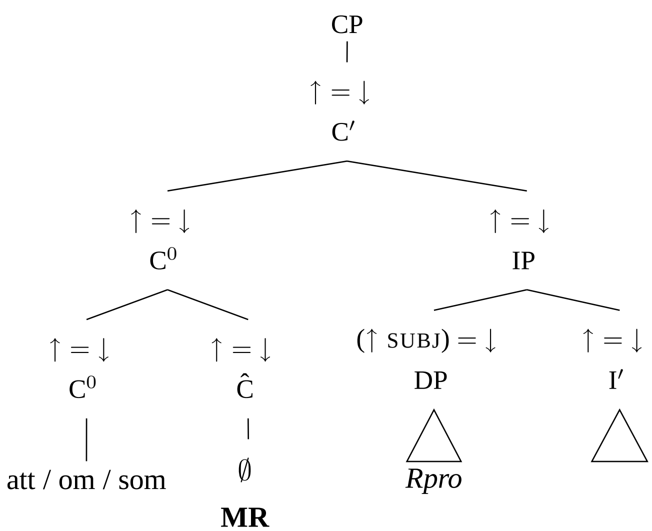
The first is just (7.42) again. The second is a $\hat{C}$ alternant that does not require the presence of an unbounded dependency function, but needs to adjoin to a C^0 via the rule in (7.44). The null $\hat{C}$ will therefore adjoin to any of the overt complementizers *att*, *om*, or *som*.

These lexical entry lead to the c-structures in (7.52) and (7.53) for a *wh*-phrase-licensed resumptive and a complementizer-licensed resumptive (only the relevant parts of the c-structures are shown).

(7.52)



(7.53)



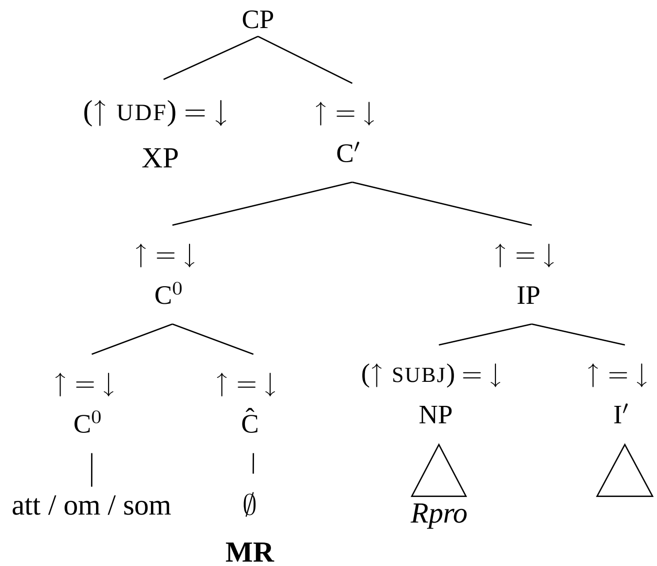
Compare these c-structures to (7.4) and (7.5), which are repeated here.

(7.54) [Vilket ord]$_i$ visste ingen [$_{CP}$ [hur många *M*]$_j$ [$_{C'}$ <u>det</u>$_i$ stavas med __ $_j$]]?
which word knew nobody how many *M*s it is.spelled with __
Which word did nobody know how many Ms *(it) is spelled with?*

(7.55) [Vilket ord]$_i$ visste ingen [$_{CP}$ [$_{C'}$ om <u>det</u>$_i$ stavas med ett *M*]]?
which word knew nobody if it is.spelled with an *M*
Which word did nobody know if (it) is spelled with an M*?*

The analysis also generates structures like (7.56), where there is material in SpecCP in addition to an overt complementizer and a resumptive pronoun subject:

(7.56)



This kind of structure is appropriate for sentences like (7.37), which is repeated here:

(7.57) Vem undrar du hur ofta som han fuskar?
Who wonder you how often that he cheats?
Who do you wonder how often (he) cheats?

A possible objection to a null complementizer being present when there is material in SpecCP is that this would be a violation of whatever constraint blocks sentences like ** I wonder how often whether he cheats*. The relevant constraint for English was originally introduced as the *Doubly-filled COMP Filter* (Chomsky and Lasnik 1977, Chomsky 1981). However, examples like this one and (7.35)–(7.36) indicate that there is no analogous constraint against simultaneous filling of SpecCP and C^0 in Swedish. Furthermore, the *Doubly-filled COMP Filter* is a constraint on the syntax-phonology interface (PF in P&P/Minimalism; Chomsky 1981:236) and should not apply to a null complementizer in any case (also see Borer 1984:234).

Finally, the analysis does not generate resumptive pronouns if there is no left-peripheral material in CP, as in example (7.8), which is repeated here:

(7.58) * [Vilken elev]$_i$ trodde ingen han$_i$ skulle fuska?
which student thought no one he would cheat
Which student did no one think (he) would cheat?
(Engdahl 1982:166, ∼(65b))

The constraint in the lexical entries for the null C^0 is not met, since this example does not have material in SpecCP and therefore lacks a UDF in the correct place. There is no overt C^0 for the null

$\hat{\mathrm{C}}$ to adjoin to either. No manager resource is contributed, since neither of the contributing lexical items can be inserted, and the pronoun is not licensed.

At this point it would be useful to bring the various pieces of the analysis together in one place and to see its application at the level of detail seen in the last chapter. The lexical entries that correspond to Irish *aN* — the null C^0 and $\hat{\mathrm{C}}$ that contribute mangager resources — are shown in (7.59) and (7.60). The c-structure rules for introducing this element and for constructing CP follow in (7.61) and (7.62). The full specifications of the manager resource, the anaphoric binding equation, and the dependency relabeling premise follow in (7.63) to (7.65).

(7.59) $\emptyset$: C^0 **Manager resource**
$(\uparrow \textsc{udf})$

(7.60) $\emptyset$: $\hat{\mathrm{C}}$ **Manager resource**

(7.61)
$$\mathrm{C}^0 \longrightarrow \underset{\uparrow = \downarrow}{\mathrm{C}^0} \quad \underset{\uparrow = \downarrow}{\hat{\mathrm{C}}}$$

(7.62)
$$\mathrm{CP} \longrightarrow \left\{ \underset{(\uparrow \textsc{udf}) = \downarrow}{\mathrm{XP}} \;\middle|\; \underset{(\uparrow \textsc{topic pred}) = \text{`pro'}}{\epsilon} \right\} \quad \underset{\uparrow = \downarrow}{\mathrm{C}'}$$
$$\left(\begin{array}{c} \textbf{Anaphoric binding} \\ \textbf{Resumptive dependency relabeling} \end{array} \right)$$

(7.63) **Manager resource**
$$\lambda P \lambda y.y : [((\uparrow \textsc{subj})_\sigma \ \textsc{ant}) \multimap [((\uparrow \textsc{subj})_\sigma \ \textsc{ant}) \otimes (\uparrow \textsc{subj})_\sigma]] \multimap [((\uparrow \textsc{subj})_\sigma \ \textsc{ant}) \multimap ((\uparrow \textsc{subj})_\sigma \ \textsc{ant})]$$

(7.64) **Anaphoric binding**
$$(\uparrow \ \textsc{udf})_\sigma = ((\uparrow \ \textsc{gf}^+)_\sigma \ \textsc{antecedent})$$

(7.65) **Resumptive dependency relabeling**
$$\lambda P.P : ((\uparrow \ \textsc{gf}^+)_\sigma \multimap \uparrow_\sigma) \multimap ((\uparrow \ \textsc{udf})_\sigma \multimap \uparrow_\sigma)$$

Notice that under the lexical analysis the CP rule no longer contributes a manager resource (compare it to (7.24) above). Notice also that the manager resource meaning constructor has the same meaning language side as the manager resource in Irish — in other words, it has the same semantic effect — despite the difference in specification discussed above (see the Irish manager resource in (6.58) on page 198). The anaphoric binding and dependency relabeling information is identical to that found in Irish. Only its source is different (the CP rule vs. *aN*).

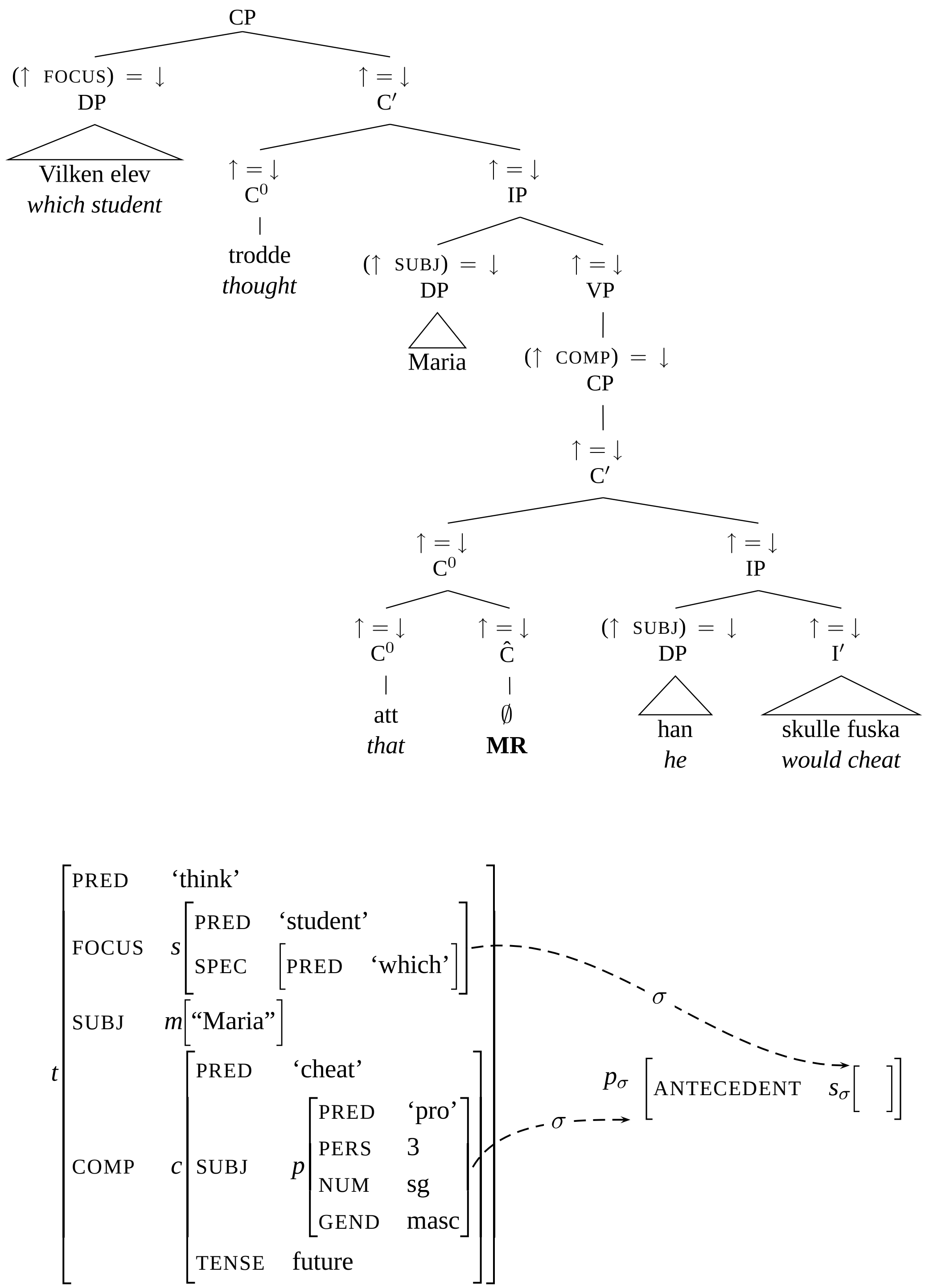
Let us see how the analysis treats the following example, which is a simplified version of (7.9):

(7.66) [Vilken elev]$_i$ trodde Maria att han$_i$ skulle fuska?
which student thought Maria that he would cheat
Which student did Maria think that (he) would cheat?

The c-structure, f-structure, and s-structure of this example (at the relevant level of detail) follow in (7.67). Notice that the finite verb is generated in C^0. This is a common LFG analysis of Germanic verb-second (Bresnan 2001, Sells 2001, Toivonen 2003).[4] A small fragment covering just this example is presented in appendix C.

[4]Sells (2001) argues that the verb in subject-initial V2 clauses is in I^0. Toivonen (2003) follows Sells in this regard. The example in (7.67) is a *wh*-initial question, though

(7.67)



The following premises are contributed by the lexical items and SpecCP, as instantiated by the f-structure and s-structure above (I have taken a shortcut by precombining the *wh*-determiner and its noun):

(7.68)

1.	$\forall X.[(s \multimap X) \multimap X]$	Lex. **vilken elev (‘which student’)**
2.	$(p \multimap t) \multimap (s \multimap t)$	SpecCP
3.	$m \multimap c \multimap t$	Lex. **trodde (‘thought’)**
4.	m	Lex. **Maria**
5.	$[s \multimap (s \otimes p)] \multimap (s \multimap s)$	Lex. $\emptyset$ **(MR)**
6.	$s \multimap (s \otimes p)$	Lex. **han (‘he’)**
7.	$p \multimap c$	Lex. **fuska (‘cheat’)**

The premises construct the proof in Figure 7.1.

Resumptive licenser ($\emptyset$): manager resource (top left) consumes pronoun (top right), leaving antecedent resource

Top of dependency (SpecCP): result of dependency relabeling

$$
\dfrac{
\dfrac{
\dfrac{
\dfrac{\overset{\textbf{∅ (MR)}}{[s \multimap (s \otimes p)] \multimap (s \multimap s)} \quad \overset{\textbf{han ('he')}}{s \multimap (s \otimes p)}}{(s \multimap s)} \quad [s]^1
}{s}
\quad
\boxed{\dfrac{
\dfrac{
\dfrac{
\dfrac{[p]^2 \quad \overset{\textbf{fuska ('cheat')}}{p \multimap c}}{c}
\quad
\dfrac{\overset{\textbf{maria}}{m} \quad \overset{\textbf{trodde ('thought')}}{m \multimap c \multimap t}}{c \multimap t}
}{t}
}{p \multimap t}\multimap_{\mathcal{I},2}
\quad \overset{\textbf{SpecCP}}{(p \multimap t) \multimap (s \multimap t)}
}{s \multimap t}}
}{t}
}{s \multimap t}\multimap_{\mathcal{I},1}
\quad \overset{\textbf{vilken elev ('which student')}}{\forall X.[(s \multimap X) \multimap X]}
}{Qu(x,\ student(x),\ think(maria,\ cheat(x))) : t}\ [t/X]
$$

Assumption on antecedent discharged, forming the scope of the *wh*-operator

Figure 7.1: Proof for a Swedish binder-resumptive dependency

7.1.3 Dialectal variation: resumptives without ECP / *that*-trace

So far I have been describing a dialect of Swedish that is fairly standard in Sweden. The dialect of Swedish spoken on the Åland Islands shows interesting variation. Åland is part of Finland, but it is geographically, historically and culturally more closely related to Sweden. *Ålandssvenska* is neither a dialect of standard Swedish nor *Finlandssvenska*, the standard Swedish spoken on the Finnish mainland, although all such claims are to a certain extent arbitrary.

The basic generalization about the Scandinavian languages in the literature (Engdahl 1982, Maling and Zaenen 1982, Engdahl 1985) is that either they allow *that*-trace violations but disallow filled-COMP resumptives of the kind we have been looking at (Danish, Icelandic, Norwegian) or they disallow *that*-trace violations but allow filled-COMP resumptives (Swedish). Speakers of *Finlandssvenska* deviate from the pattern slightly in allowing a gap after the complementizer *att*, but requiring a resumptive pronoun after all other complementizers or *wh*-phrases at the left periphery of CP.[5] From the perspective of the *that*-trace filter or the ECP this all seems to make a lot of sense. In particular, it would seem to give excellent support to Last Resort theories of resumptive pronouns that claim that resumptives occur specifically in order to avoid ECP violations, such as the theories of Shlonsky (1992) and Aoun et al. (2001). In fact, the Scandinavian languages seem to show much clearer support for such accounts than the languages that they have actually been applied to (Hebrew and Arabic). In Hebrew direct objects can be resumptive pronouns, which requires some special maneuvering (Shlonsky 1992). This is somewhat dubious if the resumptive is there by last resort, since gaps in direct object position are generally permitted cross-linguistically.

Ålandssvenska is unlike the other Scandinavian languages in allowing both *that*-trace violations and resumptive pronouns. The following are therefore both possible:

(7.69) Vem undrar du om fuskar?
who wonder you if cheats
(Who do you wonder if cheats?)

(7.70) Vem undrar du om <u>han</u> fuskar?
who wonder you if he cheats
Who do you wonder if he cheats?

Many speakers also allow either gaps or resumptives after left-peripheral *wh*-phrases:

[5] Anders Holmberg (p.c.) informs me that some Fenno-Swedes from the Finnish mainland speak a dialect that patterns like the other Scandinavian languages in allowing any *that*-trace violation and disallowing resumptives.

(7.71) Vem undrar du hur ofta fuskar?
who wonder you how often cheats
(Who do you wonder how often cheats?)

(7.72) Vem undrar du hur ofta <u>hon</u> fuskar?
who wonder you how often she cheats
Who do you wonder how often she cheats?

For some speakers gaps are only allowed after complementizers and resumptive pronouns are obligatory after left-peripheral *wh*-phrases. For other speakers, resumptive pronouns are not permitted after complementizers but are obligatory after left-peripheral *wh*-phrases (see section 7.1.2).

It is hard to see how the *Ålandssvenska* facts could be naturally accommodated in a Last Resort theory (Shlonsky 1992, Aoun et al. 2001). Here we have a language where there is no constraint against subject extraction after left-peripheral material in CP (for some speakers), yet resumptive pronouns are sanctioned. These pronouns thus do not seem to be a last resort. A last resort theory might attempt to postulate that the complementizers in *Ålandssvenska* are systematically ambiguous between homophonous alternants, one of which leads to last resort insertion of a resumptive pronoun and the other of which does not. This is Shlonsky's (1992)'s proposal for the optionality of resumptives and gaps in Hebrew direct objects. He proposes that the Hebrew complementizer *she-* is ambiguous between two homophonous alternants. There is little independent evidence for this in Hebrew, but matters become even worse in *Ålandssvenska*, since here at least three complementizers would have to be ambiguous between homophonous alternants, without independent justification. Furthermore, there is still the matter of the speakers who do not even have *that*-trace effects after left-peripheral *wh*-phrases.

Another option might be to claim that speakers of *Ålandssvenska* are bi-dialectal between the Swedish and Finnish dialects of Swedish and that they control two grammars, one that allows resumptive pronouns after left-peripheral material in CP but disallows *that*-trace (like Swedish in Sweden) and one that allows *that*-trace but disallows left-peripheral material (like *Finlandssvenska*). There is no independent evidence for this, but more importantly it lacks any explanatory force. Why do the speakers not instead do neither? Such languages exist: English does not allow either option robustly (see chapter 8).

By contrast, on the present account, as in other non-transderivational accounts, all that needs to be said is that speakers of *Ålandssvenska* have resumptives in subject position and do not have the *that*-trace filter / ECP. The speakers who only allow gaps after complementizers only have the *that*-trace / ECP filter with respect to left-peripheral *wh*-phrases. This is entirely expected, given that complementizers in many languages do not give rise to the effect and that it is generally stronger with *wh*-phrases.

7.1.4 Interim summary and discussion

I have presented a lexical analysis of Swedish resumptive pronouns that upholds McCloskey's lexical conjecture while simultaneously capturing Engdahl's generalization. The lexical analysis posits a null C^0 and a null $\hat{C}$ as the Swedish analogs of Irish *aN*. Engdahl's generalization was captured by restricting the null complementizers lexically such that they can only co-occur with material in SpecCP or an overt complementizer in C^0. Thus, a seemingly structural generalization has been captured lexically. The analysis was further restricted by the Highest Subject Restriction that has been posited for other languages (Irish, Hebrew, Arabic, Welsh; McCloskey 1990, Shlonsky 1992, Willis 2000). I showed that the HSR can be extended to Swedish and that this explains why the only true resumptives in the language are embedded subjects. All and only subjects can be resumptives, but the HSR blocks highest subjects, leaving only embedded subjects.

By pursuing the lexical conjecture as my hypothesis, I have shown that contrary to what has previously been thought (Sells 1984, McCloskey 1990), the resumptive pronoun system of Swedish quite closely resembles that of Irish. The results are summarized in Table 7.1. The resumptive licenser in both languages is a particular lexical item. In both cases it is a complementizer: non-projecting in Irish and non-projecting or projecting in Swedish. The fact that the complementizers have different forms is to be expected, since they are after all lexical items from different lexical inventories. The Swedish resumptive-licensing complementizers have null form, but I argued above that lexicalist theories must allow null forms as the limiting case of phonological realization, just as total lack of meaning is the limiting case of semantic realization. The major point of divergence between Irish and Swedish, stemming from considerations of locality, is whether the resumptive licenser occurs at the top of the binder-resumptive dependency (Irish) or at the bottom (Swedish). The analysis lends further credence to the lexical conjecture as a hypothesis about language variation with respect to true, grammaticized resumptive pronoun strategies.

The unification that this lexical analysis achieves between the resumptive systems of Irish and Swedish is only valid if the overall theory can also account for any differences between the two systems and if the overall theory can account for the Swedish resumptives that were left aside at the beginning of the chapter. This is taken up up in the next section for the subject resumptives that I have argued, are the only syntactic resumptive pronouns in Swedish, following Engdahl (1982). The other apparent resumptives in Swedish are discussed in the next chapter.

		Resumptive licenser (lexical contributor of manager resource)				Anaphoric binding	
	HSR	**Form**	**Category**	**Position (in dependency)**	**Local to**	**Position (in dependency)**	**Local to**
Irish	Yes	*aN*	$\hat{\mathrm{C}}$	Top	UDF	Top	UDF
Swedish	Yes	$\emptyset$	C^0, $\hat{\mathrm{C}}$	Bottom	SUBJ	Top	UDF

Table 7.1: A comparison of the resumptive pronoun systems of Irish and Swedish

7.1.5 Predictions

The grammaticized or syntactic resumptive pronouns in Swedish — those that occur after left-peripheral material in CP — have been assimilated to the resource management theory of resumptive pronouns that was applied in some detail to Irish. The theory of resumptives is based on the following two assumptions (see section 5.1 of chapter 5):

1. Resumptive pronouns are ordinary pronouns.

2. Resource Sensitivity: natural language is resource-sensitive.

If a resumptive pronoun is an ordinary pronoun, then it constitutes a surplus resource. If Resource Sensitivity is to be maintained, then there must be an additional consumer of the pronominal resource present. This is the manager resource that licenses the resumptive pronoun.

The theory makes the following general prediction, which applies equally to Swedish:

(7.73) Syntactic resumptive pronouns and binder-resumptive dependencies have distinct properties from gaps and filler-gap dependencies.

In chapter 4, three characteristics were identified as distinguishing resumptives and their dependencies from gaps and their dependencies: islands, form-identity effects, and weak crossover.

The theory therefore makes the following predictions with respect to Swedish:

(7.74) Swedish binder-resumptive dependencies are not island-sensitive.

(7.75) Swedish binder-resumptive dependencies do not show form-identity effects.

(7.76) Swedish binder-resumptive dependencies do not show weak crossover effects.

The corresponding predictions for Irish are all confirmed.

The fact that only embedded subjects are syntactic resumptives together with the fact that Swedish does not have many island constraints makes the first prediction hard to test. It is certainly true that syntactic resumptives in Swedish are not island-sensitive, but the sorts of clauses in which they occur are not islands in the language anyway. Therefore, it is not really possible to set up examples in which there is a gap in what is independently know to be an island and to show that this is ungrammatical. In addition, in standard Swedish the gap would violate the *that*-trace filter / ECP, so it would be impossible to establish whether the ungrammaticality is really due to the island. The prediction is confirmed vacuously, so the confirmation is not tremendously revealing.

The form-identity prediction is not readily testable either. The unmarked case for *wh*-pronouns in Swedish is likely nominative, since it is a nominative-accusative language and nominative is even the case used for post-copular pronouns:

(7.77) Det är jag / * mig | du / * dig | hon / * henne
it is I / me | you.NOM / you.ACC | she / her
It is me / you / her.

The Tarzan test similarly indicates that nominative is the default:

(7.78) Jag Tarzan. Du Jane.
I.NOM Tarzan. You.NOM Jane.

(7.79) * Mig Tarzan. Dig Jane.
I.ACC Tarzan. You.ACC Jane.

But since the syntactic resumptives in Swedish are subjects and bear nominative case anyway, there is no real opportunity for testing the form-identity prediction, although once again it is not disconfirmed.

The weak crossover prediction can be tested, on the basis that embedded subjects give rise to weak crossover effects:

(7.80) *Who$_i$ did her$_i$ teacher say $\_\__i$ cheated?

Before proceeding, there is an earlier claim about resumptive pronouns and weak crossover that needs to be addressed.

Engdahl (1985:9) understands examples like the following as establishing that Swedish resumptives do not suppress weak crossover effects:

(7.81) * mannen$_i$ som$_i$ hans$_i$ mor tyckte bäst om $\_\__i$
the.man that his mother liked best
the man who his mother liked best
(Engdahl 1985:9, (13a))

(7.82) * Vem$_i$ tyckte hans$_i$ mor bäst om $\_\__i$?
who liked his mother best
Who did his mother like best?
(Engdahl 1985:9, (13b))

These results are presented in contrast to examples that Chomsky (1982) presents showing that the corresponding English sentences are better than we would expect them to be if they were weak crossover violators.

The data in both cases has been misanalyzed as an artefact of independent theoretical assumptions, though. The pronouns in the Swedish examples in (7.81) and (7.82) count as resumptive pronouns in a theory that uses coindexation to represent binding and which takes a resumptive pronoun to be operator-bound. This is the kind of theory in which Chomsky (1982) and Engdahl (1985) were working. However, it should be clear that these pronouns are only coincidentally resumptive. In particular, they are not involved in the unbounded dependency which the relative- or *wh*-operator heads. That dependency terminates in the gap. It is only by transitivity of coindexation that these pronouns get to be considered resumptive at all.

What is really required to test weak crossover for resumptive pronouns in Swedish are examples in which the pronoun actually terminates the unbounded dependency and is therefore actually used as a resumptive. The required kind of example is one that is analogous to the embedded-subject English example in (7.80) above, except with left-peripheral CP material, since this is the only environment in which a Swedish syntactic resumptive occurs. The resource management theory predicts that these should be well-formed, because the resumptive is an actual pronoun in the syntax, not a gap. The syntactic subject resumptives of Swedish should therefore behave like the syntactic object resumptives in Irish and Hebrew, which do suppress weak crossover. The prediction that true resumptive pronouns in Swedish suppress weak crossover is confirmed:[6]

(7.83) Vilken elev$_i$ undrar hans$_i$ lärare om <u>han</u>$_i$ fuskar?
which student wonders his teacher if he cheats
Which student does his teacher wonder if (he) cheats?

(7.84) Vilken elev$_i$ undrar hans$_i$ lärare varför <u>han</u>$_i$ fuskar?
which student wonders his teacher why he cheats
Which student does his teacher wonder why (he) cheats?

(7.85) Jag känner en elev som hennes lärare undrar om <u>hon</u> fuskar.
I know a student that her teacher wonders if she cheats
I know a student who her teacher wonders if (she) cheats.

[6]As is common with weak crossover judgements, there is some speaker uncertainty and variation here. For many speakers the judgements are quite robust, though.

If the resumptive were underlyingly a gap, this pattern of grammatical data would be completely unexpected, since gaps do give rise to weak crossover in Swedish.

Further weak crossover evidence comes from the *Ålandssvenska* dialect described above. Recall that speakers of this dialect allow both gaps and syntactic resumptive pronouns after left-peripheral material in CP. There is no weak crossover violation for speakers of *Ålandssvenska* when a resumptive pronoun is used, but a corresponding gap does result in a weak crossover violation:

(7.86) * Vilken elev$_i$ undrar hans$_i$ lärare om $\_\__i$ fuskar?
which student wonders his teacher if cheats
(Which student does his teacher wonder if cheats?)

Since speakers of the dialect allow *that*-trace gaps, the ill-formedness of (7.86) can only be due to a weak crossover violation. This dialectal pattern adds further support to the theory.

7.1.5.1 Reconstruction, parasitic gaps, and across-the-board extraction

In section G of chapter 4, I presented Swedish data on reconstruction, parasitic gaps, and across-the-board (ATB) extraction that have been argued to support the view that Swedish resumptives are underlyingly gaps. The current theory claims that syntactic resumptives in Swedish are ordinary pronouns in the syntax, so it seems that this data would be problematic. In this section I will show that the theory in fact makes the correct prediction about reconstruction with respect to the subject position that true resumptives occupy in Swedish. I will also sketch an analysis of parasitic gaps that builds on previous work on coordination and ATB in Glue Semantics (Asudeh and Crouch 2002a). The resulting sketch in conjunction with the present theory points to an explanation of the Swedish parasitic gap and ATB facts that makes strong connections to past and recent work on these topics (Steedman 1987, 1996, Nissenbaum 2000) and potentially lends further support to the principal findings of this work, although it does not directly support their theoretical understanding of the findings since these theoretical assumptions are not shared with the current theory.

The Swedish reconstruction examples in chapter 4 concerned reconstruction for anaphoric binding of reflexive possessors. This kind of example cannot be used to test syntactic subject resumptives for reconstruction, since there is no way to test reconstruction of the reflexive possessor in subject position without incurring an independent binding-theoretic violation based on the locality requirements that the possessive reflexive places on its antecedent. The only option is to test for scope reconstruction. I am not convinced that such reconstruction is most profitably analyzed purely syntactically (see the discussion in Jacobson 1999 and references therein), but let us nonetheless proceed as if it were. The required kind of examples are the following, where I represent the reconstruction point as a black box:

(7.87) Which student did every teacher say ■ cheated?

(7.88) Which student did every teacher wonder if ■ cheated?

If reconstruction is possible, the *wh*-phrase should be able to take narrow scope with respect to the universal and a pair-list answer should be grammatical. if reconstruction is not possible, the *wh*-phrase must take wide scope and only an individual or individual function answer should be possible.

The Swedish question corresponding to (7.87) with a gap at the reconstruction site following no left-peripheral CP material allows all three kinds of answer:

(7.89) Vilken elev tror varje lärare __ fuskar?
Which student tror every teacher __ cheats
Which student does every teacher think cheats?

a. Pelle

b. Hans mest begåvade elev

His most gifted student

c. Andersson, Alfons; Boberg, Benny; Cornelius, Conny

Similarly, a post-complementizer gap in *Ålandsvenska* allows all three answers:

(7.90) Vilken elev undrar varje lärare om __ fuskar?
Which student wonders every teacher if __ cheats
Which student does every teacher wonder if (he) cheats?

a. Pelle

b. Hans mest begåvade elev

His most gifted student

c. Andersson, Alfons; Boberg, Benny; Cornelius, Conny

This is what we would expect, since a gap should allow both wide scope and narrow scope for the quantifier.

The theory makes the following prediction about reconstruction for subject resumptives:

(7.91) Syntactic resumptives do not allow reconstruction.

If the subject resumptive is a pronoun, as in the present theory, then reconstruction is predicted to be blocked, since the reconstruction site is occupied by a pronoun.

If the subject resumptive in Swedish is underlyingly a gap, it should allow reconstruction and the pair-list answer should be grammatical. The present theory predicts that the pair-list answer is impossible and the prediction is confirmed:[7]

(7.92) Vilken elev undrar varje lärare om han fuskar?
Which student wonders every teacher if he cheats
Which student does every teacher wonder if (he) cheats?

a. Pelle

b. Hans mest begåvada elev
His most gifted student

c. *Andersson, Alfons; Boberg, Benny; Cornelius, Conny

Reconstruction facts therefore support the current theory over a theory that posits that the resumptive pronoun is underlyingly a gap. The reconstruction facts concerning putative object resumptives are discussed in the next chapter.

Parasitic gaps and ATB extraction present a greater challenge to this theory, because the original data that was presented already established that the actual syntactic subject resumptives license parasitic gaps, as shown in (7.93), and do not result in ATB violations, as shown in (7.94):

(7.93) Det var den fången$_i$ som läkarna inte kunde avgöra om han$_i$ verkligen var sjuk utan
it was that prisoner that the.doctors not could decide if he really was ill without
att tala med $\underline{p}_i$ personligen.
to talk with __ in person
(This is the prisoner that the doctors couldn't detemine if he really was ill without talking to in person.)

[7] Once again the judgements are delicate, but several speakers robustly show the pattern reported here.

(7.94) Där borta går en man som jag ofta träffar _ men inte minns vad han heter.
There goes a man that I often meet _ but not remember what he is called
There goes a man that I often meet but don't remember what he is called.
(Zaenen et al. 1981:681, (9))

I have argued that the subject resumptive pronouns in Swedish are real resumptive pronouns, in agreement with Engdahl (1982), and the theory holds that they are therefore ordinary pronouns in the syntax. This data must therefore be construed as a syntactic resumptive pronoun licensing a parasitic gap on this theory and a syntactic resumptive pronoun not causing an ATB violation.

There is however an implicit assumption in construing the parasitic gap and ATB data as problematic for the theory. The assumption is that these phenomena are entirely syntactic. It is only on this assumption that this data indicates an underlying gap status for Swedish resumptive pronouns. Given the argument from weak crossover and reconstruction that these resumptives are not gaps, a contradiction seems to arise. One set of data indicates that the resumptives are gaps, the other set indicates that they are pronouns. However, if the assumption that parasitic gaps and ATB are purely syntactic phenomena is given up, the theory predicts the similarity between resumptives and gaps. The reason is that at the level of semantic composition represented by the linear logic Glue proofs and in the model-theoretic semantics represented by the meaning language side of the Glue meaning constructors, syntactic resumptive pronouns and gaps are equivalent. Once the manager resource that license a syntactic resumptive has removed the pronoun, the rest of the proof and the resulting interpretation are equivalent to the proofs and interpretation for corresponding sentences with gaps. In a sense, a resumptive pronoun is a pronoun in the syntax and a gap in the semantics.

The following corollary therefore results from the theory:

(7.95) If a phenomenon shows a correspondence between grammaticized resumptive pronouns and gaps, the correspondence is captured in semantic composition (proof-theoretic) or the meaning language that interprets the semantics (model-theoretic).

In other words, syntactic resumptives and gaps should only show corresponding semantic behaviour, not corresponding syntactic behaviour. Notice that this does not mean that gaps and resumptives correspond completely in the semantics, just that any correspondences there are must be semantic. One such correspondence is the fact that resumptive pronouns and gaps with antecedents that are operators are interpreted as bound by those operators. However, any restrictions that pronouns place on their antecedents, whether syntactic (such as syntactic agreement) or semantic (such as the restriction that the antecedent cannot be an individual or kind concept) still hold, since the pronoun is initiatlly present in semantic composition and is only removed through composition with a manager resource.

It has been known for quite some time that there are exceptions to ATB extraction (see Kehler 2002 and references therein). Ross (1967) already noted exceptions like the following:

(7.96) What did you go to the store and buy?

Extraction has taken place out of the second clause but not the first, yet the sentence is grammatical. Based on these and other observations, Kehler (2002) argues that ATB cannot be a purely syntactic phenomenon and is additionally governed by semantic and pragmatic factors and general conditions on discourse coherence. Asudeh and Crouch (2002a) provide a Glue analysis of ATB that can be integrated with Kehler's theory. They capture discourse-driven ATB effects through conditions of proof parallelism, similar to those that they have argued should capture scope parallelism in ellipsis (Asudeh and Crouch 2002b). Proofs are abstract, proof-theoretic objects, no matter how they are represented and the proof-theory that underlies linear logic allows the treatment of proofs as first-class objects without danger of making statements that are contingent on arbitrary features of representation (i.e., how the proofs happen to be written down). This follows because there are procedures of proof normalization that reduce any representation of a proof to a canonical form that represents the underlying proof. The analysis that Asudeh and Crouch present is fairly complicated, because one of it goals is to derive recursive conjunction in the semantics from flat conjunction in the syntax. The complexity thus comes from deriving a recursive semantics from a non-recursive synactic structure of arbitrary size.

Even if Kehler's (2002) reasoning is rejected, what Asudeh and Crouch have crucially shown is that ATB restrictions can be stated as restrictions on proofs. If ATB can be stated on proofs and if at the proof level resumptive pronouns and gaps are equivalent, then the theory makes the following prediction, which we have already observed is correct:

(7.97) Resumptive pronouns do not result in ATB extraction violations.

The prediction follows without positing that resumptive pronouns are gaps in the syntax and therefore does not compromise the reconstruction or weak crossover results.

The analysis of Asudeh and Crouch (2002a) is basically a polymorphic treatment of coordination of the kind that is common in Categorial Grammar (Steedman 1985, 2000, Carpenter 1997:177ff.). A coordinating conjunction takes its conjuncts as arguments and produces a dependency on whatever arguments the conjuncts share. For example, the following VP-coordination, would result in coordination premise as in (7.99):

(7.98) John slept and dreamt.

(7.99) $\lambda P \lambda Q \lambda x.and(P(x), Q(x)) : (j \multimap s) \multimap (j \multimap d) \multimap (j \multimap c)$

In this case, since the coordinated VP is the head of the sentence, the final result of composition of *John*, *slept*, *and*, and *dreamt* will be: $and(sleep(j),\ dream(j)) : c$. If constituents that do not head the sentence are coordinated, the resulting coordination will itself form the argument or adjunct of some head. The relevant aspect of the analysis is that despite the fact that there is only a single resource corresponding to the single realization of the shared argument (in this case the subject), the proper result is achieved through successive consumption of dependencies and eventual production of a single dependency on the single resource. The coordinating conjunction therefore takes several predicate-argument relations and reduces them to a single predicate-argument relation.

Steedman (1987, 1996) relates parasitic adjuncts to coordination by treating the adjunct essentially like VP conjunction. Nissenbaum (2000:96), although operating under a quite different set of theoretical assumptions, has proposed that "parasitic adjuncts, together with the VPs that they modify, enter into a predicate-argument relation with a local DP". Following in the tradition of Steedman and Nissenbaum, I assume that the parasitic adjunct consumes a dependency on an argument that is shared with the clause that it is an adjunct of and uses the result to modify that clause. The chestnut example below would therefore contribute the premises in (7.101):

(7.100) What did you file without reading?

(7.101)

1. $\lambda S.Qu(y, thing(y), S(y)) : \forall X.[(w \multimap X) \multimap X]$ Lex. **what**
2. $h : y$ Lex. **you**
3. $file : y \multimap w \multimap f$ Lex. **file**
4. $\lambda P \lambda Q \lambda x.without(P(x), Q(x)) :$ $(w \multimap r) \multimap [(w \multimap f) \multimap (w \multimap f)]$ Lex. **without**
5. $read : y \multimap w \multimap r$ Lex. **reading**

I have taken two prominent shortcuts here. First, I have just represented the semantics of *without* as a relation. Its truth conditions need to capture that to do X without doing Y means that X was done and Y was not done. Roughly, the semantics is conjunctive, but the the conjunct corresponding to the adjunct is negated. Second, I have left aside the details of the control relation for the subject of the adjunct and just assumed that there is a null pronoun; for further details about control in Glue, see Asudeh (2000, 2002a, 2003b) and Dalrymple (2001). The premises above construct the proof in Figure 7.2.

$$
\dfrac{
  \dfrac{
    \dfrac{
      \begin{array}{l}\textbf{without}\\ \lambda P \lambda Q \lambda x.without(P(x), Q(x)) :\\ (w \multimap r) \multimap [(w \multimap f) \multimap (w \multimap f)]\end{array}
      \qquad
      \dfrac{h : y \qquad \overset{\textbf{reading}}{read : y \multimap w \multimap r}}{read(h) : w \multimap r}
    }{\lambda Q \lambda x.without(read(h,x), Q(x)) : (w \multimap f) \multimap (w \multimap f)}
    \qquad
    \dfrac{\overset{\textbf{you}}{h : y} \qquad \overset{\textbf{file}}{file : y \multimap w \multimap f}}{file(h) : w \multimap f}
  }{\lambda x.without(read(h,x), file(h,x)) : (w \multimap f)}
  \qquad
  \begin{array}{l}\textbf{what}\\ \lambda S.Qu(y, thing(y), S(y)) :\\ \forall X.[(w \multimap X) \multimap X]\end{array}
}{Qu(y, thing(y), without(read(h,y), file(h,y))) : f}
$$

Figure 7.2: Proof for *What did you file without reading?*

This is clearly only the beginning of a theory of parasitic gaps and it does not do the theories of Steedman and Nissenbaum justice. Notice that the matter of whether a language has parasitic gaps on this theory reduces to whether it has adjuncts that interact with extraction in semantic composition in the proper way. The analysis does not predict that all languages necessarily have parasitic gaps (Irish and Welsh do not, for example). However, it does lead to the following prediction, which we already know to be confirmed for Swedish:

(7.102) Resumptive pronouns can license parasitic gaps.

Without presenting all the details, here is how this follows from the theory. The resumptive pronoun is just an ordinary pronoun in the syntax. In the semantics, the pronoun's resource is removed by a manager resource. The dependency relabeling that accompanies this modifies the dependency on the pronoun so that it is a dependency on the pronoun's binder. At this point, the resulting premise pool is indistinguishable from the pool of premises that would have been contributed by the same sentence with a gap instead of the resumptive. Therefore, the resumptive pronoun has licensed a parasitic gap without being a gap itself in the syntax. Once again the prediction follows without positing that resumptive pronouns are gaps in the syntax and does not compromise the reconstruction or weak crossover results.

7.1.6 Summary

The resource management theory of resumptive pronouns has been successfully extended to Swedish. The theory makes correct predictions about weak crossover, reconstruction, parasitic gap, and ATB extraction. The theory also makes predictions about islands and form-identity effects that are hard to test but that are not disconfirmed by the data. Analysis of Swedish has shown that a theory that treats syntactic resumptives in Swedish as pronouns in the syntax explains the facts of the language properly, whereas a theory that posits that the pronoun is a gap in the syntax or that the binder-resumptive dependency is a filler-gap dependency necessarily makes conflicting predictions that are not confirmed upon careful examination of the language.

Next I give a brief analysis of Hebrew that further confirms the theory and lends yet more credibility to the lexical conjecture. The analysis of Hebrew will also lend further support to the analyses of Swedish and Irish, since Hebrew will be analyzed in terms that reveal similarities with Swedish on the one hand and Irish on the other.

7.2 Resumptive pronouns in Hebrew

The resumptive pronoun system of Hebrew is quite close to that of Irish. Resumptive pronouns occur in every position except the highest subject (see chapter 4) and there is no indication that the resumptive licenser must be local to the resumptive, as in Swedish. However, the lexical analysis that I present here reveals similarities to Swedish as well.

Borer (1984:220, (1)) gives the following data on the distribution of direct object resumptives and gaps:

(7.103) a.

raʔiti	ʔet	ha-yeled	she- / ʔasher	rina	ʔohevet	<u>ʔoto</u>
saw.I	ACC	the-boy	that	Rina	loves	him

I saw the boy that Rina loves (him).
(Borer 1984:220, ∼(1a))

b.

raʔiti	ʔet	ha-yeled	she- / ʔasher	<u>ʔoto</u>	rina	ʔohevet
saw.I	ACC	the-boy	that	him	Rina	loves

I saw the boy that Rina loves (him).
(Borer 1984:220, ∼(1b))

c.

raʔiti	ʔet	ha-yeled	<u>ʔoto</u>	rina	ʔohevet
saw.I	ACC	the-boy	him	Rina	loves

I saw the boy that Rina loves (him).
(Borer 1984:220, ∼(1c))

d.

raʔiti	ʔet	ha-yeled	she- / ʔasher	rina	ʔohevet	_
saw.I	ACC	the-boy	that	Rina	loves	_

I saw the boy that Rina loves.
(Borer 1984:220, ∼(1d))

Examples (a) and (b) show the co-occurrence of either the complementizer *she-* or the more formal complementizer *ʔasher* with a resumptive pronoun. The pronoun is in base position in (a) and in a fronted position in (b). Example (c) is particularly interesting because there is a fronted resumptive pronoun but no apparent licenser. Example (d) has a gap in object position rather than a resumptive pronoun.

Borer (1984:225) notes that there is a process in Hebrew whereby a pronoun is fronted through an unbounded filler-gap dependency to what she calls a TOPIC position:

(7.104) ʔamarti le-kobi she-ʔoto rina ʔohevet _
said.I to-Kobi that-him Rina loves _
I told Kobi that it is him that Rina loves.
(Borer 1984:225, (11a))

(7.105) ʔamarti le-kobi she-ʔoto dalya xoshevet she-rina ʔohevet _
said.I to-Kobi that-him Dalya thinks that-Rina loves _
I told Kobi that it is him that Dalya thinks that Rina loves.
(Borer 1984:225, (11b))

Borer (1984:228–237) argues that the fronted pronoun in (7.103b) and (7.103c) is not in the TOPIC position, but is rather in COMP, although it still moves there from its base position. She notes that Hebrew does not block multiple overt elements in COMP (Borer 1984:234,240); i.e., the doubly-filled COMP filter does not apply in Hebrew.

I will adopt Borer's proposal that the fronted pronoun is in COMP, but adapt it to Toivonen's (2003) X-bar theory and theory of non-projecting words. A fronted pronoun in Hebrew will be assigned the plain category C. This means that it can be realized as either $\hat{\mathrm{C}}$ or C^0. Non-fronted pronouns will have the standard category of D^0 (or N^0, depending on auxiliary assumptions that are not directly relevant here). A sample partial lexical entry for *ʔoto* ('him') is shown here:

(7.106) *ʔoto*: $\{\mathrm{D}^0 \mid \mathrm{C}\}$ $(\uparrow \textsc{pred}) = \text{`pro'}$

Whether or not the pronoun is fronted, it serves as a syntactic argument and will therefore need to be a grammatical function (in the cases above it is OBJ). The c-structure rule that expands C' and inserts complementizers will therefore need to deal with cases where C^0 dominates a complementizer, which is a co-head indicated by $\uparrow = \downarrow$, and cases where C^0 dominates a GF pronoun:

(7.107)
$$\mathrm{C}' \longrightarrow \begin{array}{cc} \mathrm{C}^0 & \mathrm{IP} \\ \{\ \uparrow = \downarrow \ \mid\ (\uparrow \textsc{gf}) = \downarrow\ \} & \uparrow = \downarrow \end{array}$$

The fronted pronoun in example (7.103c) is therefore generated as a C^0 bearing the OBJ grammatical function. Although the pronoun can also be realized as a non-projecting $\hat{\mathrm{C}}$, when there is no overt complementizer *she* or *ʔasher* it must be realized as C^0. If it were realized as $\hat{\mathrm{C}}$ it could not be inserted under C' according to Toivonen's theory (since $\hat{\mathrm{C}}$ is a non-projecting word and only projecting words may project an X' node). The c-structure for the relativized DP *ʔet ha-yeled ʔoto rina ʔohevet* ('the boy that Rina loves (him)') is shown in (7.116) below.

The complementizers *she* and *ʔasher* are treated as regular, projecting complementizers, since I am aware of no evidence that they are non-projecting words:

(7.108) *she*: C^0 . . .

ʔasher: C^0 . . .
$(\text{ADJ} \in \uparrow)$

The complementizer *she* can be used in both relativization and in complement clauses, whereas *ʔasher* is only a relative complementizer (Borer 1984:235). This difference is captured lexically through the existential equation in *ʔasher*'s lexical entry, which requires it to appear in an ADJUNCT clause and therefore restricts its appearance to relatives (complement clauses will have the grammatical function COMP). Example (7.103d) is straightforward: the complementizer occurs in CP and there is a gap corresponding to the relativized object. The basic structure of (7.103a) is also straightforward: a complementizer occurs in CP and the pronoun is in its base position as an D^0 projecting a DP. Nothing has yet been said about how the resumptive pronoun in (7.103a) is licensed, though. The complementizers *she-* and *ʔasher* do not contribute manager resources, so their presence alone is not sufficient.

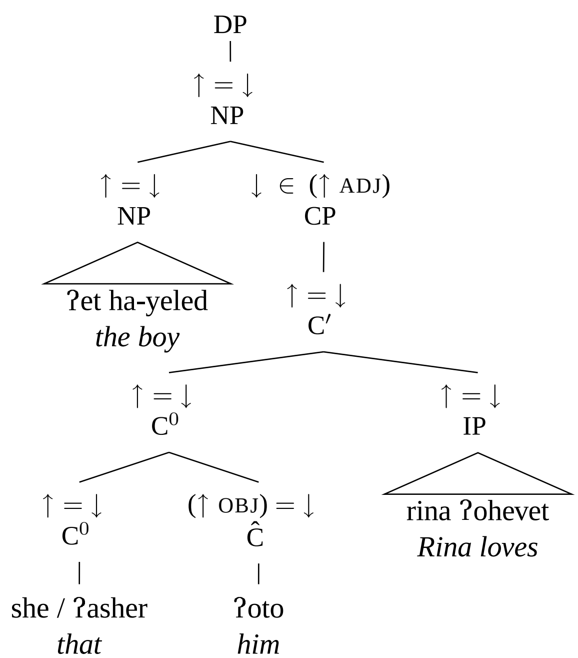
However, the lexical entries given so far are in fact sufficient to handle examples where a complementizer co-occurs with a fronted pronoun, as in (7.103b). All that is required is the addition of a rule for adjoining a fronted pronoun realized as a non-projecting $\hat{C}$:

(7.109) $C^0 \longrightarrow \underset{\uparrow = \downarrow}{C^0} \quad \underset{(\uparrow\ \text{GF}) = \downarrow}{\hat{C}}$

This rule will be further revised shortly.

The relativized DP *ʔet ha-yeled she- / ʔasher ʔoto rina ʔohevet* of example (7.103b) is shown here:

(7.110)



The fronted pronoun is adjoined to the complementizer as a non-projecting word.

The final and most important detail that needs to be determined is what lexical item licenses the resumptive pronoun in (7.103a–c). In other words, what is the equivalent of Irish *aN* in Hebrew? Example (7.103c) indicates that the requisite lexical item must be a null complementizer, as in Swedish. In (7.103c) there is a fronted resumptive pronoun with no apparent licenser. There are two alternatives to positing a null complementizer for this case, but neither is appealing. The first is to posit a structural licenser like in the structural analysis for Swedish in section 7.1.1. However we are operating under the lexical conjecture and this solution is therefore to be avoided. The second alternative is to posit that the pronoun somehow licenses itself. This solution is completely unnatural though. On the semantic side, it would constitute an element adding a certain meaning constructor and then consuming it. On the syntactic side, the pronoun would have to reach outside the grammatical function that it is in so that it can remove itself.

The null complementizer's lexical entry is given here:

(7.111) $\emptyset$: $\hat{\mathrm{C}}$ $[(\uparrow \mathrm{UDF})_\sigma \multimap ((\uparrow \mathrm{UDF})_\sigma \otimes (\uparrow \mathrm{GF}^+)_\sigma)] \multimap [(\uparrow \mathrm{UDF})_\sigma \multimap (\uparrow \mathrm{UDF})_\sigma]$

There are points of similarity between this Hebrew complementizer and the complementizers for Irish and Swedish. The resumptive-licensing complementizer has no phonological content and does not provide the anaphoric binding equation or the dependency relabeling premise. This is also the case for the Swedish resumptive-licensing complementizer. However, like Irish the resumptive licenser occurs at the top of the dependency and accesses the resumptive pronoun in terms of the unbounded dependency function that is locally specified at the top of the dependency. In Swedish locality considerations indicate that the resumptive licenser is at the bottom of the dependency and is locally specified in terms of the subject resumptive pronoun that it licenses and the pronoun's antecedent.

As in Swedish, the top of the dependency (SpecCP) handles both the anaphoric binding that integrates the resumptive pronoun and satisfies the Extended Coherence Conditions and the dependency relabeling that modifies the dependency on the resumptive pronoun:

(7.112)
$$\mathrm{CP} \longrightarrow \left\{ \begin{array}{c} \mathrm{XP} \\ (\uparrow \textsc{udf}) = \downarrow \end{array} \middle| \begin{array}{c} \epsilon \\ (\uparrow \textsc{topic pred}) = \text{‘pro’} \end{array} \right\} \begin{array}{c} \mathrm{C}' \\ \uparrow = \downarrow \end{array}$$
$$\left(\begin{array}{c} \textbf{Anaphoric binding} \\ \textbf{Resumptive dependency relabeling} \end{array} \right)$$

The anaphoric binding and dependency relabeling information is the same as for Swedish and Irish (see page 257).

The C^0 adjunction rule in (7.109) needs to be adjusted to accommodate the empty complementizer. In its current form it assigns a grammatical function to the adjoined $\hat{\mathrm{C}}$. This is appropriate for pronouns, but not for the null complementizer, which should contribute its manager resource to the same f-structure as the C^0. Furthermore, the C^0 adjunction target is itself a pronoun in cases like (7.103c). The revised rule is:

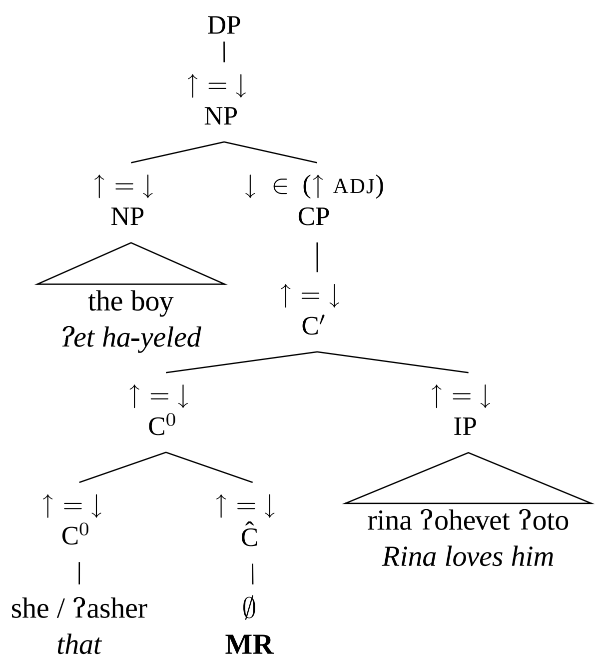
(7.113)
$$\mathrm{C}^0 \longrightarrow \begin{array}{c} \mathrm{C}^0 \\ \{\ \uparrow = \downarrow \ \mid\ (\uparrow \textsc{gf}) = \downarrow\ \} \end{array} \quad \begin{array}{c} \hat{\mathrm{C}} \\ \{\ \uparrow = \downarrow \ \mid\ (\uparrow \textsc{gf}) = \downarrow\ \} \end{array}$$

The C^0 can be either a complementizer (*she* or *ʔasher*) or a fronted pronoun. The $\hat{\mathrm{C}}$ can be either a fronted pronoun or a null, resumptive-licensing complementizer.

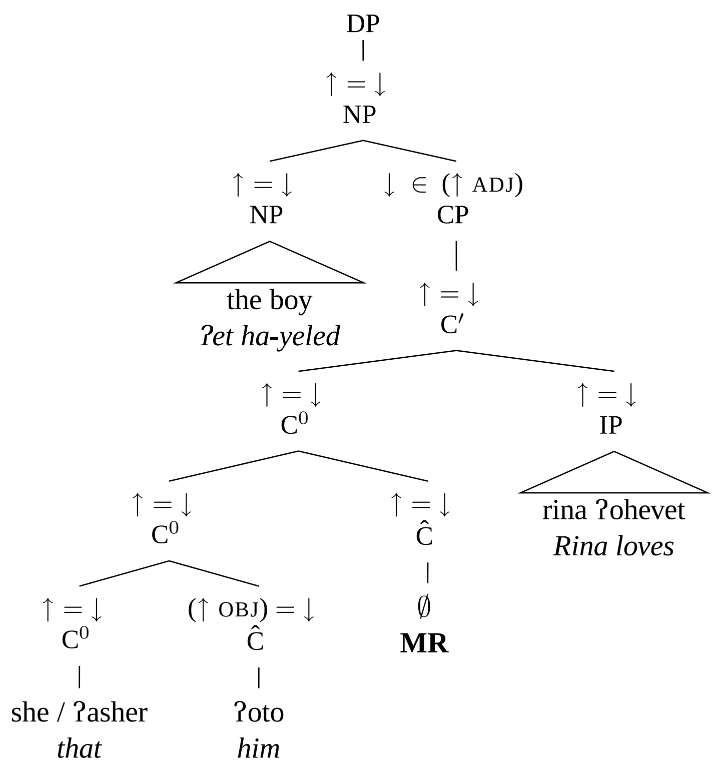
The analysis yields the following structures for the relativized DPs in (7.103), which are repeated as necessary:

(7.114)	raʔiti	ʔet	ha-yeled	she- / ʔasher	rina	ʔohevet	<u>ʔoto</u>
	saw.I	ACC	the-boy	that	Rina	loves	him

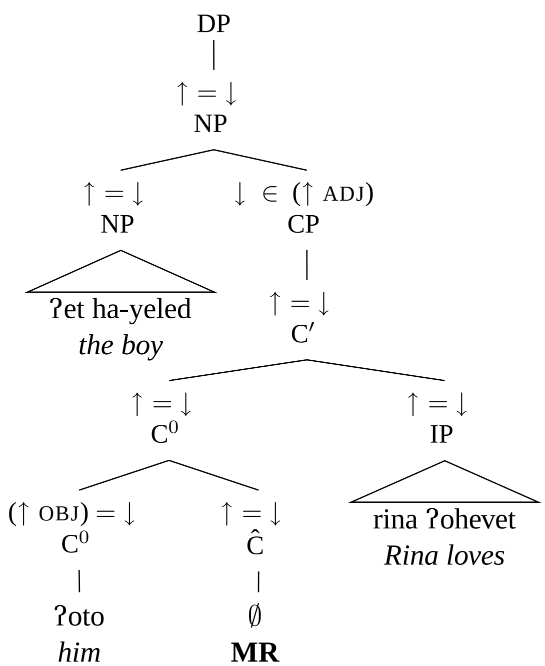
I saw the boy that Rina loves (him).



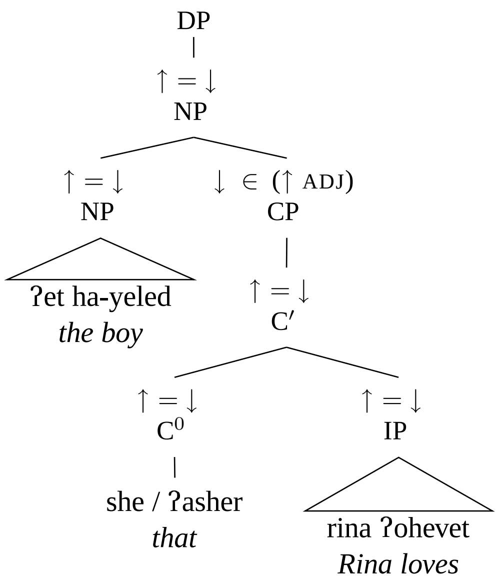
(7.115) raʔiti ʔet ha-yeled she- / ʔasher <u>ʔoto</u> rina ʔohevet
saw.I ACC the-boy that him Rina loves
I saw the boy that Rina loves (him).



(7.116) raʔiti ʔet ha-yeled <u>ʔoto</u> rina ʔohevet
saw.I ACC the-boy him Rina loves
I saw the boy that Rina loves (him).



(7.117) raʔiti ʔet ha-yeled she- / ʔasher rina ʔohevet __
saw.I ACC the-boy that Rina loves __
I saw the boy that Rina loves.



The three resumptive pronoun structures in (7.114)–(7.116) have identical functional structures and semantic structures (leaving aside the functional equality that relates the fronted pronoun to its base position). The common f-s and s-s are shown here:

(7.118)
$$b\left[\begin{array}{ll} \text{PRED} & \text{‘boy’} \\ \text{SPEC} & \left[\text{PRED} \quad \text{‘the’}\right] \\ \text{CASE} & \text{acc} \\ \text{ADJ} & \left\{ l \left[\begin{array}{ll} \text{PRED} & \text{‘love’} \\ \text{TOPIC} & a\left[\text{PRED} \quad \text{‘pro’}\right] \\ \text{SUBJ} & s\left[\text{“Rina”}\right] \\ \text{OBJ} & p\left[\begin{array}{ll} \text{PRED} & \text{‘pro’} \\ \text{PERS} & 3 \\ \text{NUM} & \text{sg} \\ \text{GEND} & \text{masc} \end{array}\right] \end{array}\right] \right\} \end{array}\right] \qquad p_\sigma \left[\text{ANTECEDENT} \quad a_\sigma\left[\ \right]\right]$$

The anaphoric binding of the resumptive pronoun by the TOPIC is established by SpecCP, as it is in Swedish.

The following premises are contributed by the lexical items and SpecCP, as instantiated by (7.118):

(7.119)

1.	$(v \multimap r) \multimap \forall X.[(b \multimap X) \multimap X]$	Lex. **ha (‘the’)**
2.	$v \multimap r$	Lex. **yeled (‘boy’)**
3.	$(p \multimap l) \multimap (a \multimap l)]$	SpecCP
4.	$(a \multimap l) \multimap [(v \multimap r) \multimap (v \multimap r)]$	REL_σ (SpecCP)
5.	$[a \multimap (a \otimes p)] \multimap (a \multimap a)$	Lex. $\emptyset$
6.	s	Lex. **rina**
7.	$s \multimap p \multimap l$	Lex. **ʔohevet (‘loves’)**
8.	$a \multimap (a \otimes p)$	Lex. **ʔoto (‘him’)**

These premises can be compared to those in (7.68) for a Swedish *wh*-question example and to those in (6.64) for a similar Irish relative clause example (see page 201). The proof that they construct should by now be familiar, but is shown in Figure 7.3 for the sake of explicitness.

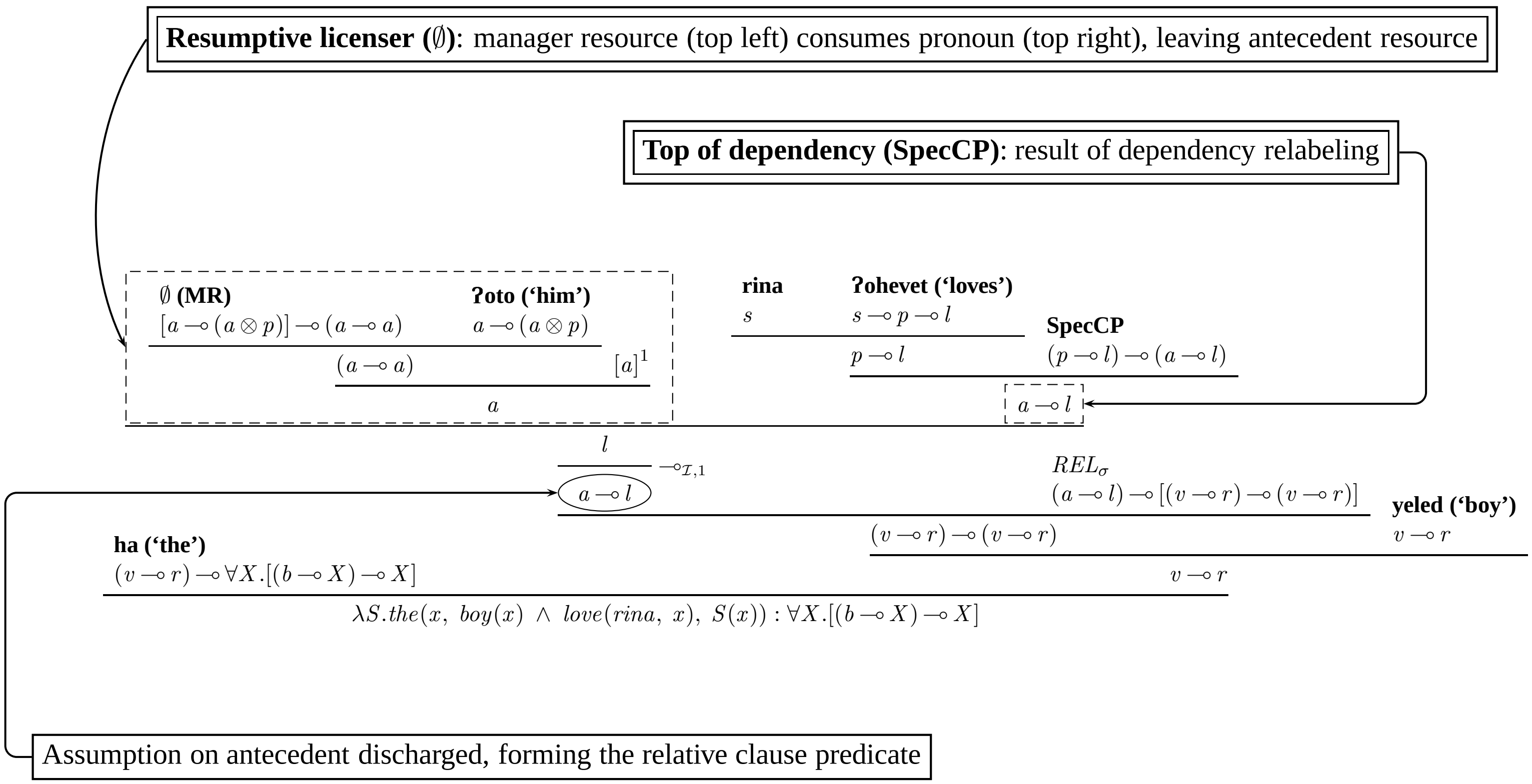


Figure 7.3: Proof for a Hebrew binder-resumptive dependency

The analysis offered here is by no means a complete account of resumptives in Hebrew. The main aim was to show that the mechanisms that have been used in the analyses of Irish and Swedish can readily deal with Hebrew. However, the analysis already captures further facts about Hebrew syntax.

Hebrew has prepositional forms that bear pronominal inflection, like in Irish. These prepositional forms set up a parallel resumptive paradigm to the direct object paradigm shown in (7.103):

(7.120) a. raʔiti ʔet ha-yeled she- / ʔasher rina xashva ʔalav
saw.I ACC the-boy that Rina thought about.him
I saw the boy that Rina thought about (him).
(Borer 1984:220, (2a))

b. raʔiti ʔet ha-yeled she- / ʔasher ʔalav rina xashva
saw.I ACC the-boy that about.him Rina thought
I saw the boy that Rina thought about (him).
(Borer 1984:221, (2b))

c. raʔiti ʔet ha-yeled ʔalav rina xashva
saw.I ACC the-boy about.him Rina thought
I saw the boy Rina thought about (him).
(Borer 1984:221, (2c))

The corresponding gap example is impossible: Hebrew does not allow prepositional object gaps (Borer 1984, Shlonsky 1992).

Borer (1984) analyzes a fronted inflected preposition as movement into COMP, similarly to what the pronoun does on her analysis. I maintain her insight by treating the inflected preposition similarly to the pronoun. In particular, the inflected preposition can either be of category P^0 as usual (cf. the D^0 option for the pronoun) or it can have the category C, which can be realized as $\hat{C}$ or C^0. This is shown in the following partial lexical entry:

(7.121) *ʔalav*: $\{P^0 \mid C\}$ $(\uparrow$ PRED$) =$ ‘about’
$(\uparrow$ OBJ PRED$) =$ ‘pro’

The inflected preposition contributes a pronominal resource, just like in Irish. If the inflected preposition is assigned these categories, then nothing more needs to be said to derive the examples (7.120). The preposition is either generated in base position as a P^0 or is fronted as a $\hat{C}$ (when the complementizers *she* and *ʔasher* are present) or as a C^0 (when the complementizers are absent). The manager resource looks for a pronominal resource in grammatical function that satisfies GF$^+$. In (7.103) the pronominal is found in OBJ, but in this case it is further embedded in OBL OBJ.

7.2.1 Dialectal variation: questions

There is one final matter that needs to be addressed. Recall from chapter 4 that there has been some dispute in the literature about whether Hebrew allows resumptive pronouns in questions or not. Borer (1981:114) makes the claim that resumptive pronouns are not possible in Hebrew questions. Subsequent work found that Hebrew does allow resumptives in questions in restricted circumstances. Sells (1984) noted that while simple *wh*-questions like (7.122) are ungrammatical, a resumptive pronoun in a question is grammatical in a *that*-trace environment:

(7.122) * mi raʔiti <u>oto</u>?
who saw-I him
Who did I see (him)?
(Sells 1984:63, (58b))

(7.123) eyze xešbon kol maškia lo zoxer im <u>hu</u> noten ribit tova?
which account every investor not remembers if it gives good interest
Which account does every investor not remember if (it) gives good interest?
(Sells 1984:64, (61))

Erteschik-Shir (1992) subsequently argued that what she calls *ECP resumptives*, like the one in (7.123), must be distinguished from true resumptives in Hebrew, which she calls *syntactic resumptives* or *restrictive resumptives*. However, Sharvit (1999:591) has recently argued that at least some dialects of colloquial Hebrew allow resumptives in *which*-questions:

(7.124) eyze student nigashta ito?
which student you.met with.him
Which student did you meet with (him)?
(Sharvit 1999:591, (9))

Sharvit (1999:591) analyzes the distinction between good examples of resumptives in questions, like (7.124) and bad examples like (7.122) in terms of *D-linking* (Pesetsky 1987). She notes that *which*-questions can qualify as D-linked more readily than *who*-questions. Based on the distinction, she argues that resumptive pronouns are sensitive to D-linking.

The analysis given in the previous section captures the dialect that allows resumptive pronouns in questions. It does not address the D-linking distinction, but if Sharvit's (1999)'s assumptions about D-linking are adopted, the lack of non-D-linked *wh*-questions will follow for independent reasons. In order to syntactically capture the dialect that does not allow resumptives in questions, all that needs to be done is to add an equation to the lexical entry for the resumptive-licensing complementizer that states that it cannot co-occur with FOCUS phrases, since this is the GF that *wh*-phrases bear:

(7.125) $\emptyset$: $\hat{\mathrm{C}}$ **MR**
$\neg\,(\uparrow \textsc{focus})$

It remains to be seen whether this simple solution is restrictive enough. Further work should also be done to see whether the distribution of resumptives can be reduced to solely semantic differences between relative clauses and questions and whether any such differences can explain the variation.

7.2.2 Summary and discussion

The lexical analysis of Irish and Swedish has been extended to Hebrew. The resulting picture is summarized in Table 7.2. All three languages license resumptive pronouns through their complementizer system. The complementizer is overtly realized in Irish, but not in Hebrew and Swedish. In Irish and Hebrew the complementizer is non-projecting and must adjoin to I^0 (Irish) or C^0 (Hebrew), whereas in Swedish the complementizer may also be realized as a projecting C^0. All three languages license ordinary pronouns as resumptive pronouns through anaphoric binding from the top of the binder-resumptive dependency. Irish and Hebrew are alike in licensing their resumptive pronouns locally to the binder, whereas Swedish licenses its resumptive pronouns locally to the pronoun. This last point is the point of real divergence between the languages, but this is lexically localized in the complementizers, too. The theory has thus achieved a unified analysis of resumptives in the three languages and it did so by pursuing McCloskey's lexical conjecture: the difference between languages with respect to whether they license resumptive pronouns and with respect to how they do so is a matter of lexical specification. English, unlike these three languages, does not have the required kind of complementizer and therefore lacks grammaticized, syntactic resumptives. The superficially similar use of intrusive pronouns and other resumptive-like pronouns, which can only pretheoretically be called resumptive if the label resumptive pronoun is to have any descriptive value, is the principal topic of the next chapter. Before leaving this chapter, though, I want to present a final, simple argument against treating resumptive pronouns as gaps.

		Resumptive licenser (lexical contributor of manager resource)				Anaphoric binding	
	HSR	**Form**	**Category**	**Position (in dependency)**	**Local to**	**Position (in dependency)**	**Local to**
Irish	Yes	*aN*	$\hat{\mathrm{C}}$	Top	UDF	Top	UDF
Swedish	Yes	$\emptyset$	C^0, $\hat{\mathrm{C}}$	Bottom	SUBJ	Top	UDF
Hebrew	Yes	$\emptyset$	C	Top	UDF	Top	UDF

Table 7.2: A comparison of the resumptive pronoun systems of Irish, Swedish, and Hebrew

7.3 A final argument against resumptive pronouns as gaps

The observation discussed in chapter 4 that resumptive pronouns are just the ordinary pronouns of the language (McCloskey 2002) is sufficient cause in most theories to seriously doubt that resumptive pronouns are underlyingly gaps or that they have lexical specifications of any sort that distinguish them as resumptives. On the standard assumption that lexical specification affects morphological exponence, the ordinary pronoun pattern would be completely surprising if either of the aforementioned positions were adopted. However, given certain recent theoretical assumptions about morphological exponence (Halle and Marantz 1993, Elbourne 2002, Boeckx 2003), this does not apply to all theories. Some theories could happily acknowledge that resumptive pronouns are not ordinary pronouns and yet derive the fact that they just happen to look like ordinary pronouns. Such a move depends on separating phonological realization from lexical specification, at least to some extent. The basic idea would be that, e.g., a gap is inserted into the syntax but it somehow gets realized like a pronoun.

There is a rather simple argument against this view. If a resumptive pronoun is anything other than an ordinary pronoun upon insertion and its phonology goes one way but its semantics goes the other (as on the typical PF / LF model), then it should surface with whatever form but with the semantics of the underlying thing. However, we have seen in section E of chapter 4 that resumptive pronouns have restrictions on their interpretation that correlate precisely with restrictions on the interpretation of ordinary pronouns. If the resumptive pronoun were not underlyingly an ordinary pronoun, this would be unexpected, even on a theory that allows identical exponence. Furthermore, gaps were shown to have crucially different possibilities for interpretation that are not shared by resumptive pronouns. Once again, if a resumptive pronoun were underlyingly a gap, even on a theory that allows proper exponence, this would unexpected. I conclude that resumptive pronouns must be ordinary pronouns, even in theories that have a looser fit between lexical specification and exponence.

Swedish is the language that has provided the most persuasive evidence for an underlying gap view of resumptives (Engdahl 1985). However, there is evidence that this view is untenable even for Swedish and that true Swedish resumptives — those in subject position after material at the left periphery of CP — are just ordinary pronouns rather than underlying gaps. We have seen some of this evidence already in section 7.1.5, where it was shown that, unlike gaps, the true resumptives in Swedish do not give rise to weak crossover effects. Further evidence was given in section 7.1.5.1, where it was shown that, unlike gaps, true resumptives in Swedish block scope reconstruction. Yet further evidence comes from interpretation of Swedish resumptives according to Doron's (1982) *de dicto* / non-specific diagnostic. Doron (1982) shows that Hebrew resumptives cannot support non-specific readings, although gaps can. Sells (1984, 1987) shows that this follows from general properties of ordinary pronouns: they can never refer to a concept antecedent, of which non-specifics are an instance (see section E of chapter 4). This follows for type-theoretic reasons, since concepts are intensional $\langle s, e\rangle$ types but pronouns need type e antecedents (see chapter 5, section 5.4).

Swedish resumptive pronouns are equally incapable of taking a non-specific antecedent, as shown by the following example:

(7.126) Kalle letar efter en bok som han inte vet hur den slutar.
Kalle looks for a book that he not knows how it ends
Kalle is looking for a book that he does not know how (it) ends.

This example can only mean that Kalle is looking for a certain book whose ending is unknown to him. It cannot mean that he will settle for any book so long as its ending is unknown to him.[8] If the resumptive pronoun were underlyingly a gap, then such a reading should be possible, since sentences like the following allow it:

(7.127) Kalle kommer att hitta boken som han letar efter __ .
Kalle comes to find book.DEF that he looks for __
Kalle will find the book that he is looking for.

This sentence allows both the non-specific reading where Kalle is looking for a book with certain properties but he does not have a particular one in mind (e.g., he is looking for a thick one or one with an ending he does not know about) and the specific reading (e.g., he is looking for *A Confederacy of Dunces*).

Similarly, in the *Ålandssvenska* dialect which allows gaps in post-*wh*-phrase subject positions, the minimal pair to (7.126) with a gap allows both non-specific and specific readings:

(7.128) Kalle letar efter en bok som han inte vet hur __ slutar.
Kalle looks for a book that he not knows how __ ends
(Kalle is looking for a book that he does not know how ends.)

[8]Native speakers typically feel quite strongly about this initially, but some waver upon considering the judgement further. Even if it is possible to get the non-specific reading with the pronoun, it is certainly true that the specific reading is highly preferred. This could also be the case with the equivalent English and Hebrew examples investigated by Sells (1984, 1987), as discussed for Hebrew by Erteschik-Shir (1992). Further work needs to be done on specificity and resumption, but the data nevertheless supports the argument I am making, because *any* difference of interpretation between resumptive pronouns and gaps would be surprising if the pronominal form of the resumptive were solely a matter of exponence.

If Swedish resumptives were underlyingly gaps, it would be mysterious why they could not receive an identical range of interpretations to gaps. Even if the resumptive's ordinary pronoun exponence could be made to follow, its interpretation should be that of the underlying object. I conclude that Swedish does not provide evidence for a "spelled out" gap theory of resumption and that such theories are untenable.

Conclusion

I have presented analyses of the resumptive pronoun systems of Swedish and Hebrew based on the resource management theory of resumption. The theory achieves a unification of Swedish resumptives with both Hebrew and Irish resumptives that has previously proven impossible (McCloskey 1990). The unification was accomplished through a strongly lexicalist analysis of Swedish and Hebrew, thus upholding the lexical conjecture of McCloskey (2002). The theory treats resumptive pronouns in all three languages as just ordinary pronouns. There is therefore no theoretical content to the term *resumptive pronoun*, which is not a theoretical construct, but rather just a descriptive label. I showed that evidence from weak crossover, reconstruction, parasitic gaps, and across-the-board extraction — phenomena which had previously been thought to support a theory of Swedish resumptives as underlying gaps — supports the ordinary pronoun theory presented here. I concluded by arguing that evidence from the interpretation of resumptive pronouns supports an ordinary pronoun theory over an underlying gap theory and that Swedish patterns as would be expected according to the interpretation test.

Chapter 8

A processing model

Introduction

In this chapter I present a processing model for resumptive pronouns. I use this term in its pretheoretic sense of a pronoun that terminates an unbounded dependency throughout this chapter. I distinguish, however, between *syntactic resumptives*, which are fully grammaticized resumptive pronouns that are grammatically licensed according to the theory presented in the last three chapters, and *processing-resumptives* that are not licensed by the grammar. I argue that the latter arise through normal constraints on production and can be accommodated under certain circumstances in parsing. The processing model that I present includes both a model of production and a model of parsing.

The chapter begins by considering how resumptive pronouns in English, i.e. *intrusive pronouns* (Sells 1984), are produced in the first place (section 8.1.1). It is argued that they are not licensed by the grammar at all, but arise from incremental production. I then consider parsing of resumptive pronouns in English in section 8.1.2. I identify three major kinds of processing-resumptives: complexity-resumptives, island-resumptives, and ECP-resumptives. Much of the section is devoted to considerations of incremental interpretation, in particular showing how incremental interpretation explains certains patterns of intrusive pronouns. In section 8.1.2.3 I return to the matter of the Swedish resumptive pronouns that I left aside at the beginning of the previous chapter. Finally, in section 8.2 I give an overview of the predictions of the overall theory of resumptive pronouns constituted by the grammatical theory and the processing theory.

8.1 The processing model

The processing model I propose makes the following key assumptions:

(8.1)
1. Production and parsing are incremental.
2. Incremental production and parsing attempt to construct *locally* well-formed structures.
3. Global well-formedness applies only to the output of production and parsing.
4. Production and parsing are constrained by memory limitations based on complexity factors, including distance, structural complexity, and intersecting interpretations of unbounded dependencies. (Kimball 1973, Dickey 1996, Lewis 1996, Gibson 1998).

The processing model developed here is based on general considerations that are supported by the psycholinguistics literature. However, I want to stress two points. First, the model is purely theoretical at this stage and has not been tested in either online or offline experiments. Support for the model currently only comes from attested experimental results and patterns of data that have been discussed in the theoretical literature based on native speaker intuitions. Second, the model has been set up with only resumptive pronouns in mind and it will almost certainly have to be revised if it is generalized to other phenomena.

The main questions that a model of resumptive processing must answer are:

1. How do speakers of languages that have no syntactic resumptives (e.g., English) produce processing-resumptives?
2. Why do speakers of languages without syntactic resumptives produce processing-resumptives?
3. Why is it that although speakers of these languages produce processing-resumptives, they
   (a) reject some sentences with processing-resumptives as ill-formed?
   (b) prefer some sentences with processing-resumptives in certain environments to sentences where the resumptive is absent?
4. How do speakers interpret processing-resumptives?
5. If a language has syntactic resumptives (e.g., Irish, Hebrew, Swedish) how does this aspect of its grammar affect processing-resumptives?

(a) Can a language have both kinds of resumptives and, if so, under what conditions?

(b) Will processing-resumptives take on different characteristics in a language that also has syntactic resumptives?

8.1.1 Production

It is fair to say that the study of production has historically taken a back seat to the study of parsing in psycholinguistics. There has however been a boom in production studies since the publication of the highly influential Levelt (1989). The scope of that book is frankly staggering and I could not hope to present a production model that does it justice. The main lesson that I am going to take from Levelt is that even in a serial production model, it is both possible and necessary to maintain that production is incremental (Levelt 1989, Kempen and Hoenkamp 1987). The simplified production model that I propose based on Levelt (1989) is shown in Figure 8.1.

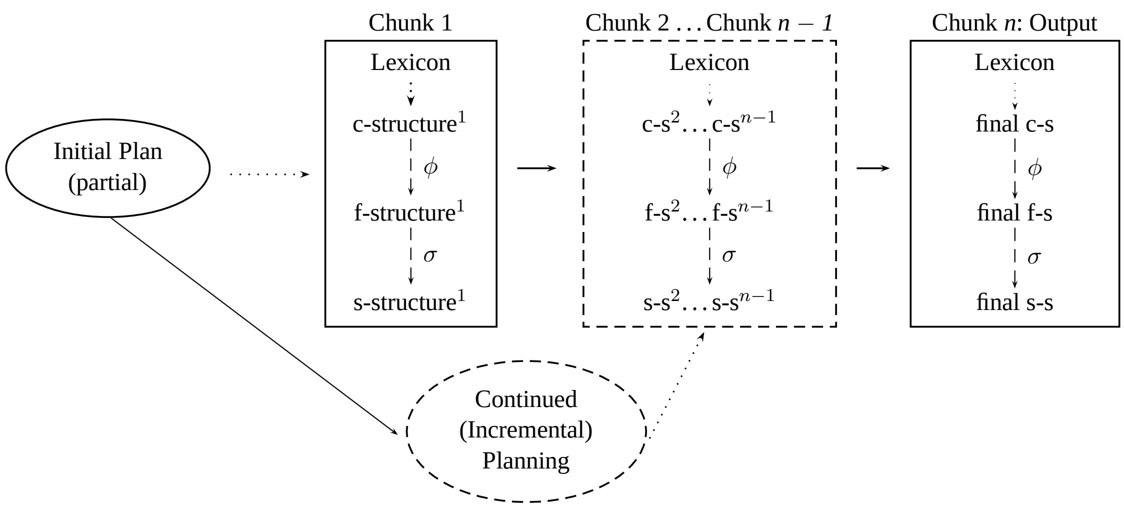


Figure 8.1: The production model

The incrementality of the model is based on the ability of LFG grammars to explain what Bresnan (2001:79–81) refers to as the "fragmentability of language". Bresnan points out that LFG grammars can characterize the internal structural relations of sentence fragments, but that not all fragments are analyzed as informative. She contrasts the fragment . . . *seems to* . . . , as in (8.2), with the fragment . . . *to by for* . . . , as in (8.3).

(8.2) [Speaker A:] And he agrees?
[Speaker B:] — seems to.

(8.3) The one he should be spoken to by, for God's sake, is his mother.

Bresnan shows that the first fragment constructs an informative partial c-structure and f-structure, which form subparts of the c-structure and f-structure for a full sentence like *He seems to agree*, whereas the second fragment constructs only three unrelated structures. Bresnan (2001:81) notes that the ability to construct informative fragments stems from the fact that the main predicator or head of a c-structure / f-structure (e.g., *seems* in this case) contains a lot of information about the larger structures in which it can be embedded.

Creswell (2002) considers the problems raised by the production of English sentences containing resumptive pronouns in islands from a Tree-Adjoining Grammar perspective. She discusses a proposal by Kroch (1981) that assumes an incremental model of speech production which generates a filler (e.g., *wh*-phrase) before planning of the sentence has been completed. As production proceeds, the speaker ends up in a situation where the intended base position of the filler-gap dependency is in an island or would violate the *that*-trace filter / Empty Category Principle (ECP). An NP is inserted to avoid the ECP or island violation.[1] Kroch (1981) does not specifically postulate that the inserted element is a resumptive, since he notes that insertion of an epithet is also possible:

(8.4) There was one prisoner that we didn't understand why <u>the guy</u> was even in jail.
(Kroch 1981:129, (13a))

The crux of Kroch's proposal is that some NP, typically a pronoun, is inserted to avoid a grammatical violation due to poor planning. Creswell (2002) does not adopt Kroch's proposal, due to theoretical problems it faces from recent developments in TAG. I will come back to Creswell's specific proposals momentarily, but I first want to discuss some recent psycholinguistic evidence which is relevant to construction of the production model and which calls into question the basis of Kroch's specific proposal.

Swets and Ferreira (2003) tested the production of resumptive pronouns in *wh*-islands by native speakers of English. They used a self-paced experimental design in which subjects were required to complete (in full sentences) partial descriptions that were presented with a picture array. The target sentences of interest were sentences like the following:

(8.5) This is a donkey that I don't know where it lives

Two control targets were also elicited. The first kind controlled for surface length:

[1] Throughout this chapter I use the term NP in its older usage as a full nominal, rather than as the complement to a functional D^0 head.

(8.6) This is a donkey that doesn't know where it lives.

The second kind controlled for length of the *wh*-dependency without an island violation:

(8.7) This is a donkey that I didn't say lives in Brazil.

They ran a preliminary grammaticality judgement experiment (both auditory and visual presentation) that showed that subjects rated the resumptive sentences as worse than the structural length controls. This is verified by the independent experimental findings of McDaniel and Cowart (1999) and Alexopoulou and Keller (2002). The resumptive sentences were also rated worse than the dependency length controls, but the latter were also rated as quite bad in comparison to the structural length controls. The authors did not expect this, but it actually also comports with the findings of McDaniel and Cowart (1999) and Alexopoulou and Keller (2002).

Swets and Ferreira (2003) then carried out two versions of the experiment of interest. In the first experiment, subjects were under no pressure to begin speaking quickly. In the second, subjects were under pressure to begin speaking quickly due to a deadline procedure (Ferreira and Swets 2002). If the resumptive pronouns in *wh*-islands were a result of lack of planning, as in Kroch's (1981) theory, then the expectation is that speakers would plan the utterance in such a way that they could avoid both the island violation and the resumptive pronoun. For example, a subject could construct the following sentence instead of (8.5):

(8.8) This is a donkey and I don't know where it lives.

Subjects in fact overwhelmingly produced island violations like (8.5) in both experiments. In the no-deadline experiment, where subjects could take as much time as they needed to plan their utterance before speaking and typically took over 2 seconds to begin, 47.3% of the targets produced for the *wh*-island condition consisted of an island containing a resumptive, as in (8.5). In other words, subjects did not use the extra time in the no-deadline experiment to plan an utterance that avoids a resumptive pronoun. In fact, the proportion of island-resumptive sentences went *down* to 39.4% in the deadline experiment. The biggest increase in the deadline experiment was in alternative well-formed sentences that were not targets, like *I don't know where this donkey lives*. Swets and Ferreira (2003) conclude that despite rating the island-resumptive sentences as ungrammatical, speakers plan to produce them. They sketch a TAG solution for generating the island-resumptive sentences and speculate that the reason that the structures are rejected despite being produced is that "the production and comprehension systems may set different parameters for accepting these structures." The upshot of the proposal is that the elementary trees required for producing the island-resumptives are part of the grammar and that the grammar therefore treats island-resumptive sentences as well-formed (in terms of production). They must countenance the fact that grammatical forms are for some reason rejected in comprehension, but this is known to be true in any case (e.g., the famous case of centre-embedding; Chomsky and Miller 1963, Bever 1970).

Creswell (2002) arrives at the same conclusion — that Kroch's (1981) proposal must be rejected and that the grammar produces the island-resumptive structures — but for theoretical reasons. Creswell observes that the TAG theory of Frank (2002) does not permit generation of the trees necessary for island violations. She notes that recent TAG-based models of incremental production (Ferreira 2000, Frank and Badecker 2001) do not permit Kroch's (1981) solution for the island-resumptive structures:

> In this model of production where we assume that a speaker only has grammatical resources with which to work, we cannot use Kroch's (1981) explanation of the appearance of resumptive pronouns in island-violation contexts. The resources needed to produce the island-violating structures are not available in the grammar that licenses the set of tree building blocks. On the face of it then, it seems that the existence of resumptive pronouns in island violating contexts would prove devastating for this model of sentence production. Based on the assumptions that 1) the processing system has only grammatically-licensed trees with which to creat larger structures and 2) the structures needed to extract from island-violation contexts are not grammatically-licensed, speakers could not be remedying violations that should not even be created given their underlying grammars. (Creswell 2002:103)

Creswell (2002) solves the quandary by arguing that in fact the grammars of English speakers must independently have the resources required to form island-resumptive structures. This is also the conclusion of Swets and Ferreira (2003), as discussed above.

The basis of Creswell's argument is the observation that resumptive pronouns in English can be found in relative clauses in *non-island* structures (Prince 1990):

(8.9) You get a rack that the bike will sit on <u>it</u>.
(Prince 1990:(15d))

(8.10) I have a friend who <u>she</u> does all the platters.
(Prince 1990:(4c))

These and other examples that Prince (1990) presents are attested examples produced by native speakers. Prince (1990) analyzes this kind of resumptive as a discourse pronoun as opposed to a bound variable (bound pronoun or gap). This is essentially the solution of Sells (1984) for English resumptive pronouns (i.e., intrusive pronouns). Erteschik-Shir (1992) also develops a very similar theory for Hebrew processing-resumptives (although aspects of her theory apply to syntactic resumptives as well). Further evidence for the discourse pronoun status of the resumptives in (8.9) and (8.10) comes from the fact that they can be replaced by non-coreferential pronouns or even full NPs that serve similar discourse functions (Prince 1990:(34a–d)):

(8.11) I had a handout and notes from her talk that <u>that</u> was lost too.

(8.12) He's got this lifelong friend who he takes money from the parish to give to <u>this lifelong friend</u>.

(8.13) I have a manager, Joe Scandolo, who <u>we</u>'ve been together over twenty years.

(8.14) You assigned me to a paper which I don't know anything about <u>the subject</u>.

In the first example, a singular deictic pronoun is used which does not even properly agree in number with its plural discourse antecedent. In the second example, the discourse antecedent itself is repeated. In the third, the resumptive takes the generally available discourse marker for the speaker (in construction with the marker for "Joe Scandolo" to form the plural antecedent) as its discourse antecedent. In the final example, the form that is used is a relational noun that takes as its implicit argument the antecedent *a paper*. As a native speaker of English, I find all of the examples in (8.9) to (8.14), especially these last four, not just ungrammatical but *grossly* ungrammatical. Yet I produce similar examples all the time and hear other native speakers do so, too.

The solution I propose incorporates elements of the analyses given by Kroch (1981), Creswell (2002), and Swets and Ferreira (2003) into the production model given above, but it is ultimately significantly different from these previous proposals. I will first present the proposal and show how it explains the production of ungrammatical forms. Afterwards I will relate the proposal to the other production proposals and isolate the points of divergence and convergence. The major distinction to bear in mind, though, is that my proposal does *not* treat the resumptive pronoun outputs of production in either the island examples or the discourse examples as grammatical.

Based on a consideration of various experimental results, Levelt (1989:258) notes that

> Taken together, these findings are supportive of the notion that the rhythm of grammatical encoding follows the semantic joints of a message — its function / argument structure — rather than syntactic joints. It is the partitioning of the message to be

> expressed that a speaker is attending to, and this (co-)determines the rhythm of grammatical encoding.

The function/argument structure that Levelt refers to above, which encodes planning units at the *message* level, is a rough thematic structure similar to the Conceptual Semantics of Jackendoff (1990, 1997, among others). Here is the crux of my proposal, which is compatible with, but which is an oversimplification of, Levelt's (1989) theory. When a speaker begins initial planning s/he puts together a message that identifies the event or state, its basic function, the function's arguments and their rough thematic relation to each other and then identifies what sort of utterance s/he wants to make with respect to these elements. S/he may declare something about them, ask something about them, etc. This rough thematic structure unfolds through the incremental construction of fragments of grammatical structure that are added to the grammatical structure with which the speaker initiates the implementation of the plan. The incremental grammatical production proceeds on the basis of choosing the next chunk and is based on the function / argument structure of heads, which is lexically encoded and will in general bear a close relationship to the function / argument structure of the planning unit. Each successive chunk of grammatical representation must be *locally* grammatical in order to be generated. This leads to incremental generation of a grammatical structure that satisfies local grammaticality requirements at each incremental step but whose end result does not necessarily satisfy global grammaticality.

The interaction of the incremental production model with the theory of unbounded dependencies is crucial to explaining processing-resumptive data we have been looking at. Throughout this work I have been assuming the LFG theory of unbounded dependencies initially developed by Kaplan and Zaenen (1989), as reviewed in chapter 2, section 2.1.6. A couple of characteristics of this theory will be relevant in this chapter, but the one that is immediately relevant is that the unbounded dependency is launched at the *top* of the dependency and searches downwards for a gap (or resumptive pronoun in syntactically-licensed binder-resumptive dependencies). This is captured in terms of an "outside-in" functional uncertainty of the form ($\uparrow$ ... GF). The elide represents further possible path specifications. We have seen in previous chapters that island constraints and other constraints on extraction are stated by modifying the path or by stating off-path constraints on the path (e.g.,$\neg$ ($\leftarrow$ SUBJ) would be used to indicate that the path cannot reach inside a SUBJECT). Now, LFG is a declarative, monostratal theory of grammar. In terms of statements of grammatical well-formedness there is no real directionality in the theory at all, merely declarative constraint statements. As such, there is no sense in which *in the grammar* there is a downward search for a gap. However, production and parsing are irreducibly directional and each must start with the material that is to be produced or parsed first. How soon production and parsing start is an empirical matter and not an uncontroversial one at that. What is uncontroversial is that production and parsing must go in the direction of the speech stream, not in the opposite direction. Although LFG as a declarative theory does not have a notion of procedural grammatical generation, it is clear that production and parsing, if they are to be incremental, are procedural and involve notions of timing. Indeed, the procedurality of production and parsing and the question of timing of grammatical operations are central to psycholinguistics (for recent overviews, see Frazier 1999, Frazier and Clifton 1996).

Given these facts about production and parsing and given the top-down theory of unbounded dependencies, there is an important consequence for the construction of locally well-formed grammatical representations. When the chunk that contains the unbounded dependency is under construction for production, the top of the unbounded dependency contributes the outside-in equation that begins the search for an empty grammatical function. This GF will be functionally equated with the filler, thus integrating filler and gap. But notice that what I am calling a gap does not leave a marker that actually identifies the presence of a gap in any of the local structures. The gap is just nothing. This has a crucial implication for incremental construction of fragments. The outside-in function contributed by the filler is unbounded and defines a path through f-structure material that is still being incrementally constructed. If the grammar cannot integrate the filler into the local f-structure being constructed because all grammatical functions are locally filled, it does not crash, because the integration site could be in the next chunk of f-structure that is yet to be constructed or in the chunk after that.[2] The one case where this is not true is when there is an island, because then the functional uncertainty terminates unsuccessfully. I will return to this shortly. The fundamental point is this: the unbounded nature of the functional uncertainty equation, the fact that it is initiated at the top of the unbounded dependency, and the fact that the gap is not marked in the local f-structure together mean that it is reasonable to assume in a model of incremental production and parsing that integration of the filler by the grammar takes place after the local structure under construction has been built.

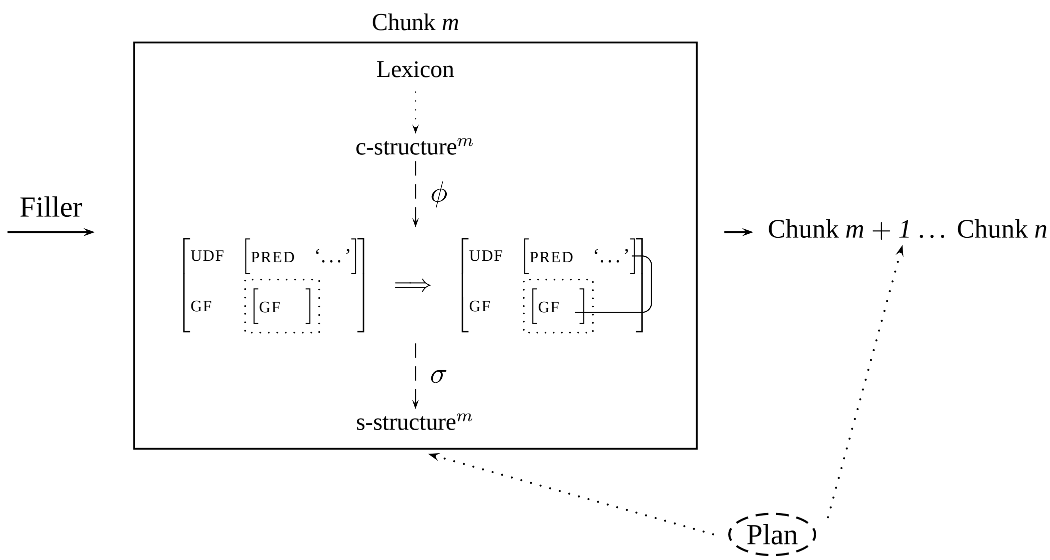
In constructing a local structure, the production system can do one of two things with each GF. First, it can leave the GF empty, to be licensed by integration of a filler. A filler must be functionally equated with this GF before moving on to the next chunk, or else the local structure would not be well-formed. Recall that the processing model assumes that incremental production and parsing construct locally well-formed structures. The second thing the production system can do is to posit

[2]Notice that I am talking about the *grammar* here. This does not impinge on the Active Filler Strategy (Frazier 1987, Frazier and Flores d'Arcais 1989), which is a property of the parser that will be relevant in section 8.1.2.

lexical material, such as a pronoun or NP, that will add its information to the GF and which is consistent with the other specifications of the local structure. For example, in English, if the GF in question is an OBJ, an accusative pronoun must be inserted, since pronouns in OBJ must have accusative case. Whatever lexical material is chosen to fulfill the local requirements for the GF must be consistent with the current plan. If this option is chosen, the filler is not integrated but the local structure is well-formed. The filler pushes on down its path looking for a gap.

The two situations are sketched here:

(8.15)



(8.16)

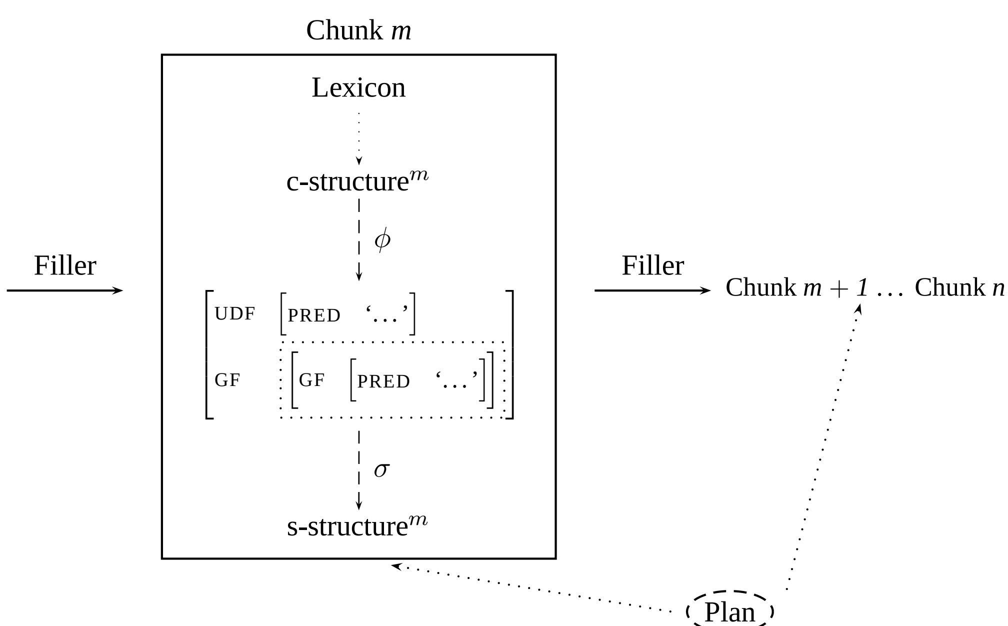


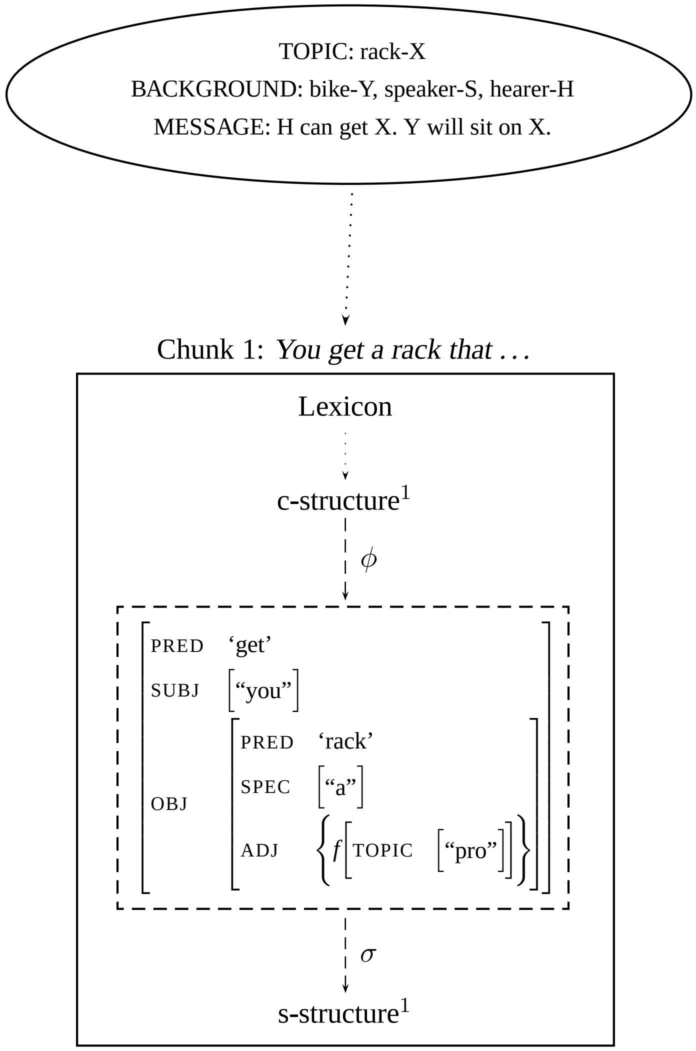
Diagram (8.15) shows what happens when the filler is locally integrated. Diagram (8.16) shows what happens if the filler is passed through the local structure rather than being integrated. The second pattern is the crucial one for explaining how ungrammatical resumptives / epithets / deictics are generated instead of a gap.

Let us see how this theory accounts for the Prince (1990) example in (8.9). I have picked this example because it is syntactically quite simple. On the one hand, that makes it suitable for illustrative purposes, but more importantly it underscores the fact that the account of production I am presenting does not depend on complexity to explain the Prince and Kroch examples. The issue of complexity will be relevant in section 8.1.2. Example (8.9) is repeated here:

(8.17) You get a rack that the bike will sit on it.

The production system gets started as in (8.18). The local structure under construction is indicated by the dashed box. I have represented the planned message rather informally. I am most definitely not making the claim that entire utterances are planned in advance. That would no longer be a Levelt-style model. But, the findings of Swets and Ferreira (2003) indicate that the production system plans at least far enough in advance to include a message of this length and complexity in the initial plan.

(8.18)



✓**Locally well-formed**

The first fragment that is constructed is made up of the head *get* and its arguments. I have assumed that the relative clause construction begins at this stage, too. This seems reasonable given that the relative pronoun is prosodically grouped with the relative head (unlike a non-restrictive relative). This chunk is locally well-formed, since all of *get*'s arguments are present and accounted for.

At this point an unbounded dependency has been launched due to the relative pronoun. This is represented by the TOPIC 'pro' in the innermost f-structure *f* in (8.18). The unbounded dependency functional uncertainty that is initiated by the relative pronoun is carried over to construction of the next chunk. The details of the functional uncertainty equation need not concern us at this point (for details, see chapter 2, section 2.1.6; for a fuller discussion, see Dalrymple 2001:404), but will become relevant when we look at islands. All that needs to be represented at this point is how much of the path has been encountered. In this case, we are still in the functional-structure where the dependency was launched, (arbitrarily) labelled *f*. The up arrow meta-variable in the outside-in functional uncertainty is set to *f* and the path encountered so far is therefore (*f* ... GF), where I again use the elide to indicate material yet to be discovered.

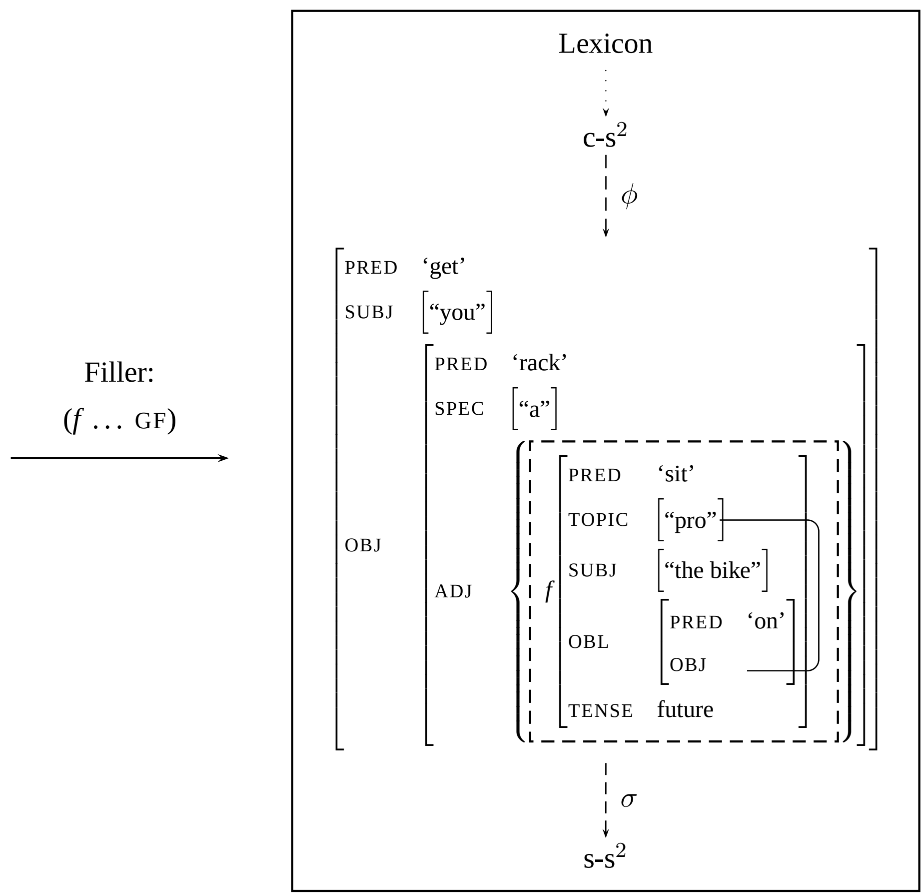
During construction of the next chunk, the production system can go for either of the options outlined in (8.15) or (8.16). If the first option is taken, the filler is integrated into the local structure being constructed and the relative clause is constructed with a gap:

(8.19) You get a rack that the bike will sit on.

The construction of the local structure is shown here:

(8.20)

Chunk 2: ... *the bike will sit on*



✓**Locally well-formed**

The filler is integrated into the local structure, satisfying both the demands of the filler and the local demand that the OBJ must be integrated into the f-structure. The overall construction of the sentence is illustrated here:

(8.21) $\boxed{\textit{You get a rack that} \ldots} \xrightarrow{\text{Filler}} \boxed{\ldots \textit{ the bike will sit on}}$

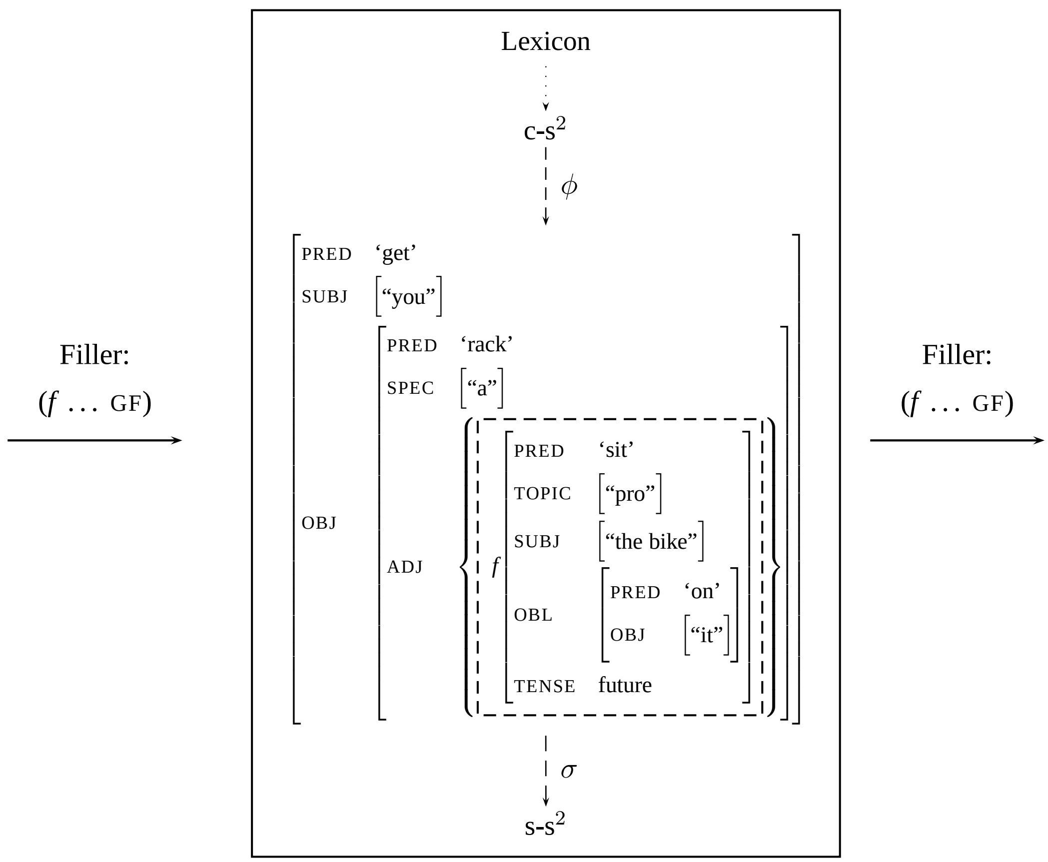
✓Locally well-formed **✓Locally well-formed**

✓Globally well-formed

Each of the local structures here is well-formed and consistent with the plan and the overall result is also well-formed.

If in constructing the local material in Chunk 2 the production system exercises the option, sketched in (8.16), of inserting lexical material that is consistent with the plan, rather than leaving the GF empty for integration with the filler, then the Prince example (8.17) is produced instead. The local structure under construction is again shown in the dashed box. Notice that the pronoun *it* has been inserted as the prepositional object.

(8.22) Chunk 2: ... *the bike will sit on it*



✓Locally well-formed

After construction of the local structure shown in the dashed box, the production system passes the filler on and attempts to continue. Having passed up the opportunity to integrate the filler, there is no longer anywhere to put it. There is no remaining structure to be built and insertion of the filler in the structure built so far is impossible. The situation is shown here:

(8.23) $\boxed{\textit{You get a rack that} \ldots} \xrightarrow{\text{Filler}} \boxed{\ldots \textit{ the bike will sit on it}} \xrightarrow{\text{Filler}}$

✓**Locally well-formed** ✓**Locally well-formed**

*** Globally ill-formed**

The grammar ultimately fails to sanction the structure that has been attempted. Crucially though, due to incremental production, the ungrammatical sentence has been *uttered*. At each stage of producing (8.17), incremental production results in local grammaticality. The result of production is however globally ungrammatical and is perceived as such by native speakers. The perception of ungrammaticality does not arise through production, but rather through parsing. What the parser does with the result of productions like (8.17) is the topic of section 8.1.2.

The account of production that I have been giving here requires the grammar to incrementally deliver locally well-formed structures. The incremental construction of grammatical structure starts from an initial plan and then continues in lockstep with incremental planning. One might wonder whether the construction of locally well-formed grammatical structures of the kind allowed by (8.16) — which is what leads to the construction of sentences like *You get a rack that the bike will sit on it* — is constrained at all. In a sense the question is whether examples like this sentence and the others above are speech errors. I do not think that they should be considered as speech errors. First, they are constrained at the level of local grammatical structure by the kinds of local structure that can be well-formed. For example, in constructing the sentence *You get a rack that the bike will sit on it*, insertion of a pronoun as the object of *on* is locally licensed by the rule that constructs PPs, the lexical requirements of *on* which require an OBJ, the fact that the OBJ of *on* must be realized by an NP, etc. If local grammatical well-formedness is a criterion, then speakers could not instead produce things like *You get a rack that the bike will sit it*. To the extent that this kind of form is produced at all, it really is a speech error. But that must be distinguished from locally well-formed structures that arise from purely incremental production. Second, the kinds of things that can be inserted are constrained by the plan itself. If the speaker wants to say something about a rack, then s/he will select a lexical item that is consistent with that plan. In English, the kinds of lexical items that are consistent with the plan are pronouns (*it*), deictics (*that*), names and definite descriptions that refer to the requisite element (*the bike*), and epithets (*the damn thing*). This is part of what prevents the production system from producing examples like the following, which Creswell (2002:106, (11–12)) worries about:

(8.24) the police officer who John prefers spinach

(8.25) the smell that my mom is baking bread

Firstly, bare nouns like *spinach* do not have the correct semantic properties to be used referentially. A plan to say something about a police officer would not lead to insertion of *spinach*. But, Creswell (2002:106) also notes that sentences like the second one are grammatical in Japanese and Korean. I agree with her position that the pragmatic discourse conditions that determine the discourse relation between the relative head and the material in the relative clause must be subject to some cross-linguistic variation. That is a fact about *grammars* though, not the production system.

The case remaining to be dealt with is island violations like the Swets and Ferreira (2003) donkey example, repeated here, or the attested example in (8.27).

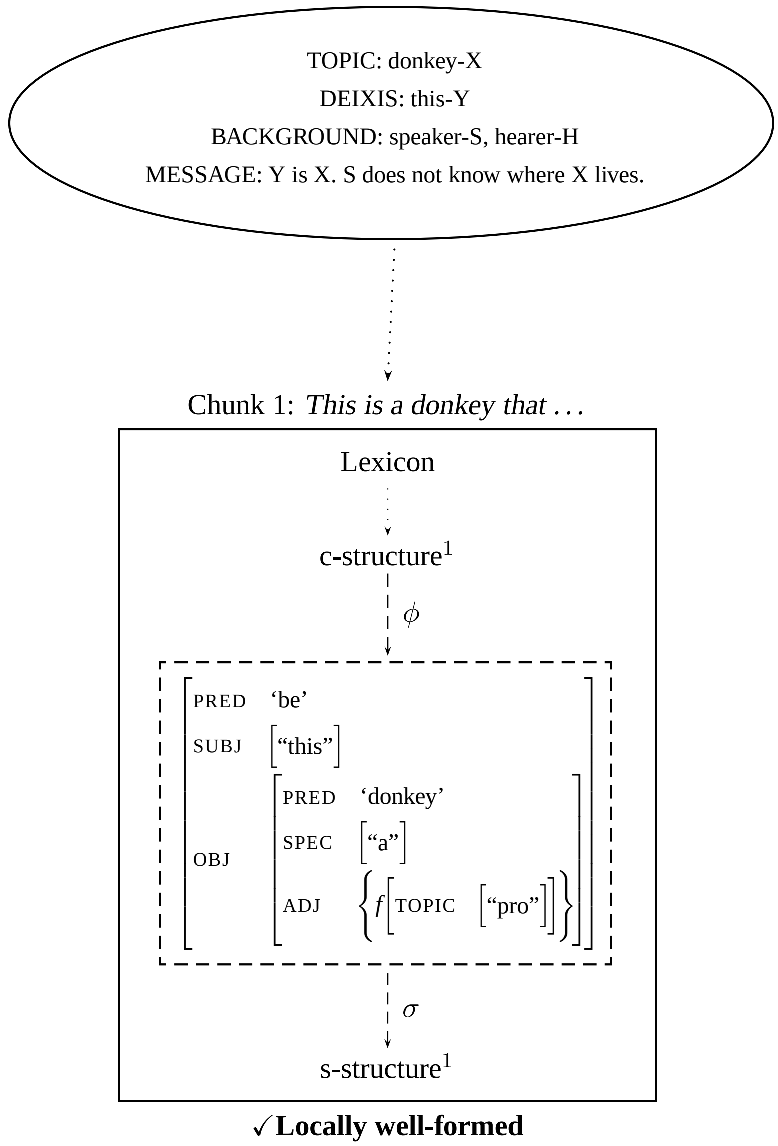
(8.26) This is a donkey that I don't know where it lives.
(Swets and Ferreira 2003)

(8.27) You have the top 20% that are just doing incredible service, and then you have the group in the middle that a high percentage of those are giving you a good day's work ...
(Creswell 2002:102, (4d); (http://www.ssa.gov/history/WEIKEL.html))

The explanation of these cases basically reduces to the cases we have already looked at plus the fact that the island prevents integration of the filler.

I will illustrate the analysis of the island cases with the simpler donkey example. Production starts in the following fashion:

(8.28)



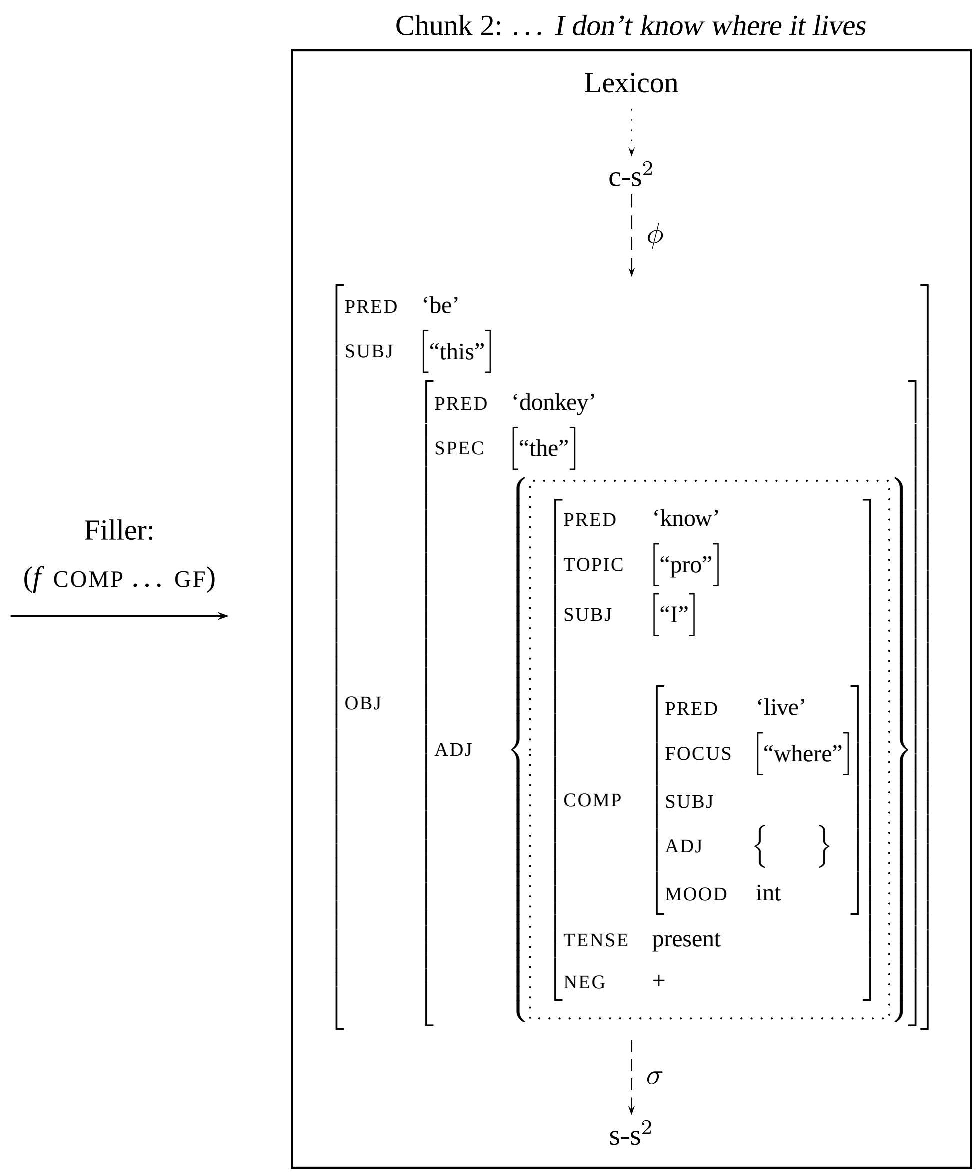
An unbounded dependency is once again launched by the relative pronoun. Island constraints in versions of LFG that use outside-in functional uncertainty for filler-gap dependencies are stated through limiting the path — either by limiting the grammatical functions that the path may pass through or by limiting the environments of these grammatical functions through off-path constraints (see chapter 2, section 2.1.6; for further details on this kind of functional uncertainty, see Dalrymple 2001:389ff.). Let us assume that the *wh*-island constraint is stated as an off-path equation to the effect that the functional uncertainty cannot pass through a COMP that contains a UDF. A simplified version of the functional uncertainty that the TOPIC initiates is shown here:

(8.29) $(\uparrow \text{TOPIC}) = (\begin{array}{c}\uparrow \text{COMP}^{*} \\ \neg(\rightarrow \text{UDF})\end{array} \text{GF})$

The equation states that the grammatical function to be equated with the TOPIC can be found by going through zero or more COMP f-structures, but none of the COMP f-structures may have a unbounded dependency function (UDF) of their own. This is a huge oversimplification, but it captures the case at hand. After construction of the first chunk, the TOPIC has not been integrated and the beginning of the path has already been instantiated to one COMP.

I assume for simplicity that the next chunk is the remainder of the sentence. Nothing hinges on this. In producing the next chunk, the production system constructs the following partial local structure (indicated by the dotted box):

(8.30)



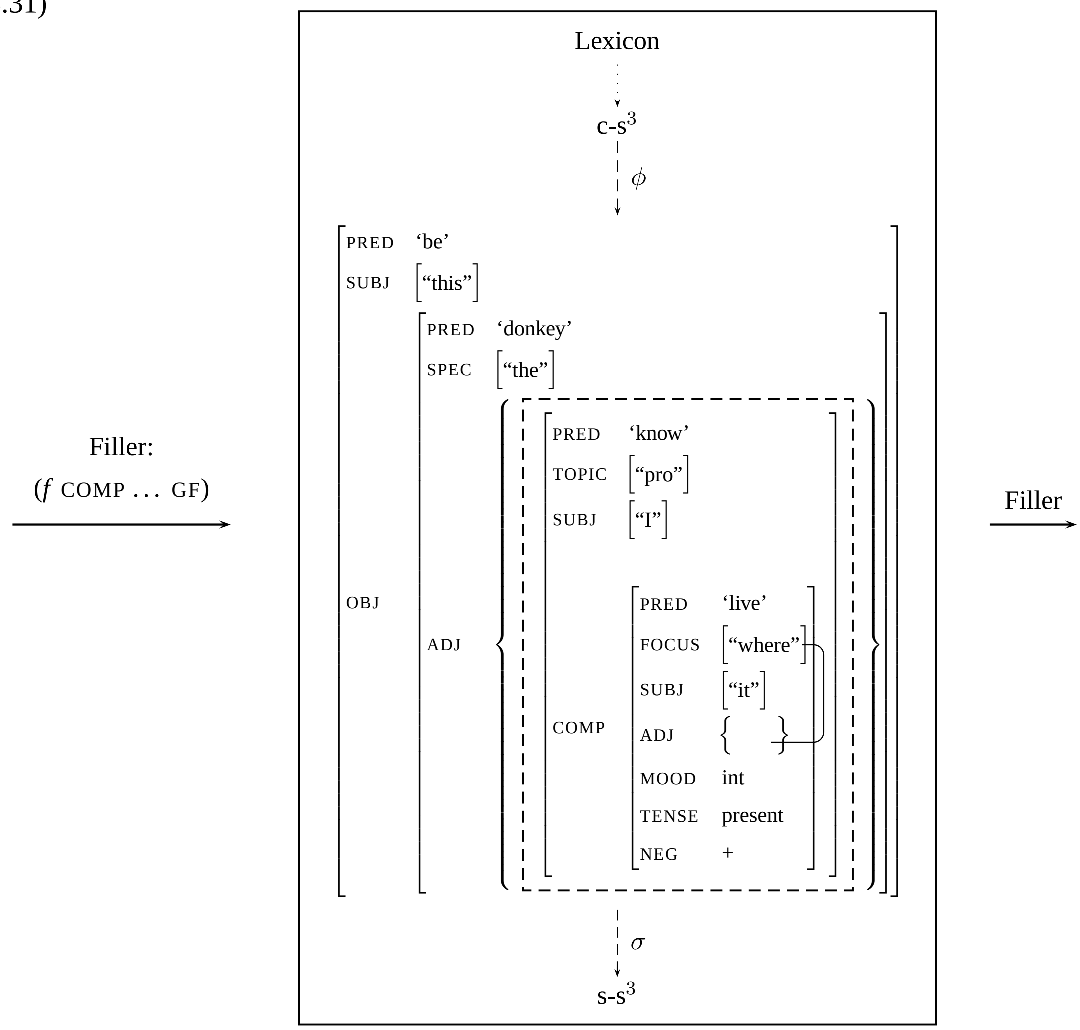
✓**Locally well-formed**

At this point things get a little more complex. The production system still has an unintegrated unbounded dependency and now it has encountered a new one. The option of positing a gap for the most deeply embedded SUBJ, as in (8.15) is not possible. The presence of the embedded FOCUS (a UDF) means that there is no way to locally satisfy the TOPIC's functional uncertainty equation. In fact there is no way to satisfy the equation period: as soon as a COMP containing a UDF is encountered, satisfaction is impossible. The result is that the only way to construct a locally well-formed f-structure is to exercise the option in (8.16) of inserting some lexical material that is consistent with the plan (i.e., that refers to the donkey). The filler does not pass through the chunk, though, because there is now way for it to do so and satisfy its equation. The new unbounded dependency also needs to be integrated and this can done using option (8.15).

The final local structure is shown here in the dashed box:

(8.31)

Chunk 3: … *I don't know where it lives*



✓**Locally well-formed**

Since the local structure is an island, there is no way for the filler to be integrated. The situation is sketched here:

(8.32) $\boxed{\textit{This is a donkey that \ldots}} \xrightarrow{\text{Filler}} \boxed{\textit{\ldots I don't know where it lives}} \xrightarrow{\text{Filler}}$

✓**Locally well-formed** ✓**Locally well-formed**

*** Globally ill-formed**

Once again, the grammar ultimately fails to sanction the structure that has been attempted. However, the sentence is uttered due to incremental production.

8.1.1.1 Summary and discussion

I have shown how a production model that is based on incremental planning and production can account for the production of both resumptives in non-islands, as in (8.33), and resumptives in islands, as in (8.34).

(8.33) You get a rack that the bike will sit on it.

(8.34) This is a donkey that I don't know where it lives.

A number of features of LFG were used in the production model. The ability of the theory to construct locally well-formed fragments (Bresnan 2001) was the basis for incremental construction of structure. This ability of the grammatical theory to construct fragments is also fundamental to the Tree-Adjoining Grammar analyses offered by Creswell (2002) and Swets and Ferreira (2003). The filler-driven theory of unbounded-dependencies provided the basis for the assumption about the timing of production, according to which local structures are constructed before filler-integration is attempted.

At the beginning of section 8.1 I posed a number of questions. Some of them can now be answered.

1. How do speakers of languages that have no syntactic resumptives produce processing-resumptives?

Processing-resumptives are produced through incremental construction of locally well-formed structure.

2. Why do speakers of languages without syntactic resumptives produce processing-resumptives?

They are produced in an attempt to construct locally well-formed structure that is consistent with the message plan.

3. Why is it that although speakers of these languages produce processing-resumptives, they

    (a) reject some sentences with processing-resumptives as ill-formed?

The rejected sentences are rejected because although they result from incremental production of locally well-formed structures, they are globally ill-formed according to the grammar. This will be discussed further in section 8.1.2.

The resulting account is broadly similar to that of Kroch (1981), in the sense that it denies a formal grammatical treatment of the phenomenon and instead localizes in the production system the phenomenon of producing resumptive pronouns that are not grammatically sanctioned by the language. A key difference between this account and Kroch's is that his account depended on lack of planning while this account does not. The findings of Swets and Ferreira (2003) indicate that these resumptives are in fact planned. The theory that I have presented respects this new finding and explains how the resumptives could be produced in accordance with a plan, even though they are grammatically ill-formed.

This sets the theory apart from those of Creswell (2002) and Swets and Ferreira (2003). They capture these data by letting them be grammatically well-formed. This fails to explain native speakers' judgements that the resulting forms are not actually grammatical. While it is true that there are grammatical forms that are nevertheless perceived to be ungrammatical, such as centre-embeddings, the sort of explanation that is offered for those cases cannot be readily extended to these cases. The basic explanation for the perceived ungrammaticality of centre-embeddings is that it arises because they are hard to parse (see Gibson 1998 for a recent overview). There is no metric of complexity that would account for the perceived ungrammaticality of a simple Prince example like (8.33). A proponent of the view that such examples are grammatical might be tempted to claim that they are perceived as ungrammatical precisely because the corresponding gap sentence is grammatical. This would constitute a transderivational explanation of a sort that has been proposed for syntactic resumptives (Shlonsky 1992, Aoun et al. 2001). There are two problems with this view, even setting transderivationality aside. The first is that if resumptive pronouns in English are grammatically generated and if they are avoided due to corresponding sentences with gaps, then there is no explanation for the fact that languages with demonstrably grammaticized resumptive pronouns allow their resumptives to occur where gaps occur (in some but not all environments) without loss of perceived grammaticality. Second, the island examples without the resumptive pronoun are not perceived as grammatical and neither are the sentences with the resumptive pronoun, according to the findings of Swets and Ferreira (2003) and other recent findings (McDaniel and Cowart 1999, Alexopoulou and Keller 2002, 2003).

Creswell (2002) notes that the view that English resumptives are generated grammatically rather than through production is a result of the current understanding of islands in Tree-Adjoining Grammar (Frank 2002). Naturally, the theory will undergo revisions that might remove this problem. In the meantime, though, it is useful to localize the point of divergence between LFG and TAG and other relevantly similar theories that allows the account developed here to avoid the problem. The key difference between the model of TAG that Creswell (2002) has in mind and the model of LFG that I have been assuming is how the theories handle islands. In the TAG theory, islands are defined *internally* to the island (Frank 2002:199ff.), as in the phase approach in the Minimalist Program (Chomsky 2000, 2001) and the subjacency approach of Principles and Parameters Theory (Chomsky 1986). There is something about the local structure that constitutes the island that is wrong. This can mean either that the relevant sort of structure cannot be constructed in the first place, as in TAG, or that the relevant sort of structure is constructed but there is no way for the filler to exit it, due to a phase boundary (MP) or a bounding node (P&P). In the theory I have presented, following Kaplan and Zaenen (1989) and Dalrymple (2001), islands are defined *externally* to the island, through constraints on outside-in functional uncertainty. This means that the local structure that in fact constitutes the island is not necessarily ill-formed locally. The difference in how islands are constructed and defined is deeply related to whether the grammar treats filler-gap dependencies as gap-driven or filler-driven. The findings in this section could therefore likely be extended to other theories that have a filler-driven approach to filler-gap dependencies, such as Categorial Grammar (Steedman 1987, Morrill 1994), or to approaches that have a mixed system, such as Head-Driven Phrase Structure Grammar (Pollard and Sag 1994, Bouma et al. 2001).

8.1.2 Parsing

The parsing model is shown in Figure 8.2. Recall that the general assumptions of the processing model that apply to both production and parsing are the following:

(8.35)
1. Production and parsing are incremental.
2. Incremental production and parsing attempts to construct *locally* well-formed structures.
3. Global well-formedness applies only to the output of production and parsing.

4. Production and parsing are constrained by memory limitations based on complexity factors, including distance, structural complexity, and intersecting interpretations of unbounded dependencies. (Kimball 1973, Dickey 1996, Lewis 1996, Gibson 1998).

With respect to parsing in particular, the model also makes the following independently-motivated assumptions:

(8.36)
1. Parsing of unbounded dependencies is *filler-driven*.
   (Active Filler Strategy (AFS); Frazier 1987, Frazier and Flores d'Arcais 1989)
2. The result of incremental parsing is incrementally interpreted.
   (Frazier 1999)
3. Unsuccessful parsing results in reanalysis.

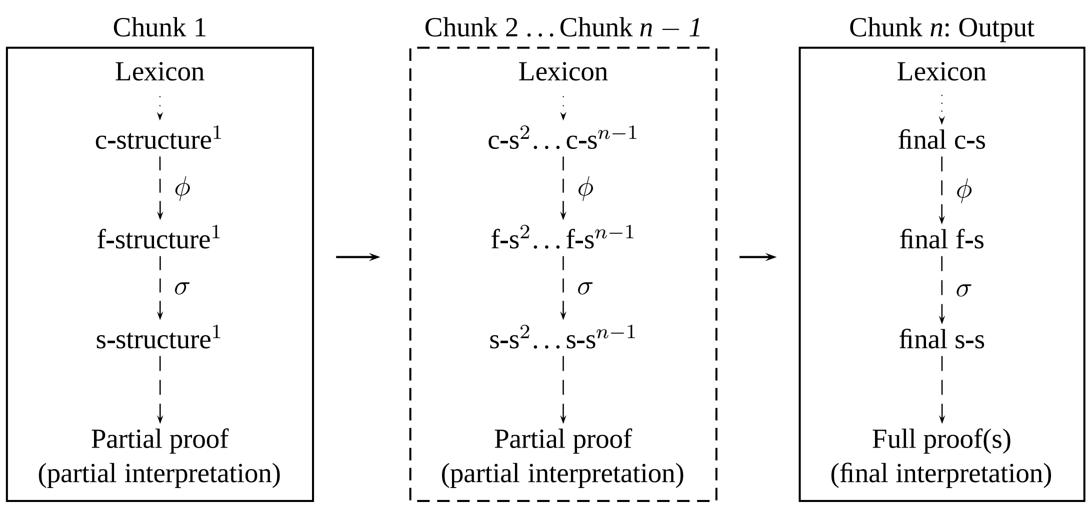


Figure 8.2: The parsing model

I started section 8.1 by posing a number of questions. Some of these questions were answered in the previous section. The questions that remain, including one whose answer was touched on already, are the following:

(8.37)
1. Why is it that although speakers of language that have no syntactic resumptives produce processing-resumptives, they
   (a) reject sentences with processing-resumptives as ill-formed?

   (b) prefer sentences with processing-resumptives in certain environments to sentences where the resumptive is absent?

2. How is it that speakers interpret processing-resumptives?
3. If a language has syntactic resumptives (e.g., Irish, Hebrew, Swedish) how does this aspect of its grammar affect processing-resumptives?
   (a) Can a language have both kinds of resumptive and if so, under what conditions?
   (b) Will processing-resumptives take on different characteristics in a language that also has syntactic resumptives?

There are three principal factors that have been identified in the theoretical literature as ameliorating English processing-resumptives. I list them here with representative examples. In each case the first example is meant to be better than the second (represented by $>$). A variety of grammaticality judgements are found for these sorts of examples in the literature, but some of the key judgements have not been corroborated by recent experimental work (McDaniel and Cowart 1999, Alexopoulou and Keller 2002, 2003). I do not want to prejudice things in advance of the more detailed discussion below by giving the absolute judgements found in the literature.

(8.38) **Distance** (Erteschik-Shir 1992)

a. This is the girl that Peter said that John thinks that yesterday his mother had given some cakes to her.

$>$

b. This is the girl that John likes her.

(Erteschik-Shir 1992:89, (4), (1))

(8.39) **Island-avoidance** (Ross 1967, Sells 1984)

a. *Weak island*

i. I'd like to meet the linguist that Mary couldn't remember if she had seen him before.

$>$

ii. I'd like to meet the linguist that Mary couldn't remember if she had seen before.

(Sells 1984:11, (9a))

a. *Strong island*

i. I'd like to meet the linguist that Peter knows a psychologist that works with her.

$>$

ii. I'd like to meet the linguist that Peter knows a psychologist that works with.

(8.40) **ECP-avoidance** (Ross 1967, Kroch 1981, Sells 1984, Swets and Ferreira 2003)

a. This is a donkey that I wonder where it lives.

$>$

b. This is a donkey that I wonder where lives.

For convenience I will refer to these respectively as *complexity-resumptives*,[3] *island-resumptives*, and *ECP-resumptives*. This should be taken as an implication that they will be handled heterogeneously by the theory. They are all treated as processing-resumptives and any differences between them fall out of independently motivated aspects of the grammar or the processing model. I should also add that these are purely descriptive labels. There is a connection between islands and ECP-violations, for example. However, I take the ECP-resumptives to involve not just an island violation but also a violation of whatever additional grammatical constraints govern *that*-trace, left-branch extractions, etc. Erteschik-Shir (1992:90) has also observed that there is an interaction between complexity- and island-resumptives, to the effect that island-repair is improved if there is greater distance between the resumptive pronoun in the island and its antecedent.

[3] Erteschik-Shir (1992) calls these "distance-resumptives", but the notion of distance does not really capture all the relevant cases.

8.1.2.1 Island- and ECP-resumptives

Let us first look at the second and third classes: the island-resumptives and ECP-resumptives. What these classes have in common is that the corresponding sentence with a gap violates some grammatical constraint. The assumptions of the processing theory that are relevant are the following:

(8.41)
1. Parsing is incremental.
2. Incremental parsing constructs *locally* well-formed structures.
3. Incremental parsing is incrementally interpreted.

Incremental interpretation will in particular be the key to explaining the properties of island-resumptives.

Turning to a specific example, let us consider first a simplified version of the weak island example in (i) above:

(8.42) I met the linguist that Kate forgot if Thora had seen him before.

An unbounded dependency is initiated by the grammar when relative clause construction begins with the word *that*. This unbounded dependency is described in terms of the outside-in functional uncertainties that we have see throughout this thesis and that we paid special attention to in section 8.1.1. For the sake of simplicity I assume that an island is marked with a feature UD, mnemonic for unbounded dependency, that has the value $-$. The functional uncertainty equation will have the off-path equation $(\rightarrow \text{UD}) \neq -$ on the grammatical function COMP. This will mean that the unbounded dependency cannot be functionally equated to a grammatical function inside a COMP that contains the feature UD with value $-$. This is obviously not a very sophisticated notion of island, but it will do to make the point about interpretation (for a quick review of unbounded dependency restrictions in LFG, see chapter 2, section 2.1.6; for more details, see Dalrymple 2001).

Assuming that the complementizer *if* contributes $(\uparrow \text{UD}) = -$, as soon as the parser encounters the complementizer it has reached a weak island. At this point the functional uncertainty associated with the unbounded dependency cannot be satisfied and there is no way to integrate the filler. The only way for local well-formedness to be satisfied is if all local arguments are occupied by lexical material. This in fact turns out to be the case, since the embedded COMP corresponds to *if Thora had seen him before*. The local f-structure for the COMP is shown here:

(8.43)
$$\begin{bmatrix} \ldots & \\ \textsc{comp} & \begin{bmatrix} \textsc{pred} & \text{‘see’} \\ \textsc{subj} & \begin{bmatrix}\text{“Thora”}\end{bmatrix} \\ \textsc{obj} & \begin{bmatrix}\text{“him”}\end{bmatrix} \\ \textsc{ud} & - \\ \textsc{tense} & \text{past} \end{bmatrix} \end{bmatrix}$$

The overall parsing situation is shown here:

(8.44) *I met the linguist that Kate forgot …* $\xrightarrow{\text{Filler}}||$ *… if Thora had seen him before*

✓**Locally well-formed** ✓**Locally well-formed**

*** Globally ill-formed**

The sentence is syntactically ill-formed, since the filler cannot be integrated due to the *wh*-island. The local structures that have been incrementally constructed are locally well-formed, though. The local structure containing the island is locally well-formed because of the presence of the processing-resumptive. The same observations apply to island-resumptives in strong islands and ECP-resumptives. The only difference is that the local structure is correspondingly more ill-formed, either due to island strength, however that is measured, or due to violation of the ECP (in addition to an island violation).

Incremental parsing is accompanied by incremental interpretation in this model. Parsing has now accumulated the following resources, which have been lexically contributed by the words that have been encountered:

(8.45)

1.	$s : i$	Lex. **I**
2.	$meet : i \multimap l \multimap m$	Lex. **met**
3.	$\lambda P.\iota y[P(y)] : (v \multimap r) \multimap l$	Lex. **the**
4.	$linguist : v \multimap r$	Lex. **linguist**
5.	$\ldots$	Lex. **that**
6.	$kate : k$	Lex. **Kate**
7.	$forget : k \multimap s \multimap f$	Lex. **forgot**
8.	$thora : t$	Lex. **Thora**
9.	$see : t \multimap h \multimap s$	Lex. **seen**
10.	$\lambda z.z \times z : l \multimap (l \otimes h)$	Lex. **him**

I have left out the relative pronoun's resource purposefully, because it has not been integrated and the parser does not know what to do with it. The relevance of this will be made clear shortly. The determiner *the* has been assigned its *iota* meaning rather than its generalized quantifier meaning (Partee 1987), so that *the linguist* will be a type e individual. The significance of this will be further discussed below. Finally, I have left out the modifer *before*, since it complicates matters without adding anything significant to the example. Incremental interpretation on these premises can accomplish a great deal, but it will not yield a well-formed Glue derivation ending in an atomic linear logic term with associated sentential semantics. The following proof is the best that can be done at this stage:

(8.46)

$$\dfrac{\dfrac{\dfrac{\begin{array}{c}\textbf{the}\\ (v \multimap r) \multimap l\end{array} \quad \begin{array}{c}\textbf{linguist}\\ v \multimap r\end{array}}{l} \quad \begin{array}{c}\textbf{him}\\ l \multimap (l \otimes h)\end{array}}{l \otimes h} \quad \dfrac{\dfrac{\dfrac{\begin{array}{c}\textbf{I}\\ i\end{array} \quad \begin{array}{c}\textbf{met}\\ i \multimap l \multimap m\end{array}}{l \multimap m} \quad [l]^1}{m} \quad \dfrac{\dfrac{\begin{array}{c}\textbf{kate}\\ k\end{array} \quad \begin{array}{c}\textbf{forgot}\\ k \multimap s \multimap f\end{array}}{s \multimap f} \quad \dfrac{\dfrac{\begin{array}{c}\textbf{thora}\\ t\end{array} \quad \begin{array}{c}\textbf{seen}\\ t \multimap h \multimap s\end{array}}{h \multimap s} \quad [h]^2}{s}}{f}}{m \otimes f}\otimes_{\mathcal{I}}}{m \otimes f}\otimes_{\mathcal{E},1,2}$$

Figure 8.3 illustrates the incremental interpretation that is computed. The result of incremental interpretation is a multiplicative conjunction of two type t resources:

(8.47) $$meet(s, \iota y[linguist(y)]) \times forget(kate, see(thora, \iota y[linguist(y)])) : m \otimes f$$

The multiplicative conjunction corresponds to a product pair in the meaning language. It is important to bear in mind that the meaning is a *pair* of meanings corresponding to a conjunction of type t resources, not a conjunction of meanings corresponding to a single t resource. The function contributed by the pronoun is a type $\langle e, \ \langle e \ \times \ e\rangle\rangle$ function. This means that the same type e argument is simultaneously added to both parts of the product pair. There is no way to have different type e arguments in each member of the pair. In this particular example, it means — over and above the semantics of ι — that $\iota y[linguist(y)]$ in each member of the pair denotes the same linguist.

$$
\begin{prooftree}
\AxiomC{$\lambda P.\iota y[P(y)] : (v \multimap r) \multimap l$}
\AxiomC{$linguist : v \multimap r$}
\BinaryInfC{$\iota y[ling(y)] : l$}
\AxiomC{$\lambda z.z \times z : l \multimap (l \otimes h)$}
\BinaryInfC{$\iota y[ling(y)] \times \iota y[ling(y)] : l \otimes h$}
\AxiomC{$s : i$}
\AxiomC{$meet : i \multimap l \multimap m$}
\BinaryInfC{$meet(s) : l \multimap m$}
\AxiomC{$[u : l]^1$}
\BinaryInfC{$meet(s, u) : m$}
\AxiomC{$kate : k$}
\AxiomC{$forget : k \multimap s \multimap f$}
\BinaryInfC{$forget(kate) : s \multimap f$}
\AxiomC{$thora : t$}
\AxiomC{$see : t \multimap h \multimap s$}
\BinaryInfC{$see(thora) : h \multimap s$}
\AxiomC{$[v : h]^2$}
\BinaryInfC{$see(thora, v) : s$}
\BinaryInfC{$forget(kate, see(thora, v)) : f$}
\RightLabel{$\otimes_{\mathcal{I}}$}
\BinaryInfC{$meet(s, u) \times forget(kate, see(thora, v)) : m \otimes f$}
\RightLabel{$\otimes_{\mathcal{E},1,2}$}
\BinaryInfC{$\mathsf{let}\ \iota y[ling(y)] \times \iota y[ling(y)]\ \mathsf{be}\ u \times v\ \mathsf{in}\ meet(s, u) \times forget(kate, see(thora, v)) : m \otimes f$}
\RightLabel{$\Rightarrow_\beta$}
\UnaryInfC{$meet(s, \iota y[ling(y)]) \times forget(kate, see(thora, \iota y[ling(y)])) : m \otimes f$}
\end{prooftree}
$$

Figure 8.3: Incremental interpretation of *I met the linguist that Kate forgot if Thora had seen him before.*

The derivation that is shown in (8.46) and Figure 8.3 does not meet the criterion for a successful Glue derivation of sentential meaning in two respects. First, the result is a type $\langle t \times t\rangle$ multiplicative conjunction of linear logic atoms, not a type t atom. The result is therefore not an appropriate semantics for *sentential* meaning, although a $\langle t \times t\rangle$ atom could potentially correspond to the semantics for a sub-sentential constituent. Second, and more importantly, the proof is not a well-formed Glue derivation because the proof is not a well-formed linear logic proof. In order to arrive at the proof the premise corresponding to the unbounded dependency (the relative clause premise) was set aside. But this means that not all resources have been consumed in constructing the derivation.

Despite not being a well-formed derivation and not being a valid meaning for a sentence, the proof is crucially *informative*. The first member of the pair in the result states that the speaker met the linguist. The second member, leaving tense, aspect and mood aside, states that Kate forgot if Thora had seen the (same) linguist. Although this is not a conjunction, it contains some of the essential information that successful construction of the restrictive relative clause would create, which is shown here:[4]

(8.48) $meet(s, \iota y[linguist(y) \wedge forget(kate, see(thora, y))]) : m$

The essential difference between (8.47) and (8.48) is that the former does not restrict the reference of the linguist and does not presuppose that there is more than one linguist, which the equivalent of (8.48) in a dynamic semantics would do.

The example we have been looking at serves as a particularly simple illustration of incremental interpretation, because analyzing *the linguist* in terms of ι gives a reasonable semantics in the static framework that I have been using. However, I mentioned above that one difference between the partial incremental semantics and the full semantics for the relative clause without the processing-resumptive (had there been no island violation) was presuppositional. The analysis of presupposition is generally now thought to require a dynamic framework of some kind (see Beaver 2001 for an overview and references). A dynamic framework is also required to make sense of a type e denotation for indefinites (Kamp 1981, Heim 1982, Groenendijk and Stokhof 1991). There are two fundamental methods for making Glue Semantics dynamic. The most straightforward method is to use a dynamic meaning language that supports lambda abstraction, such as Lambda DRT (Bos et al. 1994), as suggested briefly by Dalrymple et al. (1999b) and developed in more detail

[4]It is tempting to say that (8.47) and (8.48) have similar truth conditions, but this would be an error, since (8.47) does not have truth conditions as a whole.

by Kokkonidis (2003), or Compositional DRT (Muskens 1994), as pursued by van Genabith and Crouch (1999a). A second method is to keep the meaning language static and to allow the linear logic that composes meanings to also handle contextual update, thus effectively moving the dynamics into the linear logic side. This approach was initially developed by Crouch and van Genabith (Crouch and van Genabith 1999, van Genabith and Crouch 1999b) and further developed by Dalrymple (2001:291ff.), but it is still to some extent work in progress. I am not at this point going to move to a dynamic framework, both because it would add complexity that is not really necessary and because processing-resumptives are clause-bounded, like syntactic resumptives. However, I will help myself to a notion that is fundamental to dynamic frameworks: certain discourse referents are globally available (those corresponding to noun phrases that are principal ultrafilters, for which the *lower* type-shift is well-defined, i.e. names, indefinites and definites; Partee 1987), others are available only within the scope of their contributor.

Presupposing a dynamic framework then, the incrementally constructed partial semantics for the island resumptive we have been looking at would get a representation like (8.49), where s, y, k, and t are discourse referents contributed by *I*, *the linguist*, *Kate*, and *Thora*, respectively.[5]

(8.49) $[\ s, y, k, t \ \mid meet(s, \iota y[linguist(y)]) \times forget(k, see(t, \iota y[linguist(y)]))] : m \otimes f$

An indefinite example like (8.50) would get a partial interpretation as in (8.51):

(8.50) I met a linguist that Kate forgot if Thora had seen him before.

(8.51) $[\ s, y, k, t \ \mid meet(s, linguist(y)) \times forget(k, see(t, linguist(y)))] : m \otimes f$

In sum, the island-resumptive is both syntactically and semantically ill-formed. However, definites and indefinites alike lead to incremental construction of an informative partial interpretation that contains much of the essential content that a successful interpretation would contain, but that is nevertheless distinct from a full interpretation that properly integrates the restrictive relative clause.

This gives a ready explanation for Sells's (1984:11–12) observation that what he calls intrusive pronouns and what I am calling processing-resumptives do not allow bound variable readings. The following version of the weak island example we have been looking at with *the linguist* replaced by *every linguist* indeed seems to be markedly worse and Sells (1984:12, (9b)) assigns the sentence a star:[6]

[5] Notice that now ι is just marking the definite as a definite.

[6] The precise sentence in Sells (1984) is actually *I'd like to meet every linguist that Mary couldn't remember if she had seen him before*.

(8.52) *I met every linguist that Kate forgot if Thora had seen him before.

The theory of anaphora that I have been assuming throughout this thesis is variable-free (Jacobson 1999), so it is important to establish what the equivalent of a bound-variable reading is on this theory.

In order to receive a bound reading, a pronoun must make an assumption on its antecedent that is discharged within the scope of a scope-taking element. To be discharged within the scope of a scope-taking element means to be discharged in a contiguous sub-proof that extends from the assumption to the point at which the scope dependency is discharged (see the discussion of *audit trails* by Crouch and van Genabith 1999:160ff.). This is illustrated by the following sentence, which is ambiguous between a reading where *her* gets a bound interpretation from *every girl* and a reading where *her* takes the name *Kim* as its antecedent:

(8.53) Every girl said Kim thinks John likes her.

The two readings are shown in (8.54), where the antecedent is *Kim*, and in (8.55), where the antecedent is word *every girl*. The proof in (8.54) is more indirect than it needs to be, for expository purposes.

(8.54)

$$\dfrac{k \quad \dfrac{\dfrac{\forall X.[(g \multimap X) \multimap X] \quad \dfrac{\dfrac{\dfrac{\dfrac{[k]^1 \quad k \multimap l \multimap t}{l \multimap t} \quad \dfrac{[h]^2 \quad \dfrac{j \quad j \multimap h \multimap l}{h \multimap l}}{l}}{t} \quad \dfrac{[k]^3 \quad k \multimap (k \otimes h)}{k \otimes h}}{t}\otimes_{\mathcal{E},1,2} \quad t \multimap g \multimap s}{g \multimap s}}{s}}{k \multimap s}\multimap_{\mathcal{I},3}}{s}$$

(8.55)

$$\dfrac{\forall X.[(g \multimap X) \multimap X] \quad \dfrac{\dfrac{\dfrac{[g]^1 \quad \dfrac{\dfrac{\dfrac{k \quad k \multimap l \multimap t}{l \multimap t} \quad \dfrac{[h]^2 \quad \dfrac{j \quad j \multimap h \multimap l}{h \multimap l}}{l}}{t} \quad t \multimap g \multimap s}{g \multimap s}}{s} \quad \dfrac{[g]^3 \quad g \multimap (g \otimes h)}{g \otimes h}}{s}\otimes_{\mathcal{E},1,2}}{g \multimap s}\multimap_{\mathcal{I},3}}{s}$$

In the bound reading in (8.55) the assumption on the antecedent is discharged within the scope of *every girl*, but in (8.54) it is not. The more direct proof that can be constructed for (8.54) would make no assumption on k at all, allowing the pronoun to take the name directly as its antecedent.

Now let us return to (8.52). The noun phrase *every linguist*, unlike *the linguist*, cannot take a type e meaning. The ι lift cannot apply and there is no way to *lower every linguist* from its generalized quantifier meaning to a type e meaning, because *every linguist* is not a principal ultra-filter (Partee 1987). Therefore the premise contributed by *every linguist* must be of the generalized quantifier type $\langle\langle e,\ t\rangle\ ,\ t\rangle$, as in (8.56), and cannot have the type e that *the linguist* received above.

(8.56) $\lambda S.every(x,\ linguist(x),\ S(x)) : \forall X.[(l \multimap X) \multimap X]$

This means that *every linguist* must be a scope-taking element and that a pronoun that takes it as an antecedent must be a bound variable.

Consider the proof that results from replacing the resources for *the linguist* in (8.46) with the resource for *every linguist*:

(8.57)

$$\dfrac{\dfrac{[l]^3 \quad \overset{\textbf{him}}{l \multimap (l \otimes h)}}{l \otimes h} \qquad \dfrac{\dfrac{\dfrac{\overset{\textbf{I}}{i} \quad \overset{\textbf{met}}{i \multimap l \multimap m}}{l \multimap m} \quad [l]^1}{m} \qquad \dfrac{\dfrac{\overset{\textbf{kate}}{k} \quad \overset{\textbf{forgot}}{k \multimap s \multimap f}}{s \multimap f} \quad \dfrac{\dfrac{\overset{\textbf{thora}}{t} \quad \overset{\textbf{seen}}{t \multimap h \multimap s}}{h \multimap s} \quad [h]^2}{s}}{f}}{m \otimes f}\otimes_{\mathcal{I}}}{m \otimes f}\otimes_{\mathcal{E},1,2}$$

The argument l of the pronominal resource must be introduced by assumption now, because there is no l that corresponds to a type e individual and the pronoun must be a bound variable. The result of incremental interpretation at this stage is:

(8.58) $meet(s, x) \times forget(kate, see(thora, x)) : m \otimes f$

This says that two things hold: the speaker met whatever x is a variable for and Kate forgot if Thora had seen whatever x is a variable for. This is obviously highly uninformative. Since the theory is variable-free and there are never any free variables or any assignment functions, there is not even an assignment function to help out (whatever that would mean).

Furthermore, it is impossible to add *every linguist* to the incremental interpretation. *Every linguist* requires a dependency of the form $l \multimap X$, but there is no such dependency available. Discharging the assumption on l results in the following:

(8.59) $\lambda x.meet(s, x) \times forget(kate, see(thora, x)) : l \multimap (m \otimes f)$

There is no single type t linear logic atom that can serve as X for *every linguist*. Therefore, incremental interpretation ends up with an uninformative conjunction and the conjunction does not say *anything* about every linguist. In sum, the impossibility of a bound reading for a processing-resumptive (intrusive pronoun) is a reflection of the fact that if it is a bound variable incremental interpretation cannot assign an informative meaning to the relative clause.

If the pronoun in (8.52), which is resumptive on *every linguist*, cannot receive a bound interpretation, then to the extent that it receives any interpretation at all it must be some "other" interpretation (Sells 1984:9ff.). Chao and Sells (1983) argue that the other interpretation in question for intrusive pronouns with indefinite or definite relative heads as antecedents, i.e. the kind that I argue leads to informative partial interpretation, is the E-type interpretation defended by Evans (1980). Sells (1984:454) abandons this approach and gives two reasons for doing so. The first is that the work of Heim (1982) and Kamp (1981) in dynamic semantics undermines an appeal to E-type pronouns as involving a special mechanism for pronominal interpretation (which was crucial to the Chao and Sells 1983 approach), because a single dynamic method for interpreting pronouns subsumes E-type interpretations. The second reason is that Heim (1982:25–33) shows that E-type readings make certain false predictions.

Heim (1982) in fact only claims that the E-type account has trouble with *indefinite* antecedents, not universals. She makes a slightly more subtle claim than the claim that the E-type account makes false predictions. She shows that it fails to make a certain valid prediction and that the assumptions necessary to make the prediction on an E-type account are not obviously consistent with other predictions of the account. She subsequently writes:

> Recall that I have attributed to Evans two assumptions which are independent of each other: (a) the assumption that certain anaphoric pronouns mean the same thing as certain definite descriptions, and (b) the assumption that definite descriptions are to be analyzed in a certain way, which involves predicting uniqueness-implications for singular definite descriptions. As it turns out upon closer investigation of the facts, it is (b) and not (a) that we should question . . . Heim (1982:31–32)

Her basic point is what is behind Sells's first reason for abandoning the Chao and Sells appeal to E-type interpretation. She argues that the task of properly accounting for definite descriptions in E-type pronominal reference to indefinites boils down to the task of accounting for pronouns with indefinite antecedents. This is the subsumption that Sells refers to.

However, Heim (1982) does not consider cases of E-type reference to an *every*-antecedent. Evans (1980:220, (21–22)) noted that an E-type interpretation in this case requires a plural pronoun, even though the antecedent is singular (the grammaticality judgements are those assigned by Evans):

(8.60) *Every congressman came to the party, and he had a marvellous time.

(8.61) ?Every congressman came to the party, and they had a marvellous time.

I am not going to argue that dynamic semantics could not somehow handle this case, but however it is handled it could not follow from the standard mechanism of dynamic variable-binding. Dynamic semantics explains the following semantic chestnut by defining a contextualized notion of variable-binding that allows an indefinite to bind across a clause boundary but which does not allow a universal to do so:

(8.62) A man walked in the park. He whistled.

(8.63) Every man walked in the park. * He whistled.

If E-type binding just is the dynamic binding mechanism the relevant contrast would be impossible. I am not disputing the dynamic semantics account of definites and indefinites, but rather pointing out that not all instances of E-type binding can be assimilated to dynamic binding.

Evans (1980:220) offers the following explanation for (8.60) and (8.61):

> If it is the role of [E-type pronouns] to refer to the object(s) which verify the antecedent clause, the deviance of [(8.60)] is explained, since in the antecedent clause there are asserted to be a plurality of such objects. [(8.60)] is certainly improved by pluralizing the pronoun [as in (8.61) – AA]

It is not clear that the antecedent clause "asserts" that there is a plurality of objects. It would rather seem to presuppose or implicate it (since if there were only one object it would have been more informative for the speaker to use *the* or *a*), but the presupposition or implicature can be contextually cancelled. The following could be uttered for comic effect:

(8.64) Every honest CEO came to the party. He had a marvellous time.

As for the intermediate grammaticality that Evans assigns (8.61), it perhaps arises due to a conflict between the necessity of using a plural pronoun because of the implicature and the lack of agreement between the pronoun and its linguistic antecedent. I personally do not find (8.61) ill-formed in the least, but in the dialect of English that I speak third person plural pronouns like *they* may also be interpreted as third person singular with indeterminate gender.

The overall picture that I have been presenting is the following. Incremental processing of island-resumptives, gives rise to incremental interpretation. Due to the impossibility of integrating the filler in the island, the result of incremental interpretation is only partial. However, if the antecedent of the processing-resumptive is a definite or indefinite, the partial interpretation is nevertheless informative and contains much of the essential information of an equivalent fully-interpreted restrictive relative clause. A bound variable reading for a processing-resumptive fails to give rise to an informative partial interpretation. The only interpretation that a processing-resumptive with a quantificational antecedent can attempt is an E-type interpretation. The following version of the sentence we have been looking at certainly seems to be better than the *every*-version (making certain adjustments to make the sentence more plausible):

(8.65) I've met few linguists that Kate manages to remember if Thora has seen them before.

This would have to be tested more systematically, though. Furthermore, the matter of *how* E-type interpretations get resolved needs to be settled.

If processing-resumptives have E-type readings, a couple of patterns of data are explained — one from the literature and one that I have collected myself. One of my Swedish informants consistently ranks the Swedish equivalents of *every*-examples as follows: gaps are best, and both a 3SG pronoun and a 3PL pronoun in the gap position are fairly bad but not completely impossible. This is shown immediately below. It should be noted that Swedish does not have weak islands and that the gap equivalent is therefore well-formed (Engdahl 1982). The significance of this will be explored later in this chapter.

(8.66) Jag skulle vilja träffa varje lingvist som Maria inte kunde komma ihåg om hon hade
I will want.to meet every linguist that Maria not could remember if she had
sett _ förut.
seen _ before.
I'd like to meet every linguist that Mary couldn't remember if she had seen before.
$>$

(8.67) Jag skulle vilja träffa varje lingvist som Maria inte kunde komma ihåg om hon hade
I will want.to meet every linguist that Maria not could remember if she had
sett <u>honom</u> förut.
seen him before.
I'd like to meet every linguist that Mary couldn't remember if she had seen him before.

(8.68) Jag skulle vilja träffa varje lingvist som Maria inte kunde komma ihåg om hon hade
I will want.to meet every linguist that Maria not could remember if she had
sett dom förut.
seen them before.
I'd like to meet every linguist that Mary couldn't remember if she had seen them before.

This pattern of data is partially explained if the pronoun that is anaphoric on the universally quantified nominal must have an E-type reading. The singular E-type is incompatible with the universal antecedent and is therefore ill-formed (it does not seem to be completely precluded though). The plural E-type is compatible with the universal, but Swedish does not allow the dialectal English use of the 3PL pronoun as a gender-indeterminate singular. The agreement conflict discussed above therefore arises.

Equivalent sentences with *ingen linvist* ('no linguist') were judged to be completely ungrammatical with either pronoun:

(8.69) * Jag skulle vilja träffa ingen lingvist som Maria inte kunde komma ihåg om hon hade
I will want.to meet no linguist that Maria not could remember if she had
sett honom / dom förut.
seen him / them before.
I'd like to meet no linguist that Mary couldn't remember if she had seen him/them before.

Evans (1980:218–219) notes that *no X* does not allow E-type reference and it is obvious why this should be so. If the E-type interpretation that the pronoun receives in, e.g., *Few congressmen admire Kennedy, and they are very junior* is *the congressmen who admire Kennedy*, then this is the same E-type interpretation that the pronoun receives in ** No congressmen admire Kennedy, and they are very junior* and the latter sentence is just a contradiction.

A second pattern of data comes from the literature on Hebrew resumptives and again concerns *every* versus *no* (actually, *not any*). Shlonsky (1992:448, fn.3) disputes Sells's (1984) analysis of Hebrew and writes:

> I believe that Sells is wrong in claiming that Hebrew allows resumptive pronouns to be linked to quantificational heads whereas English does not. This is manifest if one considers relative clauses headed by negative quantifiers rather than universal ones.

He then gives the following example:

(8.70) * Rina lo ʔahava ʔaf balšan še-Dalya hikira ʔet ha-ʔiša še-<u>hu</u> pagaš.
Rina not loved no linguist that-Dalya knew ACC the-woman that-he met
Rina did not love any linguist that Dalya knew the woman that he met.

Shlonsky's entire account is centered around the ECP and for him a Hebrew subject resumptive is there to avoid an ECP (*that*-trace) violation. Without taking on board Shlonsky's specific proposal, in terms of the present theory the resumptive in the above example would be a processing-resumptive if Hebrew subject resumptives are not syntactically licensed. If this is true, then the fact that the resumptive in question must receive an E-type interpretation immediately accounts for Shlonsky's observation that a universal quantifier allows the relevant instance of resumption whereas a negative quantifier does not. The theory actually makes a more particular prediction: any quantifier except one that entails the non-existence of its restriction should allow the requisite resumptive. Thus, something like *few linguists* should allow the resumptive, even though it is a monotone decreasing (negative) quantifier. The distinction that Shlonsky mentions does not follow from anything in his theory or the theory of Safir (1986) that he cites in the footnote in question in support of his claim. It would have to be stipulated.

So far I have only been considering quantificational antecedents to processing-resumptives, but the observation that bound variable interpretations of processing-resumptives lead to uninformative partial interpretations applies to scope-taking elements in general and therefore also applies to *wh*-phrases. The question is what about questions? Chao and Sells (1983) present two kinds of data that indicates that resumptive pronouns in questions are not bound variables. The first kind concerns the inability to provide list-answers to resumptive *wh*-questions. List answers are however perfectly well-formed for *wh*-questions in which the *wh*-dependency terminates in a gap rather than a resumptive. Here is an example of the resumptive case:

(8.71) Q: Who did you say you'd forgotten whether <u>she</u> had paid her fees?
A: Abby
#A: Abby, Buffy, and Connie
(Sells 1984:475, ∼(169))

The E-type interpretation for *she* must be *the (female) person* and the question is questioning the identity of this person. The impossibility of answering with a list then follows from the fact that *Abby, Buffy, and Connie* is not a female person, but rather an aggregate of such persons.

The second kind of data that Chao and Sells (1983) consider concerns functional questions (Engdahl 1986). They note that resumptive *wh*-questions cannot be understood functionally and that a functional answer is therefore impossible:

(8.72) Q: Which woman does no Englishman even wonder if <u>she</u> will make a good wife?
A: Margaret Thatcher.
#A: The one his mother likes best.
(Sells 1984:477, ∼(173))

A standard analysis of functional questions is that the gap is a free variable of type $\langle e, e\rangle$, a function from individuals to individuals, rather than the type e of an individual (Engdahl 1986). Jacobson (1999:149ff.) presents a variable-free and trace-free alternative to the standard analysis. By contrast the processing-resumptive is assigned an E-type interpretation. The E-type pronoun is therefore just the wrong sort of thing and does not allow a functional reading of the question. The only interpretation the definite description in the answer can get is a bizzare "lucky" woman / conspiracy of mothers reading where all the English mothers have decided on a single woman as being the best.

Summary Island- and ECP-resumptives are treated as ungrammatical on this theory, but they can lead to informative partial interpretation if the antecedent is a definite or indefinite or if the pronoun can receive an E-type interpretation. This result follows from the usual grammatical analysis of the relevant constructions and the theoretical assumption that incremental parsing is incrementally interpreted.

8.1.2.2 Complexity-resumptives

The key difference between complexity-resumptives and island- and ECP-resumptives is that in the former the equivalent sentence with a gap instead of the processing-resumptive is grammatically well-formed. Erteschik-Shir (1992:89, (1–4)) offers the following examples; the judgements are hers:

(8.73) This is the girl that John likes __ / * her.

(8.74) This is the girl that Peter said that John likes __ / ?? her.

(8.75) This is the girl that Peter said that John thinks that Bob likes __ / ? her.

(8.76) This is the girl that Peter said that John thinks that yesterday his mother had given some cakes to ? __ / her.

These examples illustrate two separate things. First, as the distance between the filler and the gap site increases, a gap becomes less acceptable. Second, as the distance between the filler and the process-resumptive increases, the resumptive becomes more acceptable. The cut-off point for speakers is pretty variable for both. Sentences like the first example are rejected quite strongly, though, and the experimental literature, which I will consider below, confirms this.

The features of the model that are relevant to exlaining complexity-resumptives are the following:

(8.77)
1. Parsing of unbounded dependencies is *filler-driven*.
   (Active Filler Strategy (AFS); Frazier 1987, Frazier and Flores d'Arcais 1989)
2. Parsing is limited by short-term memory.
   (Kimball 1973, Dickey 1996, Lewis 1996, Gibson 1998)
3. Unsuccessful parsing results in reanalysis.

Point 1 bears a little elaboration. The Active Filler Strategy (Frazier 1987, Frazier and Flores d'Arcais 1989) has two components that are relevant. The first is that the search for a gap begins when the filler is encountered rather than when a "missing argument" (i.e., gap or putative trace) is encountered.[7] Notice that this happens to be in agreement with what the LFG grammar is independently doing, since a filler is described in terms of an outside-in functional uncertainty that is initiated when the filler is encountered.

The second component of the AFS is that the parser attempts to stick the filler in as soon as possible. Here is the formulation of the AFS by Frazier and Flores d'Arcais (1989:332, (3)):[8]

(8.78) **Active Filler Strategy**

Assign an identified filler as soon as possible; i.e., rank the option of a gap above the option of a lexical noun phrase within the domain of an identified filler.

The postulation of a gap before lexical material will be particularly important,

The AFS and the fact that English does not have syntactic resumptives is sufficient to explain the striking ungrammaticality of short-distance resumptives:

(8.79) * This is the girl that John likes her.

[7]The AFS is consistent with the postulation of traces. It just states that the trace itself is not what drives parsing of a filler-gap unbounded dependency. Pickering and Barry (1991) make the even stronger argument that traces are not psychologically real. Further discussion is offered by Gibson and Hickok (1993) and Pickering (1993).

[8]Gibson (1998:54ff.) argues that the AFS effects be derived from his Syntactic Prediction Locality Theory (SPLT).

According to the AFS, a search for a gap is initiated as soon as the clause begins. The first potential gap site is the subject of the relative clause. This gap site is occupied by lexical material (*John*) and the parser must therefore engage in reanalysis. A key piece of evidence in favour of the AFS is that subject relatives are processed faster than object relatives, since there is no need to revise the parser's first attempt (for discussion and references, see Gibson 1998:54ff.). Reanalysis results in continued search for a gap. The second gap site is the object of *like*. The parser integrates the active filler here. At this point the sentence is syntactically complete and incremental interpretation can construct a full interpretation for the sentence. Then along comes *her*. The parser cannot do anything with this word. The sentence is therefore as ungrammatical as, e.g.:

(8.80) * John likes the girl her.

Notice that this is just a matter of parsing and not a causal explanation. The sentence *This is the girl that John likes her* is not ungrammatical on this theory *because* the sentence *This is the girl that John likes* is grammatical. There is no transderivationality required to state that the resumptive sentence is out.

The assumption that the parser is limited by short-term memory becomes relevant for long sentences where resumptives improve:

(8.81) This is the girl that Peter said that John thinks that yesterday his mother had given some cakes to her.

The assumption is not a controversial one (for an overview, see Lewis 1996). It has previously formed the basis of a parsing model of resumptive pronouns by Dickey (1996), who discusses the issue of memory limitations in parsing in some detail. Dickey's model is principally meant to address the amelioration effect of a resumptive versus a gap and it does not address the issue of reanalysis or the issue of general ill-formedness of processing-resumptives in English, which has been established experimentally in the meantime (McDaniel and Cowart 1999, Alexopoulou and Keller 2002). Furthermore, he only looks at what I am calling complexity-resumptives and does not address island- and ECP-resumptives. However, Dickey examines languages that I do not examine here (Chinese, Igbo, Swahili) and provides some pilot data. Since his model is largely compatible to this one in its appeal to memory constraints (although the specifics are of course different), taken together the two models can hopefully serve as a good basis for further investigation of resumptive processing.

The proposal I want to make specifically with respect to resumptive pronouns is the following:

1. A resumptive pronoun reactivates a filler that is no longer active (due to memory limitations).
2. This results in reanalysis of the local structure that the pronoun appears in.
3. If reanalysis succeeds in integrating the filler, the pronoun is *removed*.

On the model developed here, the perceived deterioration of a gap as distance gets larger follows from incremental construction of locally well-formed structure. If a filler is no longer being posited, then the gap will be initially perceived as an illicitly missing argument.

The reanalysis that is posited here seems quite radical in that it actually removes the linguistic contribution of a word. Reanalysis typically concerns revising syntactic assumptions based on ambiguity (for a fairly recent discussion, see Frazier and Clifton 1996). But, the fact that it is a destructive operation is not in itself radical, because reanalysis always entails the destruction of posited grammatical material and its replacement with new material (otherwise it would be just more analysis, not *re*analysis). Despite its unconventional nature, the current proposal really just is the usual sort of remove-and-replace reanalysis. Furthermore, the alternative to removal of the pronoun is not really in prospect. Any syntactic formulation to the effect that the pronoun is underlyingly a gap, etc., would have to explain why the short examples are ill-formed. It might be tempting to attempt a transderivational (e.g., Last Resort) explanation to the effect that the short examples with a pronoun are ill-formed because a short example with a gap is well-formed. But, the long examples with a gap are also well-formed. A syntactic account would therefore have to make reference to distance or count nodes or some such thing. As Erteschik-Shir (1992:90) points out, “distance is not a syntactically well-defined notion.” Syntactic operations are either unbounded or they are local.

The question to ask is why the pronoun is initially permitted in the first place. The answer is the same as in the island- and ECP-resumptive cases. The parser is trying to build locally well-formed structure and a gap does not meet this requirement. In island- and ECP-resumptives this was due to the impossibility of integrating the filler. In complexity-resumptives it is due to the fact that, when the resumptive is encountered, there is no filler to integrate. The difference between the present case and the other two is that after reanalysis there is no problem in integrating the filler, since there is no island. The kinds of processing-resumptives are not entirely independent, though. The model does not entail that just because an island-resumptive is also sufficiently far from or in a complex embedding relation to its filler that it counts as a complexity-resumptive instead. It does count as a complexity-resumptive, but reanalysis of the filler is not successful because it cannot be integrated in the island. Reanalysis merely reveals an island-resumptive and it is analyzed as in the previous section. Similarly, if the language in question does not have the relevant sort of island-violation, then the "island-resumptive" is not an island-resumptive at all. It is just a complexity-resumptive. It will only be grammatical if the filler is no longer active and reactivation of the filler will result in successful reanalysis that removes the pronoun. The same comments apply to the interaction of complexity-resumptives and ECP-resumptives.

Summary Complexity-resumptives, island-resumptives, and ECP-resumptives share the property of allowing construction of locally well-formed structure. In the latter two cases, it is impossible to construct well-formed structure otherwise, due to impossibility of integrating a filler. In the complexity-resumptive case, the filler has become inactive due to memory limitations. The parser is therefore not positing gaps when the resumptive is encountered and the resumptive meets the parser's expectations and allows construction of a locally well-formed structure. In finding its antecedent the pronoun reactivates the filler. The reactivation leads to reanalysis with respect to the filler and the pronoun and attempted integration of the filler. Whether this integration is successful or not depends on the syntactic structure in which the pronoun occurs. If the filler can be successfully integrated in this structure according to the grammatical constraints of the language in question, then the filler is integrated and reanalysis is completed by removing the pronoun. If the filler cannot be integrated in the structure according to the grammatical constraints of the language — for example if there is an island or ECP configuration and these are grammatical violations in the language — then the filler is not integrated and the pronoun functions as it does in island- and ECP-resumptives. The sentence is ill-formed and leads to only partial interpretation.

One might question what happens if there are multiple potential antecedents for the pronoun:

(8.82) This is the girl that Peter said that Julia thinks that yesterday his mother had given some cakes to her.

If the pronoun takes *Julia* as its antecedent then full interpretation is not possible. The sentence will result in an uninformative partial interpretation. Either the perceiver will perceive it as ungrammatical or else another attempt at reanalysis will be made. The question really just boils down to the more general one of how a perceiver recovers from misidentifying a pronominal antecedent.

8.1.2.3 Complexity-resumptives in Swedish

In chapter 7 I noted that Swedish has been claimed to have resumptives in four environments. I then set aside all but the resumptives that occur immediately following material at the left-periphery of

CP, which I argued were the only true, syntactic resumptives in Swedish. I would now like to return to the other three environments, which are repeated here:

1. Deep embedding (at least two clauses)

(8.83) I går såg jag [en film]$_i$ [$_{\mathrm{CP}}$ som jag undrar om någon minns [$_{\mathrm{CP}}$ vem som
Yesterday saw I a film that I wonder if anyone remembers who that
regisserat __$_i$ / den$_i$]].
directed __ / it.
Yesterday I saw a film that I wonder if anyone knows who directed (it).
(Engdahl 1982:154, ∼(12))

2. Sentential subjects

(8.84) [Vilken skådespelare]$_i$ var det att publiken inte kände igen __$_i$ / honom$_i$ ganska
which actor was it that audience.DEF not recognize __ / him rather
konstigt?
strange
(Which actor was the fact that the audience did not recognize (him) rather strange?)
(Engdahl 1982:165, (58))

3. Crossing dependencies

(8.85) [Den här presenten]$_i$ kan du säkert aldrig komma på vem$_j$ jag fick den$_i$ / * __$_i$
this here present.DEF can you surely never come on who I got it / __
av __$_j$.
from __
(This present you'll never guess who I got (it) from.)
(Maling and Zaenen 1982:236, ∼(13a))

Engdahl (1982) argues that these all arise due to processing factors. I will show in this section that all of these cases can be analyzed as complexity-resumptives.

The first case involves distance and is just the sort of case that we have already seen in section 8.1.2.2. As discussed in that section, distance is not a well-defined syntactic notion and the fact that these resumptives become acceptable as they get further from their binders indicates that they are governed by processing factors, not by grammatical factors. Swedish patterns exactly like English with respect to complexity-resumptives and distance. Engdahl (1982:152–153) notes that while sentences like (8.83) are accepted by native speakers, short examples like the following are not:

(8.86) * Nobelpriset i medicin ska vi snart få reda på vem som fått det.
the.Nobel prize in medicine shall we soon find out who that got it
The Nobel prize in medicine, we will soon find out who got (it).
(Engdahl 1982:152, ∼(4))

(8.87) * I går såg jag en film som jag redan glömt vem som regisserat den.
Yesteday saw I a film that I already forgot who that directed it
Yesterday I saw a film that I already forget who directed (it).
(Engdahl 1982:152, (5))

(8.88) * Vilken bok kunde ingen minnas vem som skrivit den?
Which book could nobody remember who that wrote it?
Which book could nobody remember who wrote it?
(Engdahl 1982:152, (6))

The corresponding gap examples are grammatical. Notice that this is extraction from an embedded question, which is ungrammatical in English, but grammatical in Swedish. Engdahl (1982:154) writes that "[a]lthough one might occasionally hear a resumptive pronoun instead of a gap in a sentence with only two levels of embedding, as in [(8.86)–(8.88)], the general consensus among speakers of Swedish is that a gap is preferable." This mirrors what Erteschik-Shir (1992) notes about English complexity resumptives: they start improving at around the second level of embedding and become quite good at the third. Lewis (1996) has argued in the psycholinguistic literature that two or three levels of embedding seems to be the significant cut-off point for a variety of parsing phenomena.

Resumptives in sentential subjects can also profitably be analyzed as complexity-resumptives. Showing this involves a little bit of setting up. The examples in question first have to be shown to count as complex in the relevant sense. Engdahl (1982) observes that there is a strong tendency in Swedish to extrapose sentential subjects. She notes that (8.89) is "by far more natural" (Engdahl 1982:165) than (8.90):

(8.89) Det var konstigt att publiken inte kände igen Evert Taube.
it was strange that the.audience not recognize Evert Taube
It was strange that the audience did not recognize Evert Taube.
(Engdahl 1982:165, (57c))

(8.90) Det att publiken inte kände igen Evert Taube var konstigt.
it that the.audience not recognize Evert Taube was strange
That the audience did not recognize Evert Taube was strange.
(Engdahl 1982:165, (57b))

Engdahl goes on to note that extractions out of sentential subjects, as in (8.91) are quite unnatural, and that speakers greatly prefer (8.92) and even spontaneously produce such questions when asked about sentential subject extraction.

(8.91) Vilken skådespelare var det att publiken inte kände igen __ ganska konstigt?
which actor was it that the.audience not recognize __ rather strange
(Which actor was that the audience did not recognize rather strange?)
(Engdahl 1982:165, (58))

(8.92) Vilken skådespelare var det ganska konstigt att publiken inte kände igen __ ?
which actor was it rather strange that the.audience not recognize __
Which actor was it rather strange that the audience did not recognize?
(Engdahl 1982:165, (59))

Nevertheless, when prompted for a grammaticality judgement about (8.91) speakers accept it. On the reasonable assumption that sentential subject extraction out of a non-extraposed sentential subject counts as complex in the relevant sense, both the reticence of speakers in accepting gaps in this environment and the possibility of a complexity-resumptive are explained. The assumption regarding the complexity of the gap sentence needs to be independently confirmed, but the complexity of non-extraposed sentential subjects in general has been established in the psycholinguistic literature (Frazier 1985:177, Gibson 1998:53).

The last remaining environment is crossing dependencies (Engdahl 1982, Maling and Zaenen 1982). Engdahl (1982:168) notes that although it had previously been claimed that syntactically interchangeable fillers must be interpreted in a nested fashion (the Nested Dependency Constraint Fodor 1978), this does not seem to be universally valid and the Scandinavian languages in general seem to allow non-nested readings, although in the case of multiple gaps nested readings are still more readily available. The preference for nested readings is derivable from the Active Filler Strategy, if it assumed that the most recent filler is the active filler. The difficulty of an intersecting reading is then due to the necessity of reanalysis, since the filler that is integrated first is integrated in the wrong gap. In other words, the reading that is first available for (8.85) with multiple gaps is a bizzare reading in which the perceiver is being urged to guess who the speaker got from the present, rather than who the speaker got the present from. Engdahl (1982:169–170) notes that if symmetric predicates are used or if the gaps are of distinct kinds, then a resumptive is not necessary to get an intersecting reading. The following example is a case of gaps disambiguated by kind:

(8.93)

Sina	föräldrar$_i$	är	det	lätt	att	glömma	hur	mycket$_j$	man	är skyldig	__$_i$ __$_j$
SELF's	parents	is	it	easy	too	forget	how	much	one	owes	__ __

It is easy to forget how much one owes one's parents.
(Engdahl 1982:169, (80))

The crossing dependency case can also be explained as a complexity-resumptive case and therefore should not be captured in the grammar.

8.1.2.4 Summary and discussion

Three kinds of processing-resumptives have been proposed and investigated in this section: island-resumptives, ECP-resumptives, and complexity-resumptives. The parsing model offers explanations for all three phenomena. The basic outline of the model is repeated here:

1. Parsing is incremental.
2. Incremental parsing attempts to construct locally well-formed structures.
3. Global well-formedness applies only to the output of parsing.
4. Parsing is constrained by memory limitations based on complexity factors.
5. The result of incremental parsing is incrementally interpreted.
6. Parsing of unbounded dependencies is filler-driven.
7. Unsuccessful parsing results in reanalysis.

The components of the model are supported by the psycholinguistic literature, although their exact nature is far from a settled matter.

The remaining questions posed at the beginning of section 8.1.2 can now be answered.

1. Why is it that although speakers of language that have no syntactic resumptives produce processing-resumptives, they
   (a) reject some sentences with processing-resumptives as ill-formed?

(b) prefer some sentences with processing-resumptives in certain environments to sentences where the resumptive is absent?

The sentences that speakers reject as ill-formed are those that involve island- and ECP-resumptives. They are rejected because they underlyingly ungrammatical — i.e., they do not meet global well-formedness criteria — and receive only a partial interpretation. Some partial interpretations are more informative and therefore more acceptable than others. ECP-resumptives are the only case that have been demonstrated to be better than the corresponding gap sentence (McDaniel and Cowart 1999). This is arguably because the gap incurs additional grammatical violations that the resumptive pronoun does not, since the relevant constraint (ECP / *that*-trace) by definition applies only to gaps. Island and ECP effects are discussed further in section 8.2.3 below.

The sentences that speakers supposedly do not reject are those involving complexity-resumptives. Erteschik-Shir (1992) discusses complexity-resumptives having to do with distance and her judgements are that deeply embedded resumptives are well-formed. I also argued that the resumptive pronouns that do not fit the bill of syntactic resumptives in Swedish are complexity-resumptives. These resumptives are also perceived as grammatical. The theory expects this to be the case, because the structures underlying complexity-resumptives after reanalysis are grammatical. This expectation has not been confirmed by experimental findings (see Alexopoulou and Keller 2002, 2003), but it has not been disconfirmed either, since the relevant experiments did not test complexity-resumptives that were embedded more than two clauses deep. These are not expected to be well-formed if the filler is still active. These experiments are discussed further in the next section.

The next question was:

2. How is it that speakers interpret processing-resumptives?

Speakers interpret processing-resumptives incrementally, using the normal grammar. Island- and ECP-resumptives receive only partial interpretation, which may or may not be informative. Complexity-resumptives are interpreted like gaps, since reanalysis removes the pronoun.

The last question was:

3. If a language has syntactic resumptives (e.g., Irish, Hebrew, Swedish) how does this aspect of its grammar affect processing resumptives?

   (a) Can a language have both kinds of resumptive and if so, under what conditions?

   (b) Will processing-resumptives take on different characteristics in a language that also has syntactic resumptives?

Swedish has both syntactic resumptives and processing-resumptives. The conditions that govern its processing-resumptives are just the same condition that govern the ones in English, except that island-resumptives do not arise due to the general lack of islands in the language and there are no ECP-resumptives, because in that environment Swedish has syntactic resumptives. The complexity-resumptives yield to the general explanation of complexity resumptives. The answer to the question of whether processing-resumptives take on different characteristics in a language that has syntactic resumptives therefore seems to be negative at this stage.

As for the general question of how syntactic resumptives might affect processing-resumptives, the language that offers the most promise of the three that I have been looking at in depth would seem to be Irish, since it has the most comprehensive and robust grammaticized resumptive strategy. However, it is hard to see how Irish could have processing-resumptives at all. Island-resumptives and ECP-resumptives are irrelevant, because the language has syntactic resumptives in these environments. Given the analysis of filler-gap dependencies in which the filler is successively passed up from complement to complement, one wonders see how complexity-resumptives could possibly arise. The filler is integrated into each new clause, so it is hard to see how it could become inactive. One possibility presents itself, though. It may be that analysis presented in chapter 5 and the analysis of McCloskey (2002) is wrong in treating the Pattern 2 mixed chains as a grammatical phenomenon. Recall that this pattern has the form *aL* ... *aN* ... *Rpro*. The dependency is marked at the top by the filler-gap complementizer *aL* and at the bottom by the binder-resumptive complementizer *aN*. It may be that the pronoun at the bottom is actually a processing-resumptive. However, both grammatical analyses derive this pattern from general properties of the language. There is no real reason to suppose that the resumptive pronoun in question is a processing-resumptive and there is quite an array of grammatical data that would seem to stand in the way of any such assertion. Nevertheless, the processing theory developed here makes several predictions and therefore indicates somethings that would have to be shown about Irish to back up the putative claim. I now turn to the predictions made by the processing model in concert with the grammatical theory.

8.2 Predictions of the overall theory

In this section I want to discuss the predictions of the processing theory, the predictions of the grammatical theory of resumptive pronouns developed in previous chapters, and predictions of the overall theory of resumptives constituted by the processing and grammatical theories taken together. The predictions of the grammatical theory have already been discussed in depth in previous chapters, but it is nevertheless useful to mention them again where appropriate, since this better reveals the big picture.

8.2.1 General predictions

Syntactic resumptives and processing-resumptives alike are ordinary pronouns in this overall theory. A syntactic resumptive is present in the syntax and grammatically sanctioned by a manager resource. Processing-resumptives are inserted through the usual grammatical means and preserve local well-formedness. Complexity-resumptives that are removed by successful reanalysis also must be inserted through the usual grammatical channels, even though the decision is later revised. However, they could not be inserted in the first place if, for example, they did not have the right case or agreement information. In all cases, the simple insertion of the pronoun into local structure means that whatever grammatical constraints the pronoun brings with it must be satisfied. The overall theory therefore makes the following general prediction:

(8.94) The resumptive pronoun's lexical information is preserved.

The term lexical information is meant to include the form of the pronoun and whatever grammatical information it bears. Grammatical information includes agreement, case, and any conditions the pronoun places on its antecedent through lexical specification.

Next let us consider similarities and differences between resumptives and gaps that are predicted by the theory. There are three points of possible similarity or dissimilarity: 1) syntactic, 2) proof-theoretic (Glue proofs), and 3) model-theoretic (Glue meaning language).

(8.95) Complexity-resumptives that are removed by successful reanalysis of a filler display syntactic, proof-theoretic, and model-theoretic characteristics of gaps.

(8.96) Island- and ECP-resumptives do not display any characteristics of gaps.

(8.97) Syntactic resumptives do not display syntactic characteristics of gaps, since in the syntax they are pronouns; however:

1. Syntactic resumptives display any *proof-theoretic* characteristics of gaps, i.e. any characteristics of gaps stated on the proofs, since they are absent at the proof level after their removal by manager resources.
2. Syntactic resumptives display any *model-theoretic* characteristics of gaps, i.e. any characteristics of gaps stated on the meaning language, since their removal by a

manager resource results in the corresponding semantic argument being interpreted like a gap.

Predictions (8.94)–(8.97) will be discussed with respect to particular phenomena in the next few sections.

8.2.2 Interpretation

Since syntactic resumptives and processing-resumptives just are ordinary pronouns, the following prediction is made.

(8.98) Syntactic and processing-resumptives are interpreted as ordinary pronouns.

Syntactic resumptives receive a bound interpretation and this is an intepretation that is available for other pronouns. Island- and ECP-resumptives receive an E-type interpretation, which is also a generally available pronominal interpretation. If E-type interpretation is successfully subsumed to some other interpretive strategy, island- and ECP-resumptives should display the characteristics of that other strategy. Complexity-resumptives are not interpreted at all if successfully reanalyzed and therefore satisfy this vacuously.

A corollary of (8.94) and (8.98) is:

(8.99) Syntactic and processing-resumptives block non-specific / *de dicto* readings.

Zimmermann (1993) shows that non-specific / *de dicto* readings are contingent on properties of certain quantified NPs. Sells (1984, 1987) shows that pronouns in general cannot take these NPs as antecedents. This was discussed in detail in section E of chapter 4, section 5.4 of chapter 5, and section 7.3 of chapter 7. It is therefore a lexical property of pronouns that they cannot take such antecedents and this is preserved under the current theory.

The theory correctly predicts that processing-resumptives in English block the relevant reading:

(8.100) **Island-resumptive**
John is seeking a unicorn that Mary doubts if he will find it.

(8.101) **ECP-resumptive**
John is seeking a unicorn that Mary knows that it will shy away from him.

(8.102) **Complexity-resumptive**
John is seeking a unicorn that Mary claimed Bill told Susan that no one except a fool would persist in the attempt to find it.

None of these sentences permit a non-specific / *de dicto* reading.

8.2.3 Island and ECP effects

The first prediction regarding islands concerns syntactic resumptives and follows from the fact that syntactic resumption involves anaphoric binding which is not island-sensitive. This is a standard prediction made by most theories of resumptives for the simple reason that most theories treat resumption as a kind of anaphoric binding, rather than a kind of movement (for a recent exception, see Boeckx 2001, 2003).

(8.103) Syntactic resumptives are not island- or ECP-sensitive.

This prediction is confirmed by Irish and Hebrew. Swedish is a trickier case, because it does not have that many islands. According to the analysis of the previous chapter the only syntactic resumptives in Swedish occur immediately following material in the left periphery of CP. In standard dialects of Swedish this position is an ECP violator for a gap, though. It is therefore impossible to test the pure island violation.

The part of the following prediction that has to do with grammaticality has been confirmed by experimental work. The part about interpretation is not yet confirmed.

(8.104) Island-resumptives and ECP-resumptives result in local well-formedness but the resulting parse is globally ungrammatical and results in only partial interpretation.

McDaniel and Cowart (1999) and Alexopoulou and Keller (2002, 2003) found that insertion of a resumptive pronoun does not improve the grammaticality of a weak island violation. These experiments were all carried out using similar methodologies that involved using Magnitude Estimation (Bard et al. 1996, Cowart 1997) for grammaticality judgements of written material. Magnitude Estimation allows subjects to construct their own scale and is an inherently relational measure of grammaticality, since subjects compare grammaticality of subsequent items to an initial item to which they have assigned an arbitrary value. Alexopoulou and Keller's experiments were carried out on the web using WebExp,[9] whereas McDaniel and Cowart's was carried out using a scannable line-drawing method (Cowart 1997:74–75). McDaniel and Cowart's experiment was on English. Alexopoulou and Keller (2002) ran experiments for English and Greek that were methodologically identical and Alexopoulou and Keller (2003) ran a third, equivalent experiment for German. In all of these experiments island-resumptives in weak islands were reported to be worse than grammatical

[9] Software and documentation available at `http://www.hcrc.ed.ac.uk/web_exp/`; checked 05/12/2003.

controls and as bad as equivalent items with gaps. Alexopoulou and Keller (2002, 2003) ran items at both one level of embedding and two levels of embedding. A control was included at zero levels of embedding. The zero-embedding control obviously did not contain an island, but it did contain a resumptive pronoun which was judged to be vastly worse than a gap. The weak island-resumptives did not even improve at two levels of embedding. Complexity-resumptives did not improve with embedding either, but it should be noted that two levels of embedding is not thought to be necessarily sufficient for complexity to arise (Lewis 1996) and the theoretical literature also indicates that more embedding than this is required for distance to improve resumption (Erteschik-Shir 1992).

Swets and Ferreira (2003) carried out both a visual and auditory grammaticality judgement task with grammaticality assigned by a forced scale (1 for grammatical, 5 for ungrammatical). They found that subjects assigned weak island sentences containing resumptives a mean judgement of greater than 3 in both the visual and auditory presentations. Sentences that controlled for surface length with no *wh*-island violation, such as *This is a dog who doesn't know what it has*, were assigned a mean judgement of less than 2 in both visual and auditory presentations. Swets and Ferreira did not test corresponding *wh*-islands with gaps instead of resumptives, so their results do not indicate whether resumptives were better or worse than gaps. In sum, the experimental literature shows that weak islands containing island-resumptives are ungrammatical.

The case for strong islands is slightly murkier and perhaps therefore more interesting. Alexopoulou and Keller (2002) tested island-resumptives in strong islands (but not in ECP positions). The following are example items for strong islands at one level of embedding and at two levels of embedding Alexopoulou and Keller (2002):

(8.105) Who does Mary meet the people that will fire __ / <u>him</u>?

(8.106) Who does Jane think that Mary meets the people that will fire __ / <u>him</u>?

It must be noted that the use of the present tense in these example sounds quite odd in English, since it leads to a habitual interpretation that is hard to contextualize. Nevertheless, the point is that in both the English and Greek experiments resumptive pronouns failed to improve the grammaticality of strong island violations. There was no significant difference between the grammaticality of resumptives and gaps in either the one- or two-level embedding. All of the items were judged to be as bad as a zero-level resumptive pronoun:

(8.107) * Who will we fire him?

This item got the worst ratings in both English and Greek and intuitions confirm its ungrammaticality in both languages.

However, in Alexopoulou and Keller's (2003) experiment on German, strong islands were the only condition in which resumptives became significantly better than gaps. It is a little hard to know what to make of this data, though. Resumptive pronouns in strong islands, whether at one or two levels of embedding, were not significantly better than zero-level resumptives, which are as bad in German as in English and Greek. What happened instead was that gaps became drastically bad in strong islands. But the gaps were still not significantly *worse* than the zero-level resumptives. Thus, although the gaps became worse than resumptives, all the data points are crowded together and if we take the zero-level resumptive as the gold standard of ungrammaticality for the experiment, resumptives and gaps alike were ungrammatical. The results show not so much that island-resumptives improve strong islands in German, but rather that German speakers have extremely low tolerance for strong-island violations.

The German results are tremendously interesting, since it has been claimed in the theoretical literature that "standard German seems not to possess the kind of resumptive strategy familiar from English ('intrusive' resumptives) at all" (Merchant 2001:139). The presupposition in this quote is that English *does* have some kind of resumptive strategy. I have argued that this is just a processing strategy though and that the resulting sentences are ungrammatical and only partially interpretable. The experimental results uphold this. The examples that Merchant (2001) gives do not undermine this theoretical position, since all they show is that speakers of German, like speakers of English, resist resumptive pronouns. What would have to be shown is that speakers of German do not even build a partial interpretation for these sentences. That would be more problematic on this theory, but would follow if *wh*-operators in German obligatorily bind variables and never allow E-type pronominal interpretation. In turn, the present theory does not undermine Merchant's own point, which is that sluicing cannot be reduced to a binder-resumptive dependency. This result stands, because all that is necessary to establish it is that German does not allow resumption but allows sluicing, which Merchant (2001) demonstrates to be true. If German does allow resumptives in strong islands, then this undermines both the present theory, because this is predicted to be ungrammatical, and Merchant's theory, since German would after all have some kind of resumptive strategy (though any proponent of the resumptive analysis of sluicing would have to explain why the resumptive strategy is so marginal while sluicing is not). However, in order to establish that German does have a resumptive strategy, it must be demonstrated that resumptives in strong islands are better than controls, not just better than gaps, and this has not been demonstrated.

In addition to testing weak island-resumptives, McDaniel and Cowart (1999) tested ECP-resumptives. They found that ECP-resumptives were in fact significantly better than ECP-gaps. The theory of processing-resumptives developed here does not predict this, but it does not conflict with the theory either. In order to predict this finding, the theory would have to be invested with a notion of degrees of grammaticality (Keller 2000). At present, the theory merely predicts that ECP-resumptives are ungrammatical, which McDaniel and Cowart's results confirm. Their findings can be accommodated in the current theory if we make the auxiliary assumption that, in addition to the island violation that is common to ECP-resumptives and corresponding gaps, an ECP-gap violates a further constraint, namely the *that*-trace filter or its equivalent. This seems like a reasonable assumption and is what is generally independently assumed to be behind the observation that ECP violations in islands are worse than island violations on their own. The present theory undermines the assertion by McDaniel and Cowart (1999:B23) that "[Their] results provide evidence for a framework like Minimalism that incorporates competition among derivations." There is no competition among derivations on the present account and if I am granted the assumption that McDaniel and Cowart (1999) share that ECP-gaps violate additional grammatical constraints that do not apply to pronouns, then their pattern of data is predicted. Therefore, their results are compatible with both a framework that has competition among derivations and one that does not and fails to provide any evidence for the former kind of framework. Insofar as transderivationality is an added theoretical assumption and their account is consistent with a theory that does not make this assumption, their findings actually provide evidence against a transderivational theory, for reasons of parsimony.

In addition to these implications for syntactic and island- and ECP-resumptives, the theory makes predictions about complexity-resumptives with respect to island and ECP effects:

(8.108) Complexity-resumptives in an island or ECP configuration in a language that does not have grammatical constraints against the relevant configuration display the following characteristics:

a. In short / non-complex dependencies where the filler is active, the complexity-resumptive is ungrammatical.

b. In long / complex dependencies where the filler is no longer active, the complexity-resumptive leads to successful reanalysis and the sentence is grammatical.

These predictions have not been verified by experimental work to my knowledge, but there is data in the theoretical literature that supports them.

The first prediction is verified by Swedish pairs like the following:

(8.109) Vilken tavla kände du faktiskt killen som målat?
which picture knew you in fact the.guy that painted
Which painting did you actually know the guy who painted?
(Engdahl 1985:10, (15))

(8.110) * Vilken tavla kände du faktiskt killen som målat den?
which picture knew you in fact the.guy that painted it
Which painting did you actually know the guy who painted (it)?
(Engdahl 1985:10, (15))

The first sentence is a short strong island violation that the grammar of Swedish allows. The corresponding sentence with a processing-resumptive is ungrammatical.

The second prediction is also verified by Swedish. I argued in section 8.1.2.3 above that extraction out of a non-extraposed sentential subject in Swedish counts as complex and noted that this is in accord with what has been claimed in the psycholinguistic literature, although these claims were not made about Swedish. If the argument that these extractions are complex is correct, the theory correctly predicts that a resumptive pronoun is possible instead of the gap, as noted above. The relevant sentence is repeated here:

(8.111) Vilken skådespelare var det att publiken inte kände igen honom ganska konstigt?
which actor was it that the.audience not recognize him rather strange
(Which actor was that the audience did not recognize him rather strange?)
(Engdahl 1982:165, (58))

8.2.4 Local well-formedness

The experiments discussed in the previous section confirm the global ill-formedness of island- and ECP-resumptives, but they have nothing to say about local well-formedness, since they were all off-line experiments and therefore only accessed judgements of global well-formedness. The predictions of the theory with respect to processing-resumptives is that sentences containing such resumptives are *globally* ill-formed, but that the local structure containing the resumptive is locally well-formed. The theory therefore makes the following prediction about the timing of on-line processing:

(8.112) If an on-line processing task measures local well-formedness, structures containing processing-resumptives will do better on the measure than corresponding structures with gaps.

A common measure of local well-formedness, or at least global well-formedness up to the point of interest, is a self-paced reading task. If the subject takes longer to initiate presentation of the next word after a gap than after a processing-resumptive, the prediction above would be supported.

8.2.5 Form-identity effects

On the standard assumption that any non-default case on a *wh*-phrase or relative pronoun at the top of an unbounded dependency is assigned in the base position, the theory makes the following prediction:

(8.113) The binder in a syntactic binder-resumptive dependency cannot bear the case of the syntactic resumptive.

This is just Merchant's (2001) *Case and resumptive-binding operator generalization*, which was initially discussed in chapter 4, section F. It follows from the theory because syntactic resumptives are base-generated pronouns. The binder does not originate in the pronominal position and therefore cannot receive that case. The binder will instead receive some default case, typically nominative.

The theory makes the opposite prediction with respect to complexity-resumptives that result in successful reanalysis. The result of reanalysis is integration of a filler (not a resumptive binder) into the position in which the complexity-resumptive occurs.

(8.114) A filler that successfully reanalyzes a complexity-resumptive bears the case of the base position.

If case is assigned to the base position and the filler in a complexity-resumptive reanalyzes the resumptive pronoun as its gap, then it must bear the case appropriate for that position, since case is assigned locally, or else it could not be integrated successfully. I do not have any data from a language with the right case-marking properties to test this prediction.

The prediction for island- and ECP-resumptives is less straightforward and depends on auxiliary assumptions. These cases are by definition ungrammatical. Therefore, whether the filler bears case associated with the pronominal position or it bears neutral case is to some extent beside the point: the sentence is ungrammatical in either scenario. However, I suppose that it seems reasonable that bearing case which is not grammatically sanctioned could lead to additional ungrammaticality. On this assumption, a filler with neutral case should lead to a lesser degree of ungrammaticality than a filler with non-neutral case. As stated above, though, the present theory does not have a notion of graded grammaticality built-in, so any such prediction would depend on adding such a notion to the theory.

8.2.6 Weak crossover

The theory makes the following prediction about weak crossover for syntactic resumptives:

(8.115) Syntactic resumptives do not result in weak crossover violations.

This was confirmed in previous chapters by data from Irish, Hebrew, and Swedish.

Complexity-resumptives are reanalyzed as gaps, but island- and ECP-resumptives are not. The theory makes the following two predictions about weak crossover:

(8.116) Island- and ECP-resumptives do not result in weak crossover violations.

(8.117) Complexity-resumptives result in weak crossover violations.

The first prediction is not easy to test, since the relevant sentences are ungrammatical. Once again, it may be that weak crossover leads to additional ungrammaticality. But since weak crossover is a fairly subtle effect, it will probably be swamped by the ungrammaticality of the island violation. However, it does seem that the following weak crossover example is worse with a gap than with an island-resumptive:

(8.118) Who$_i$ did his$_i$ mother wonder if Mary likes him$_i$?
$>$

(8.119) Who$_i$ did his$_i$ mother wonder if Mary likes _$_i$?

This will be quite hard to test experimentally, though. We are after all talking about relative grammaticality of two sentences that speakers judge to be independently bad.

Testing complexity-resumptives for weak crossover is also quite difficult. Since the sentences are independently long or otherwise complex, it is quite hard to bring out the weak crossover effect. The following example with a gap is quite a bit worse than the example with a pronoun, but we know that this level of embedding leads to gaps being degraded anyway:

(8.120) Who$_i$ did his$_i$ mother tell Jo that Nikki said that Thora suspects that Alli saw him$_i$ yesterday.
$>$

(8.121) Who$_i$ did his$_i$ mother tell Jo that Nikki said that Thora suspects that Alli saw $\_\__i$ yesterday.

Furthermore, I have a rather strong intuition that the complexity-resumptive example (8.120) is worse than an example in which both pronouns are embedded quite low:

(8.122) Who$_i$ did Alli tell Jo that Nikki said that Thora suspects that his$_i$ mother saw him$_i$ yesterday.
$>$

(8.123) Who$_i$ did his$_i$ mother tell Jo that Nikki said that Thora suspects that Alli saw him$_i$ yesterday.

If these judgements are upheld, it would seem to indicate that weak crossover is perceived quite early.

8.2.7 Reconstruction

The theory makes the following prediction about reconstruction:

(8.124) Syntactic resumptives block reconstruction.

This prediction was confirmed for subject resumptives in Swedish (see section 7.1.5.1).

The processing theory makes the following additional predictions, based on the fact that only a complexity-resumptive is reanalyzed as a gap:

(8.125) Island- and ECP-resumptives block reconstruction.

(8.126) Complexity-resumptives do not block reconstruction.

Safir (1986:685) has claimed that English island-resumptives do not allow reconstruction (Safir's judgement is given):

(8.127) ?*Michael Jackson, a picture of whom Mary wondered who would buy it, arrives tomorrow.

This lends some initial support to the theory.

The case of complexity-resumptives was confirmed by the original reconstruction data from Zaenen et al. (1981), although I noted in chapter 4, section G that reconstruction is not straightforward even for these cases:

(8.128) Vilken av sina$_i$ flickvänner undrade du om det att Kalle$_i$ inte längre fick träffa $\_\__i$
which of his girlfriends wondered you if it that Kalle no longer sees $\_\_$
kunde ligga bakom hans dåliga humör?
could lie behind his bad mood
Which of his girlfriends do you think the fact that Kalle no longer gets to see could be behind his bad mood?
(Zaenen et al. 1981:680, (5))

The resumptive in this example is in a non-extraposed sentential subject. These resumptives were argued to be complexity-resumptives, and the possibility of reconstruction is correctly predicted. Clearly more work needs to be done on the relationship between resumptives and reconstruction.

8.2.8 Parasitic gaps and ATB

If parasitic gaps and ATB can be analyzed at the proof level, as argued for in section 7.1.5.1 of chapter 7, the theory makes the following predictions, which were discussed in that section:

(8.129) Syntactic resumptives license parasitic gaps.

(8.130) Syntactic resumptives do not violate the constraint on ATB extraction.

These predictions were confirmed by Swedish, as discussed in section 7.1.5.1. Notice that they do not mean that no other constraints can hold of these structures. For example, the fact that Hebrew syntactic resumptives do not robustly license parasitic gaps can be due to other aspects of its grammar, such as the Leftness Condition discussed by Sells (1984) and Demirdache (1991).

The processing theory makes the following predictions about parasitic gaps and ATB extraction:

(8.131) Island- and ECP-resumptives do not license parasitic gaps and lead to ATB extraction violations.

(8.132) Complexity-resumptives license parasitic gaps and do not violate the constraint on ATB extraction.

The island / ECP case is again hard to test, since these are ungrammatical anyway, but the following examples give some support:

(8.133) *What did you wonder if it repulsed John upon tasting?

(8.134) *Which cats do you forget if John deloused them without hurting?

Furthermore, a weak island with a gap — which is normally perceived of as only weakly ungrammatical, as confirmed by experimental results (Alexopoulou and Keller 2002, 2003) — licenses a parasitic gap, whereas the same example with an island-resumptive does not:

(8.135) Which cake do you forget if John dropped before tasting?
$>$

(8.136) Which cake do you forget if John dropped it before tasting?

ATB extraction with a weak island gap are similarly better than with an island-resumptive:

(8.137) What show do you forget if Alli watches but dislikes?
$>$

(8.138) What show do you forget if Alli watches it but dislikes?

The prediction about complexity-resumptives does not initially seem to be supported, because a complexity-resumptive does not seem to allow a parasitic gap in examples like the following:

(8.139) *What did Becca tell Jo that Nikki said that Thora suspected that Alli sold it after buying?

However, this could well be due to the adjunct being parsed with the material containing the complexity-resumptive, in which case the parasitic gap is not perceived as having a proper host gap. If more material is added to the right of the complexity-resumptive, the sentence becomes much improved:

(8.140) ?What did Becca tell Jo that Nikki said that Thora suspected that Alli sold it to the scary man from Wellington who frightens children after buying?

ATB cases pattern similarly. They are bad if the ATB gap is parsed with the complexity-resumptive, but improve with the addition of separating material:

(8.141) Which book did Becca tell Jo that Nikki said that Thora suspected that Alli reads it repeatedly to the kids at Thora's preschool who are there on Thursdays and still enjoys? $>$

(8.142) Which book did Becca tell Jo that Nikki said that Thora suspected that Alli reads it repeatedly and still enjoys?

For some reason that I do not understand, I find the case without intervening material better for ATB than for parasitic gaps.

Conclusion

I have presented a processing model that explains several facets of the distribution of non-grammaticized resumptive pronouns, which I have called processing-resumptives. The model is based on the following assumptions:

(8.143)
1. Production and parsing are incremental.
2. Incremental production and parsing attempt to construct *locally* well-formed structures.
3. Global well-formedness applies only to the output of production and parsing.
4. Production and parsing are constrained by memory limitations.

These are all assumptions that are supported by the psycholinguistic literature, although the model itself has not yet been tested experimentally. Several predictions of the processing model together with the resource management theory of grammaticized resumptives were identified in the last section. These predictions can form the basis for future experimental work.

The processing model was further articulated in models of production and parsing. The production model explained how processing-resumptives are produced, despite being rejected as ungrammatical by native speakers. The model was based on the notion of fragments in LFG, which allow a definition of locally well-formed structures. I argued that in producing locally well-formed structures that are consistent with the production plan speakers can insert pronouns and other nominals in positions where a filler ought to be integrated. This leads to local well-formedness, even though the overall result is global ill-formedness. However, since production is incremental, such productions can nevertheless be uttered. This accounted for the Prince (1990) examples like the following, where a nominal occurs where a filler could be successfully integrated:

(8.144) You get a rack that the bike will sit on it.

Another option for the formation of locally well-formed structure is to integrate the filler, resulting in the fully locally and globally well-formed equivalent of this example without the resumptive.

The situation for the production of processing-resumptives in islands, as originally discussed by Kroch (1981), is similar. The key difference is that the island blocks integration of the filler. This means that the only choice for constructing locally well-formed structure is to insert in the gap position in the island a pronoun or other nominal that is consistent with the production plan and local well-formedness. This gets sentences like the following:

(8.145) This is a donkey that I don't know where it lives.

(8.146) There was one prisoner that we didn't understand why the guy was even in jail.

Locally well-formed structures are possible in these cases because the island theory of LFG identifies islands externally to the island structure through constraints on outside-in functional uncertainty. Theories which identify islands internally would have difficulty even generating the required local structure.

The parsing model explained how processing-resumptives are parsed despite their ungrammaticality. Three major subclasses of processing-resumptives were identified: island-resumptives, ECP-resumptives, and complexity-resumptives. Island- and ECP-resumptives are underlyingly ungrammatical on the model, which is supported by recent experimental findings. However, parsing of the relevant sentences leads to partial interpretation that can nevertheless be informative. Whether the partial interpretation is informative depends on properties of the resumptive's binder or antecedent. If the resumptive is bound by an operator, e.g. a quantifier or *wh*-word, the resulting partial interpretation is uninformative. By contrast, if the resumptive is bound by a type e binder, such as a name, indefinite, or definite, partial interpretation is informative. This explained patterns of data that have been noticed in the literature for intrusive pronouns. I argued in support of Chao and Sells (1983) that the only interpretation that a processing-resumptive with a quantificational antecedent can attempt is an E-type interpretation. The E-type interpretation of operator-bound processing-resumptives explained the impossibility of giving list answers to resumptive *wh*-questions.

The memory limitations that I assume for parsing were instrumental in the model's explanation of complexity-resumptives. I also assumed the Active Filler Strategy, whereby the integration of an unbounded dependency is driven by the filler rather than by the gap. Complexity-resumptives occur when a pronoun is encountered after the active filler has dropped out of working memory. When the pronoun finds its antecedent, the filler-gap dependency is reanalyzed and the pronoun is removed. Complexity-resumptives are therefore reanalyzed as gaps. Whether the reanalysis results in well-formedness depends on whether the underlying structure is well-formed. In the typical distance resumptive cases discussed by Erteschik-Shir (1992), the underlying structure is grammatical. The theory of complexity resumptives was then applied to an explanation of the non-grammaticized Swedish resumptives that were set aside at the beginning of chapter 7.

Part III

Extending Resumption

Chapter 9

Copy raising in English

Introduction[1]

In this chapter I show how the resource management theory of resumption can unify resumptive pronouns and copy raising pronouns. It has been previously observed that the two phenomena are related (McCloskey and Sells 1988, Boeckx 2003), but they have resisted a unified, formal analysis. The analysis of copy raising needs a little scene-setting, though. In particular, I spend the first part of the chapter arguing that true copy raising verbs (*seem* and *appear* in English) should be distinguished from superficially similar perception verbs (*look*, *sound*, *smell*, *feel*, *taste*).

I introduce the two related phenomena in section 9.1 and claim that copy raising verbs and these perceptions verbs share the same syntax but have different compositional semantics. In particular, copy raising verbs contribute manager resources, whereas the perceptions verbs do not. The equivalent syntax accounts for their similarities and the difference in lexical specification of manager resources accounts for why copy raising verbs require copy pronouns whereas the perception verbs do not. In section 9.2 I present a critical review of some previous approaches to copy raising. Section 9.3 presents the shared syntax for the copy raising and perception verbs. In particular, both verb classes take predicative complements, which in the relevant cases are realized as predicative PPs headed by the prepositions *like* and *as*. The similarities between the two verb classes follow from their identical syntax. I show how a lexicalist analysis that localizes special properties of the two constructions in the lexical entries for the prepositions *like* and *as* accounts for the curious possibility of raised and doubled expletives. Finally, in section 9.4 I show how the resource management theory of resumption extends to copy raising. I also show that certain facts about the scopal

[1]This chapter is a revised and expanded version of Asudeh (2004).

behaviour of copy raising subjects follows from the proposed compositional semantics. The section ends with a discussion of the prospects for extending the analysis of copy raising to other languages. A puzzle about Irish copy raising is shown to be solved by the theory.

9.1 Copy raising and perceptual resemblance

Alongside nonfinite and predicative raising complements, as in (9.1), English has finite raising complements, as in (9.2):

(9.1) a. Richard seems / appears to have won

b. Richard seems / appears sad.

(9.2) a. Richard seems like he won.

b. Richard seemed as if he hated the movie.

c. Richard appeared like he was happy.

d. Richard appears as though he got caught in the rain.

Finite raising complements are typologically common. In many languages, they are the *only* raising complements, as illustrated by Greek (9.3) and Farsi (9.4):[2]

(9.3) a. Fenete oti i kopeles θa fevgun.
seem.3SG COMP the girls.NOM FUT leave
It seems that the girls will be leaving.
(Perlmutter and Soames 1979:156, (10); based on Joseph 1976)

b. I kopeles fenonde na fevgun.
the girls.NOM seem.3PL SUBJUNCTIVE leave
The girls seem to be leaving.
(Perlmutter and Soames 1979:156, (11); based on Joseph 1976)

(9.4) a. Benæzær miad (ke) bæcheha khæste hæstænd.
opinion PRES.come.3SG (COMP) children tired be.3PL
It seems that the children are tired.

[2]Ghomeshi (2001) states that the subject in examples like (9.4b) is actually a topicalized constituent, i.e., not a subject, but data that I have gathered from my informants challenges this contention, indicating that there could well be dialect variation at play. Further work is required.

b.	Bæcheha	benæzær	miand	(ke)	khæste hæstænd.
	children	opinion	PRES.come.3PL		tired be.3PL
	The children seem to be tired.				

In both (9.3b) and (9.4b) the complement to the raising verb is a finite pro-drop verb. The complement is saturated by a null pronominal copy of the plural matrix subject, as indicated by plural agreement on the embedded verb. The matrix subject also agrees with the matrix verb.

The phenomenon in (9.2)–(9.4) is standardly referred to as *copy raising*. Unfortunately, copy raising in Greek does not seem to be as robust as initially reported — many speakers reject (9.3b).[3] The Farsi examples also raise complex issues: it is not clear if the matrix copy raising subject is a subject (see footnote 2) and speakers vary on whether there is agreement between the putative copy raising subject and the matrix verb. However, copy raising has been reported in a number of other languages as well, including Samoan (Chung 1978), Hebrew (Lappin 1984), Irish (McCloskey and Sells 1988), Haitian Creole (Déprez 1992), Igbo (Ura 1998), and Turkish (Moore 1998). It is thus neither a rare construction nor one that is idiosyncratic to Indo-European languages, although I think it is fair to say that at this point it is less well-understood than paradigmatic raising from infinitivals.

Rogers (1971, 1972, 1973, 1974), in pioneering work on perceptual reports in English, proposed the transformation "Richard" (which is actually doubling and copying; see Postal 1974:268, fn.1 and Horn 1981:353–356) to account for an alternation in what I will call *perceptual resemblance verbs*, shown in (9.5). Rogers sought to assimilate copy raising verbs such as *seem* and *appear* in (9.2) to the Richard class of perception verbs, based on the fact that they participate in the same alternation, as shown in (9.6).

(9.5)	a.	Richard	smells	like	he smokes.
			feels	as if	
			looks	as though	
			sounds		
			tastes		
	b.	It smells like Richard smokes.			

(9.6) a. Richard seems like he smokes.

b. It seems like Richard smokes.

[3] This was initially brought to my attention by Jason Merchant (p.c.; 25/04/2002) and my own work with native speakers has confirmed it.

Recent work continues to treat copy raising verbs (CRVs) and perceptual resemblance verbs (PRVs) as a unitary phenomenon (Bender and Flickinger 1999, Potsdam and Runner 2002, Matushansky 2002), but despite certain similarities, there is a striking difference between the classes of verb: CRVs require a pronominal copy in their complements, while PRVs do not.[4]

My key claims about the syntax of copy raising verbs and perceptual resemblance verbs are as follows:

(9.7) The syntax of copy raising and perceptual resemblance verbs is *identical*.

(9.8) The complement clause is a predicative prepositional phrase headed by *like* or *as*.

The similarities between CRVs and PRVs follow from their identical syntax and complementation..

My key semantic claim about CRVs and PRVs is:

(9.9) The compositional semantics of CRVs and PRVs is different with respect to how they compose with their complements:

A copy raising verb consumes a pronominal resource in its complement and composes with a complement containing an unsaturated proposition, whereas a perceptual resemblance verb does not consume a pronominal and composes with a complement containing a saturated proposition.

The difference between CRVs and PRVs, that the former require a pronominal copy while the latter do not, follows. In other words, copy raising is a case of resumption and will be analyzed in terms of the resource management theory that has already been applied extensively to analyses of resumptive pronouns.

9.1.1 The data

There are five key similarities between copy raising and perceptual resemblance verbs, some of which have been alluded to already:

1. CRVs and PRVs take complements introduced by the same set of subordinating conjunctions (*like, as if, as though*); also see (9.2) and (9.5) above.

   (9.10) Richard seems like he drinks.

[4]Matushansky (2002:221) notices that pronouns “seem near-obligatory” in the complements of copy raising verbs, but does not observe the asymmetry between the two verb classes. Furthermore, the obligatoriness of the copy pronoun does not follow from her analysis.

(9.11) Richard looks / smells like he drinks.

2. PRVs and raising verbs can take predicative complements:

(9.12) Richard seems drunk.

(9.13) Richard looks / smells drunk.

3. CRVs and PRVs can take expletive subjects:

(9.14) It seems like Richard won.

(9.15) It looks / smells like Richard is drunk.

4. CRVs and PRVs can raise expletives (Rogers 1971, Postal 1974, Horn 1981):[5]

(9.16) %There seems like there is a problem with the car.

(9.17) %There looks / smells like there is a problem with the car.

5. CRVs and PRVs cannot take scope over their subjects (Lappin 1984, Potsdam and Runner 2002):

(9.18) Many goblins seemed like they had hidden in the coal.
$many > seem$
*$seem > many$

(9.19) a. Many goblins looked like they had hidden in the coal.
$many > seem$
*$look > many$

b. Many goblins smelled like they had hidden in the coal.
$many > seem$
*$smell > many$

The crucial difference between copy raising and perceptual resemblance verbs was mentioned in (9.9) and is repeated here:

1. A CRV needs a bound "copy" of its subject in its complement (Lappin 1983); a PRV does not. Copy raising verbs thus constitute a resumption environment.

[5]There is dialectal variation here (Horn 1981, Potsdam and Runner 2002), which will be accounted for below.

(9.20) *Richard seems like Gonzo has been baking.

(9.21) Richard smells like Gonzo has been baking.

No account of copy raising that I am aware of has noticed the distinction between CRVs and PRVs with respect to the pronominal copy requirement shown here.

9.2 Previous approaches

The original Richard transformation posited by Rogers moves the subject of the clause after *like / as* into the matrix subject position and leaves a pronominal copy in its place. This kind of construction-specific, ad hoc transformation is clearly undesirable and does not fit into current linguistic theory, in which there is a general consensus that variation is principally lexically conditioned.

Ura's (1998) Minimalist proposal suffers from a similar weakness. He proposes a language-particular rule for copy raising, which he calls *Rule S*, that spells out a trace in an A-chain as a pronominal copy of the A-chain's head. Potsdam and Runner (2002) note this problem and further point out that since Ura's proposal treats Rule S as a last resort operation he predicts that copy raising should function like other pronominal insertion operations in English that are candidates for a last resort characterization, in particular intrusive pronouns (Chao and Sells 1983, Sells 1984); this prediction is incorrect, as shown in detail by Potsdam and Runner (2002).

Potsdam and Runner also point out that Ura's proposal involves A-movement across a tensed clause boundary. This violates the Tensed S Conditon of Chomsky (1973). Although the Tensed S Condition itself is theoretically outdated and no longer construed as a theoretical construct, it continues to be descriptively accurate. Potsdam and Runner (2002) also point out that the effects of the Tensed S Condition are still derived in current transformational theory in the Minimalist Program. In particular, it holds under Chomsky's recent theory of *phases* (Chomsky 2000, 2001). Phases include tensed clauses (CPs). In order for an element to undergo A-movement out of a phase it must first move to the edge of the phase. However, there is no motivation for A-movement to the edge of the tensed CP in question, since no features of the moved element or landing site need checking. More generally, under Minimalist assumptions, the central problem is why the copy-raised subject would move from the embedded position when 1) the embedded position apparently satisfies all of the A-moved element's feature-checking requirements and 2) the moved element in its base position satisfies all of the embedded position's feature-checking requirements.

Boeckx (2001:76–77,165–166, fn.1) mentions that his Minimalist analyses of resumptive pronouns could possibly be extended to copy raising, although he explicitly sets this phenomenon aside.

His analysis of resumptive pronouns involves Merging a constituent consisting of a resumptive pronoun and its antecedent and subsequent $\overline{\text{A}}$-movement of the antecedent, stranding the resumptive pronoun in the base position. The straightforward extension of this analysis to copy raising — Merge of pronoun and antecedent plus subsequent *A-movement* and stranding — would encounter the Tensed S problem that Potsdam and Runner (2002) discuss for Ura's analysis: why is A-movement possible out of a tensed clause?

Potsdam and Runner (2002) themselves propose that in fact both the copy-raised subject and its pronominal copy are base-generated and that an A-chain is formed between these two elements to make sure that the matrix subject does not violate Full Interpretation (FI; Chomsky 1986). While this proposal avoids the difficulties noted above, the appeal to Full Interpretation suffers the criticisms offered in section 3.3.6 of chapter 3. Furthermore, it is still unclear what the difference is between a language that has copy raising and one that does not. In fact, there would seem to be nothing more lexicalist about Potsdam and Runner's proposal than Ura's. Second, although Potsdam and Runner rightly propose that this kind of A-chain formation, if available at all, must be available in general, it is unclear what conditions limit it, leaving us with the following question: if pronominal elements can form A-chains with nominals so that the latter can satisfy FI, why is this strategy not generally available? Not only is there potential for wild overgeneration, the proposal also offers no explanation as to why pronouns are obligatory in CRV complements but not in PRV complements. By contrast, the proposal in this chapter conditions copy raising purely lexically, which accounts for the limited distribution of the relevant pronouns and also accounts for linguistic variation according to current theory. Third, Potsdam and Runner fail to account for the similarities between CRV / PRV complements headed by *like / as* and predicative complements. Fourth, no explanation is offered of why copy raising can occur with only these particular complements. They offer a speculative explanation in terms of phases (Chomsky 2000, 2001) as to why copy raising from a CP headed by *that* is impossible, but as we will see in the next section there is reason to believe that the copy pronoun is sometimes contained in a CP anyway, so this is not a general solution.

Matushansky (2002) presents an exploration of scalar complements to the verb *seem* that touches on various issues that are relevant to the issue of copy raising as resumption and the similarities and differences between copy raising and perceptual resemblance verbs. However, the main concerns of this chapter and Matushansky (2002) are largely orthogonal, since she is principally concerned with the syntax and semantics of scalar complements to *seem*. There are a number of key points of divergence that should be mentioned, though. First, Matushansky is largely concerned with predicative complements to *seem*, since these are the ones that exhibit the scalarity effects she is interested in. She assumes that complements headed by *like* and *as* are CPs and not predicative complements (Matushansky 2002:221). She therefore sets these complements aside after some initial discussion (Matushansky 2002:228). However, I argue at length in the next section that the complements to copy raising and perceptual resemblance verbs are predicative PPs and not CPs. Second, Matushansky assumes that subjects of copy raising verbs are assigned a theta-role (Matushansky 2002:221). This fails to account for the obligatoriness of the copy pronoun and the difference between CRVs and PRVs with respect to resumption. Third, on a related note, Matushansky claims that predicative complements to *seem* have a perceptual rather than epistemic semantics. However, no explanation is offered for what the perceptual semantics is or how it is derived. It is hard to conceive of a semantics for *seem* that treats it as anything other than a monadic predicate, so the proposed distinction between epistemic *seem* and perceptual *seem* is not readily apparent. By contrast, on the present proposal the perceptual / epistemic distinction to which Matushansky alludes is tied to the semantics of the head of the predicative PP complement of the copy raising verb — *like* or *as* (see section 9.4). It is true that the proposed explanation for the distinction in its current state does not extend to raising verbs with complements not headed by *like* or *as* (e.g., *Richard seems sad*), but it serves as a concrete starting point for further work.

In the next section, I argue that the fact that copy raising is possible from these complements has to do with them being predicative PPs. The claim that the complements are PPs is also made by Maling (1983), Heycock (1994), and Potsdam and Runner (2002), but is not explored in any detail.

9.3 Similarities between CRVs and PRVs are syntactic

Recall from page 366 that the similarities between copy raising and perceptual resemblance verbs are to be accounted for by treating them as syntactically identical. Evidence for this comes from the behaviour of raising verbs and PRVs with respect to predicative complements, to which I turn next. I will afterwards argue that the *like/ as if / as though* complements (henceforth *like*-complements) to CRVs and PRVs are arguments (rather than adjuncts, as might be supposed) and that they are predicative prepositional phrases and can therefore be assimilated to the class of predicative complements.

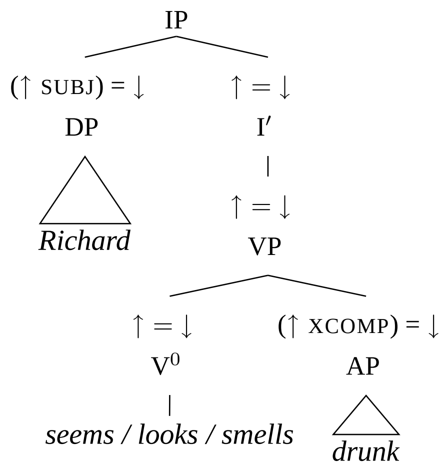
9.3.1 Predicative Complements

As shown in examples (9.12)–(9.13) above, PRVs take predicative complements, as do raising verbs. These can be treated as subject-to-subject raising from an adjectival predicate. The lexical entries for the raising verb and the PRV therefore require a functional control equation:

(9.22) $(\uparrow \text{XCOMP SUBJ}) = (\uparrow \text{SUBJ})$

Examples (9.12)–(9.13) have identical c-structures and f-structures, modulo the verb and adjective:

(9.23) a.



b.
$$\begin{bmatrix} \text{PRED} & \text{‘seem/look/smell’} \\ \text{SUBJ} & \\ \text{XCOMP} & \begin{bmatrix} \text{PRED} & \text{‘drunk’} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{‘Richard’} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

In order to be a raising predicate, a predicate must not select for a thematic subject (or object). PRVs and raising verbs do not select for a subject. It is the predicative complement (AP) that licenses the subject. Of course, predicative complements are not necessarily APs, and can generally be of any major category. Note that raising and perceptual resemblance verbs tend to resist nominals as predicative complements:

(9.24) *Richard seems / looks / smells a student

There is some dialectal and register variation under certain circumstances; see Matushansky (2002:237–239).

In addition, raising and perceptual resemblance verbs take only gradable PPs, not spatio-temporal ones:

(9.25) Richard seems / looks / smells pretty under the weather.

(9.26) *Richard seems / looks / smells under the bed.

This distinction is discussed at length by Maling (1983).

9.3.2 *Like*-complements

In this section, I will argue that *like*-complements to copy raising and perceptual resemblance verbs are arguments (not adjuncts) and that they are in fact predicative prepositional phrases. This allows them to be treated much like other predicative complements.

9.3.2.1 Arguments or adjuncts?

Various syntactic tests show that *like*-complements are in fact arguments. I will present evidence from extraction, deletion, and coordination.[6]

It is possible to extract from CRV and PRV *like*-complements (9.27)–(9.31), but not from more clearly adjunct *like*-phrases (9.32)–(9.33):

(9.27) What did Richard seem like he was ashamed of?

(9.28) What does Richard smell like Mary has been baking?

(9.29) Who does this place look like the floor has been designed by?

(9.30) How much does Richard seem like he enjoys running?

(9.31) How badly did Richard look like he lost in Vegas?

(9.32) a. Richard slinked away like he was ashamed of his actions.

b. *What did Richard slink away like he was ashamed of?

(9.33) a. Richard runs like he enjoys it a lot.

b. *How much does Richard run like he enjoys it?

It is not possible to delete the *like*-complement: it either leads to ungrammaticality (9.34) or changes the meaning of the verb (9.35). By contrast, an adjunct *like*-phrase can be dropped without affecting semantics or grammaticality (9.36):

(9.34) *Richard seemed / sounded / tasted / felt.

[6] See Bender and Flickinger (1999) for further evidence that these are arguments.

(9.35) ≢Richard looked / smelled.

(9.36) a. Richard ran like he couldn't be bothered.

b. Richard ran.

Lastly, it is possible to coordinate the *like*-complement with a predicative argument (9.37)–(9.38), but it is impossible to coordinate an adjunct *like*-phrase with an argument (9.41):[7]

(9.37) Richard seemed quite ashamed and like Gonzo had scolded him.

(9.38) Richard looked filthy and as if the disposal had exploded again.

(9.39) Richard put the ice cream in the freezer like he meant to eat it later.

(9.40) Richard put the ice cream in the freezer and on the shelf.

(9.41) *Richard put the ice cream in the freezer and like he meant to eat it later.

In conclusion, evidence from extraction, deletion and coordination shows that *like*-complements to CRVs and PRVs are in fact arguments.

9.3.2.2 Categorial status

If these complements are arguments, what is their categorial status? There are at least two sensible options for the categorial status of the *like*-complement:

1. *Like*-complements are CPs: *like*, *as if* and *as though* are complementizers.
   (Bender and Flickinger 1999, Matushansky 2002)

2. *Like*-complements are PPs: *like* and *as* are prepositions.
   (Maling 1983, Heycock 1994, Potsdam and Runner 2002, Huddleston and Pullum 2002:971)

I will argue that the second analysis is correct; in particular *like* complements are headed by prepositions with clausal complements.

The first argument comes from the fact that *like*-complements take the same pre-modifiers as prepositions (9.42)–(9.43); these cannot modify complementizers (9.44):

(9.42) a. Richard put the book just on the shelf.

b. Richard smells just as though he has been drinking.

[7]Examples (9.37) and (9.38) are better with the *like*-complement as the second conjunct rather than the first. I assume that this has to do with effects of the sort found in heavy NP shift (Wasow 2002).

(9.43) a. Richard passed the ball almost at the sideline.

b. Richard seems almost like he's been drinking.

(9.44) a. *Richard thinks almost / just that he won.

b. *Richard wonders almost / just whether he won.

c. *Richard asked almost / just if he had been bad.

d. *Richard wanted almost / just for Gonzo to leave.

The second argument comes from two different kinds of uniformity: uniformity of *as / like* with prepositions, and uniformity of *if / though* with complementizers. First, treating *as* and *like* as prepositions (there goes one now!) allows us to assimilate their uses in *like*-complements to prepositional uses:

(9.45) Richard dressed like / as Charlie Chaplin.

(9.46) Richard is wary of actors as directors.

(9.47) With transformations like these, who needs global rules?

Second, treating *as* as a preposition taking a clausal complement allows us to assimilate the occurrences of *if* and *though* in *as if / as though* to normal complementizer uses:[8]

(9.48) Richard rarely drinks, though he enjoys the occasional beer.

(9.49) Richard wondered if he should leave early.

In other words, *as* in *like-complements* takes a CP complement introduced by *if* or *though*.

Treating *if* in *as if* as a complementizer also explains the possibility of subjunctive mood with *as if*, since the complementizer *if* generally licenses subjunctive:

(9.50) If he were alive today, John Lennon would probably protest the war.

[8]Huddleston and Pullum (2002:971) classify the subordinating conjunction *though* as a preposition rather than a complementizer. Similarly, they classify *as if* as a complex preposition and presumably would do the same for *as though*, although it is not found in their list. This classification does not really affect things here. The main point is that *like*-complements are predicative PPs headed by P^0 and on this point there is agreement between their classification and this account. In generative terms, it seems reasonably to assign the use of *though* in question the category C^0.

(9.51) But the way the section was constructed, it seemed as if he were telling the party it was bigoted and no longer welcome at his convention.
(Peggy Noonan, "Welcome to Hard Truths", *Time*, August 26, 1996.
`http://www.cnn.com/ALLPOLITICS/1996/analysis/time/9608/26/noonan.shtml`
checked 29/02/2004)

The alternative is to postulate, less parsimoniously, that *if* and *as if* are both complementizers that license the subjunctive.

The third argument comes from dialect variation:[9] certain dialects of English use full CPs after *like*. An internet search turned up several examples, of which I present just two:

(9.52) I had some interest in Bill Bradley but it seemed like that he totally catered to the pro-choice people on the abortion side and I thought that he supported some reconciliation on this issue as Tony Campolo and Jim Wallis have promoted.
(`http://www.sojo.net/sojomail/index.cfm/action/sojomail/issue/031700.html`
checked 29/02/2004)

(9.53) My bike barely missed him as he seemed like that he didn't even notice us.
(Douglas T., "Drunken Apparition", *Paranormal Story Archives*, March 2002
`http://paranormal.about.com/library/blstory_march02_01.htm`
checked 29/02/2004)

If we were to maintain that *like* is a complementizer, then the *like that* dialect would either have a double complementizer or we would have to maintain that in this dialect *like* is a preposition while in the standard dialect it is a complementizer. By contrast a more elegant explanation is possible if we assume that *like* is a preposition in both dialects: in the *like that* dialect *like* takes a CP complement, whereas in other dialects (including the one reported here) it takes an IP complement.

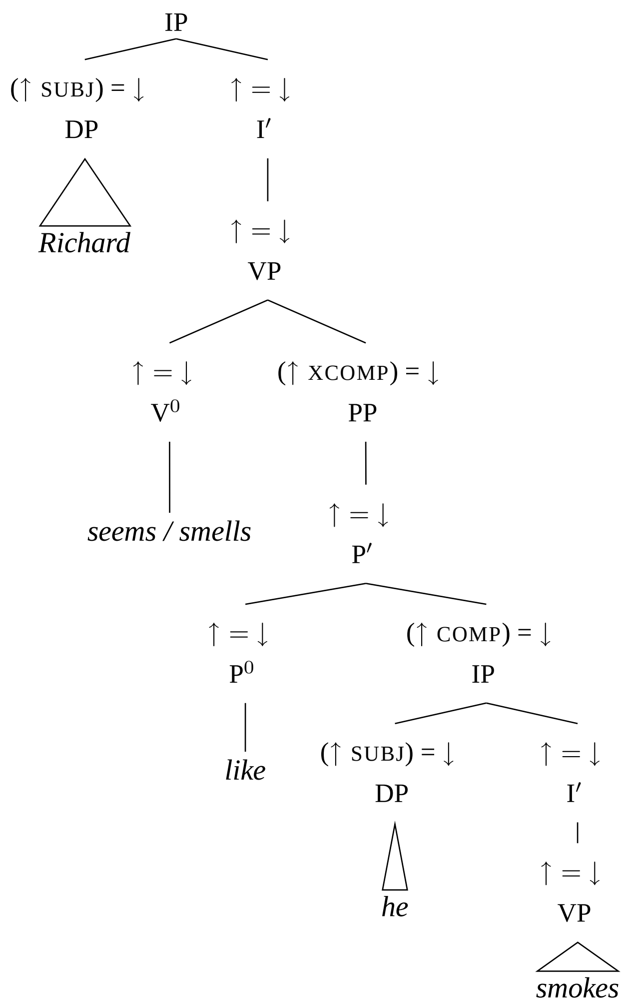
In conclusion, evidence from modification, uniformity, and dialect variation suggests that *like*-complements are prepositional phrases, headed by *like* or *as*. *Like* takes an IP or CP complement, depending on dialect, while *as* takes a CP complement, headed by *if* or *though*.

Having established that *like*-complements are PPs and that raising verbs and PRVs can take predicative PP complements, it is a natural move to treat *like*-complements of copy raising verbs, as well as those of perceptual resemblance verbs, as predicative PPs. In other words, CRVs and one alternant of PRVs are syntactically just raising verbs with predicative complements. Perceptual

[9] I thank Mary Dalrymple for bringing these to my attention (p.c.). I have not have much information about these dialects, but they seem to be concentrated in the American South.

resemblance verbs also have an alternant that is not a raising verb and that can take a thematic subject. Recall the CRV and PRV examples (9.5a) and (9.6a); as we observed for raising verbs and PRVs with AP complements, (9.5a) and (9.6a) have identical c-structures and f-structures, modulo relevant lexical substitutions:

(9.54) a.



b.

$$\left[\begin{array}{ll} \text{PRED} & \text{`seem/smell'} \\ \text{SUBJ} & \\ \text{XCOMP} & \left[\begin{array}{ll} \text{PRED} & \text{`like'} \\ \text{SUBJ} & \left[\begin{array}{ll}\text{PRED} & \text{`Richard'}\end{array}\right] \\ \text{COMP} & \left[\begin{array}{ll} \text{PRED} & \text{`smoke'} \\ \text{SUBJ} & \left[\begin{array}{ll} \text{PRED} & \text{`pro'} \\ \text{PERS} & 3 \\ \text{NUM} & \text{sg} \\ \text{GEND} & \text{masc}\end{array}\right]\end{array}\right]\end{array}\right]\end{array}\right]$$

The f-structure in (9.54) is essentially the same as the f-structure in (9.23) for the adjectival complement. The only added complication is that the preposition *like* takes a clausal argument as well as a SUBJ. It is the *like*-complement that licenses the subject; the functional control equation in the lexical entry for the CRV / PRV raises the subject to be the matrix subject, too. Importantly, since the PP lacks a c-structural position to host a subject, the shared subject is realized in the matrix subject position and not in the PP (see page 379 below).

I have thus far accounted for the following similarities between copy raising verbs and perceptual resemblance verbs: 1) PRVs and raising verbs take predicative complements; 2) CRVs and PRVs take *like*-complements. Next I turn to an account of their behaviour with expletives.

9.3.3 Expletives

Copy raising verbs and perceptual resemblance verbs have interesting behaviour with respect to expletives:

(9.55) a. It seemed / looked / smelled like Richard was drunk.

b. It seemed / looked / smelled like it rained.

c. It seemed / looked / smelled like there was a problem.

d. %There seemed / looked / smelled like there was a problem.

e. *There seemed / looked / smelled like it rained.

There are two noteworthy aspects here. First, as shown in examples (9.55a–9.55c), CRVs and PRVs can take expletive subjects and the expletive is *it*, as we would expect. Second, and more surprisingly, some dialects (including my own) allow these verbs to take a *there* expletive subject (9.55d), but only if the complement of *like / as* is headed by a verb that independently licenses a *there* subject (9.55e). Not only is it surprising that a verb such as *seem* takes an expletive subject with form *there* rather than *it*, it is also surprising that the verb apparently raises *there* not from its own complement, but rather from the complement of its complement. Since raising is a local operation, we would expect that the verb could raise only the subject of the *like*-complement; otherwise we would have to give up the locality of raising.

A more natural assumption is the following, which maintains the locality of raising, but has consequences for LFG's theory of open complements, as we will see shortly:

(9.56) *Like* and *as* have raising alternants.

This means that *like* or *as*, the head of the *like*-complement, raises the expletive subject from its complement, and then the expletive is raised one step further by the CRV / PRV, which we know independently can raise the subject of its predicative complement. Thus, we have double raising, but each step is completely local.

Let us next explore the consequences of assumption (9.56) for our theory before turning to a more detailed exposition of the expletive pattern in (9.55). We have already noted that the head of the *like*-complement, i.e., *like* or *as*, licenses the subject of a copy raising verb. Thus, assumption (9.56) means that there must be two entries for *like*, one that licenses thematic subjects and one that licenses non-thematic subjects:

(9.57) *like*$_1$: P^0
$(\uparrow \textsc{pred}) = \text{`like'}$
$\text{IP} \in \text{CAT}(\uparrow \textsc{comp})$
$\text{CP} \notin \text{CAT}(\uparrow \textsc{comp})$
$(\uparrow \text{PTYPE}) = \text{clausal-comparative}$

(9.58) *like*$_2$: P^0
$(\uparrow \textsc{pred}) = \text{`like'}$
$\text{IP} \in \text{CAT}(\uparrow \textsc{cf})$
$\text{CP} \notin \text{CAT}(\uparrow \textsc{cf})$
$(\uparrow \text{PTYPE}) = \text{clausal-comparative}$
$$\left\{ \begin{array}{l} (\uparrow \textsc{subj}) = (\uparrow \textsc{xcomp subj}) \mid \\ (\uparrow \textsc{subj expletive}) =_c \textsc{it} \end{array} \right\}$$

The second and third line of each entry uses the CAT operator[10] (Kaplan and Maxwell 1996, Dalrymple 2001) to ensure that the complement is an IP, not a CP. Information from CP and its IP complement generally map to the same f-structure node. It is therefore insufficient to only state that IP is in the set of labels of the complement, because this does not preclude CP from also being in the set. The lexical entries for dialects that have *like that* would simply lack the line precluding CP, which would allow complements to *like* with or without *that*, or else have a a line requiring CP, which would only allow CP complements to *like*. The fourth line states that this use of *like* heads a PP that functions as a clausal comparative, setting it apart from other uses of *like*, such as nominal comparatives (*John talks like Bill*) and appositive uses (*Some sentences, like this one, contain appositive "like".*).

Turning to *like*$_2$, in the standard fashion for raising predicates, the non-thematic subject can be filled either by an expletive or by raising its complement's subject. This latter possibility is standardly expressed by a functional control equation, as we have previously seen for raising verbs. The optionality of the equation allows the use of an expletive to fill the subject position instead. As with the majority of raising predicates, *like*$_2$ subcategorizes for an *it* expletive; a *there* expletive can only serve as the subject of *like*$_2$ if it is raised from a complement that licenses the *there* expletive, such as an existential or locative predicate. Lastly, *like*$_2$ subcategorizes for a COMPLEMENT FUNCTION (CF), i.e. XCOMP or COMP. When the functional control equation is realized the CF is an XCOMP, otherwise it is a COMP.

The entries for *as* in its *like*-complement usage would be similar, except that they would state that the category of the complement is CP, as discussed for the *like that* dialect above, and place further restrictions on the form of the complementizer, which must be *if* or *though*.[11]

The assumption that the prepositions *like / as* in *like*-complements can be raising predicates has immediate consequences for the theory of open complements (XCOMPS; Bresnan 1982a, 2001). It is standardly assumed that XCOMPS are complements that have an f-structural SUBJ, but that they are projections of lexical categories (i.e., P^0, V^0, A^0, or N^0) and therefore do not host subjects in their specifiers at c-structure. Since these complements subcategorize for a SUBJ but cannot host it in c-structure, they can only be licensed as complements of a verb that shares its SUBJ with the XCOMP via a functional control equation and provides an IP host for the subject at c-structure (Bresnan

[10] Using the inverse of the ϕ function, which is defined to have sets as values, this operator returns the set of c-structure labels that map to the f-structure node identified by its argument (see Dalrymple 2001:171).

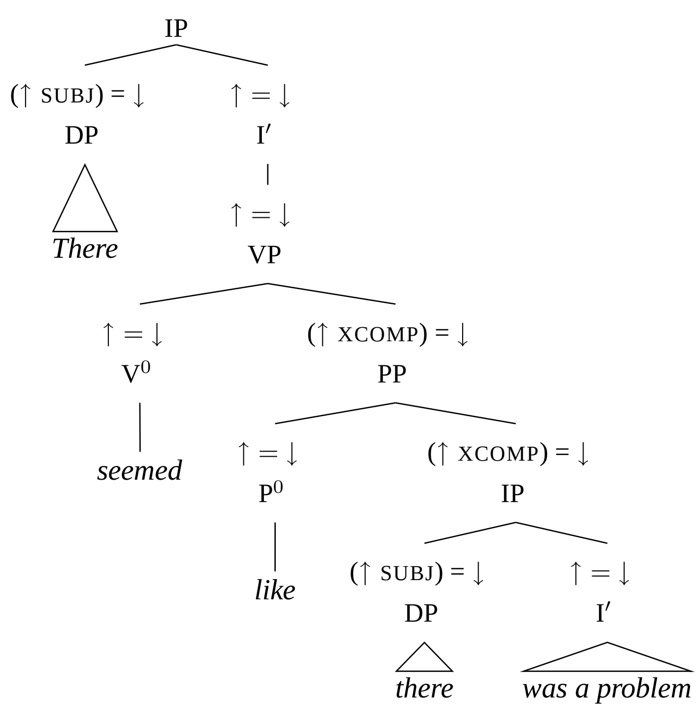
[11] Presumably this would be done by lexically specifying the mood of the clause the complementizer introduces, in this case subjunctive, as this should be compatible with the lexical specifications of only the relevant complementizers; otherwise we would have to resort to an approach that selects for specific complementizers using the COMPFORM attribute (see page 253 in section 7.1.2 of chapter 7).

2001). The key point is that the criterial difference between a COMP and an XCOMP is that the latter lacks a c-structural position to host a subject, while the former does not.

However, the complement of *like / as* is always an IP or CP, even when it is an XCOMP. The alternative would be for it to be a COMP and for the functional control equation in *like*$_2$ to read ($\uparrow$ SUBJ) = ($\uparrow$ COMP SUBJ). But, this effectively removes the distinction between open and closed complement functions at f-structure, despite the fact that grammatical functions in general are f-structural entities. Arguably, it is better to remove the c-structural requirement that an XCOMP always corresponds to a lexical projection. Under the modification to LFG theory proposed here, the defining property of XCOMP is not its c-structural category, but rather whether it contains a grammatical function that is the target of a functional control equation.

The following c-structure and f-structure for (9.55d) illustrate the proposal:

(9.59) a.



(9.60)
$$\begin{bmatrix} \text{PRED} & \text{‘seem’} \\ \text{SUBJ} & \\ \text{XCOMP} & \begin{bmatrix} \text{PRED} & \text{‘like’} \\ \text{SUBJ} & \\ \text{XCOMP} & \begin{bmatrix} \text{PRED} & \text{‘be’} \\ \text{SUBJ} & \begin{bmatrix}\text{EXPL} & \text{there}\end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{‘problem’} \\ \text{SPEC} & \begin{bmatrix}\text{PRED} & \text{‘a’}\end{bmatrix}\end{bmatrix}\end{bmatrix}\end{bmatrix}\end{bmatrix}$$

The verb *was* subcategorizes for a *there* expletive subject. This subject is raised to be the subject of the *like*-complement via the functional control equation in the entry for *like*$_2$. The matrix raising verb or PRV raises the same expletive again to matrix subject position. Each raising step is entirely local, from complement's subject to own subject, resulting in the same expletive filling three SUBJ values. Given that there are three f-structural subject positions, why do only two expletives occur in the c-structure? That is, what prevents the occurrence of sentences such as:

(9.61) *There seemed there like there was a problem

Sentences like this are blocked because the *like*-complement, being a PP headed by the lexical category P^0, cannot host a subject in its specifier.

I have thus far accounted for example (9.55d), the puzzling case of long distance *there*-raising. We have seen that we can maintain the locality of raising if we assume that *like / as* have raising alternants. Yet we noted that not all dialects have the possibility of *there*-raising with *like*-complements. Horn (1981) argues that these dialects nevertheless have expletive raising with *it* expletives, as in sentence (9.55c) above. Horn notes that the Richard sentence (9.62) below is non-contradictory, even though the closely related extraposition sentence (9.63) is contradictory.

(9.62) It seems like it's raining harder than it is.

(9.63) #It seems that it's raining harder than it is.

Since (9.62) patterns like raising sentences, Horn argues that there is *it*-raising through *like*-complements, even in dialects without *there*-raising. However, in the present analysis there would still be raising from the subject of *like* in (9.62) to the matrix subject, which may in fact be the crucial difference between raising sentences and extraposition sentences. Even if this were not the case, this does not preclude an alternative where the uppermost *it* is structure-shared between the subject of *seems* and *like*, but not with that of *raining*. If this second reading is contradictory, the first reading would nonetheless be available.

The dialectal raising difference can be captured if in dialects with *there*-raising the *like* and *as* heads of *like*-complements do not subcategorize for the form of the expletive (allowing either *it* or *there*) when they raise their complement's subject (as in the entry for *like*$_2$ in (9.58) above), while in dialects with only *it*-raising these heads subcategorize for an *it* expletive whether the expletive is raised or not.[12] The difference between the two dialects is reduced to a minor lexical difference. Notice that we lack clear motivation for stating this dialectal distinction in the entries for the relevant verbs, because the dialects that prohibit *there*-raising for CRVs still allow it for raising verbs with non-finite complements, as in *There seems to be a problem*.

Accounting for the other examples requires no further assumptions. Consider first examples (9.55a) and (9.55b), which I repeat here:

(9.64) It seemed / looked / smelled like Richard was drunk.

(9.65) It seemed / looked / smelled like it rained.

These are licensed by the instantiation of *like*$_2$ that selects for a CF that is COMP and an *it* expletive subject. Example (9.65) can be alternatively realized similarly to (9.55d), by double raising the *it* expletive subject of *rained* (see above).

Example (9.55c), which I repeat here, is essentially like (9.64).

(9.66) It seemed / looked / smelled like there was a problem.

This example cannot be an instance of double raising, because there would then be unification failure for the value of the EXPLETIVE feature (IT versus THERE).

Lastly, (9.67), which was presented above as (9.55e), is not generated at all:

(9.67) *There seemed / looked / smelled like it rained.

The expletive *there* is not licensed by either the matrix raising / PRV verb or raising *like*, since these select for an *it* expletive or else raise their complement's subject. The latter option is again not possible due to unification failure for the EXPLETIVE feature.

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[12] This amounts to modifying the entry for *like*$_2$ so that the material in braces is replaced by:

(i) $(\ (\uparrow \text{SUBJ}) = (\uparrow\ \text{XCOMP SUBJ})\ )$
$(\uparrow \text{SUBJ EXPLETIVE}) =_c \text{IT}$

9.4 Copy raising as resumption

The key difference between copy raising verbs and perceptual resemblance verbs is that the former but not the latter absolutely require a pronoun in their complement:

(9.68) a. *Richard seems like Gonzo has been baking.

b. Richard seems like he has been baking.

(9.69) Richard smells like Gonzo has been baking.

The obligatoriness of this pronoun, the fact that it is not necessarily in subject position, and the fact that the subject of the copy raising verb cannot be a thematic subject of that verb but must instead be interpreted in the position of the pronoun all indicate that copy raising is a case of resumption. The difference between this case and what are normally considered to be resumptive pronouns in the literature is that copy raising does not involve an unbounded dependency. This has been observed only in passing in the literature. For example, Boeckx (2003:165–166, fn.1) conjectures that copy raising is the A-movement analog of $\overline{\text{A}}$-movement resumptive pronouns. This specific proposal was criticized in section 9.2 above.

The theory of resumption that has been developed here can readily accommodate copy raising. I only need to make the assumption that copy raising verbs have manager resources of the kind that we have already seen in part II. Furthermore, as in Swedish binder-resumptive dependencies (see section 7.1 of chapter 7), the manager resource in copy raising is specified in terms of the SUBJECT that the manager resource is local to. The manager resource in the lexical entry for a copy raising verb (e.g., *seem*) would be:

(9.70) $\lambda P \lambda x.x : [(\uparrow \text{SUBJ})_\sigma \multimap ((\uparrow \text{SUBJ})_\sigma \otimes (\uparrow \text{GF}^+)_\sigma)] \multimap [(\uparrow \text{SUBJ})_\sigma \multimap (\uparrow \text{SUBJ})_\sigma]$

This premise is coupled to another lexical specification on the copy raising verb that states that its subject must be the antecedent of a pronoun embedded in its complement. The specification is just the usual kind we have seen before (see section 2.1.5 of chapter 2):

(9.71) $(\uparrow \text{SUBJ})_\sigma = ((\uparrow \text{GF}^+)_\sigma\ \text{ANTECEDENT})$

The local names method discussed in chapter 5 can be used to add further control where necessary.

The normal, unbounded nature of anaphoric binding explains the capacity for a copy raising verb to be satisfied even if the pronoun it finds is not the highest subject or even a subject at all:

(9.72) Richard seems like the judges have finally announced that he won.

(9.73) Richard seemed like Gonzo had scolded him.

(9.74) Richard seems like the assertion by Mary that Thora suspects the motives behind the gift offended his dignity.

Any account that tries to assimilate copy raising to strictly local raising would have trouble accommodating these facts. Yet the current account does not treat copy raising as an unbounded dependency. Its unbounded nature stems purely from the resource management theory of resumption, which depends on anaphoric binding, which is non-local.

Finally, the account offers some preliminary explanation for the fact that copy raising is restricted to only the verbs *seem* and *appear* and cannot be arbitrarily extended to any raising verb:

(9.75) *Richard tends like he won.

The raising verb in question must allow a predicative complement, which *tend* does not:

(9.76) *Richard tends sad.

Furthermore, since the manager resources that allow copy raising are properties of the lexical entries of *seem* and *appear*, only these predicative raising verbs may license copy raising.

A sample lexical entry is given here:

(9.77) *seem*: V

$$(\uparrow \textsc{pred}) = \text{`seem'}$$
$$(\uparrow \textsc{subj})_\sigma = ((\uparrow \textsc{gf}^+)_\sigma \ \textsc{antecedent})$$

$$\lambda P \lambda x.x :$$
$$[(\uparrow \textsc{subj})_\sigma \multimap ((\uparrow \textsc{subj})_\sigma \otimes (\uparrow \textsc{gf}^+)_\sigma)] \multimap$$
$$[(\uparrow \textsc{subj})_\sigma \multimap (\uparrow \textsc{subj})_\sigma]$$

$$\lambda x \lambda P.seem(P(x)(x)) :$$
$$(\uparrow \textsc{subj})_\sigma \multimap [(\uparrow \textsc{subj})_\sigma \multimap (\uparrow \textsc{gf}^+)_\sigma \multimap (\uparrow \textsc{comp})] \multimap \uparrow_\sigma$$

Consider the following example and the premises that result:

(9.78) Richard seems like he drinks.

(9.79)

1.	$richard : r$	Lex. **Richard**
2.	$\lambda x \lambda P.seem(P(x)(x)) : r \multimap (r \multimap h \multimap l) \multimap s$	Lex. **seems**
3.	$\lambda P \lambda x.x : [r \multimap (r \otimes h)] \multimap (r \multimap r)$	Lex. **seems (MR)**
4.	$\lambda x \lambda p.resemble(x,\ p) : r \multimap d \multimap l$	Lex. **like**
5.	$\lambda z.z \times z : r \multimap (r \otimes h)$	Lex. **he**
6.	$drink : h \multimap d$	Lex. **drinks**

These premises construct the proof in Figure 9.1. The relation expressed for *like* is presented in a rough form: it merely states that there is a resemblance relation between *like*'s subject and the proposition for its complement. This does not really get the truth conditions completely right, but it expresses the basic combinatorics. A more appropriate semantics would involve events or situations.

$$\dfrac{\dfrac{\begin{matrix}\textbf{MR}\\ \lambda P\lambda x.x : [r \multimap (r \otimes h)] \multimap (r \multimap r)\end{matrix} \qquad \begin{matrix}\textbf{he}\\ \lambda z.z \times z : r \multimap (r \otimes h)\end{matrix}}{\lambda x.x : (r \multimap r)}}{}$$

$$\dfrac{\begin{matrix}\textbf{seems}\\ \lambda x\lambda P.seem(P(x)(x)) : r \multimap (r \multimap h \multimap l) \multimap s\end{matrix} \qquad \dfrac{\begin{matrix}\textbf{Richard}\\ rich : r\end{matrix} \qquad \lambda x.x : (r \multimap r)}{rich : r}}{\lambda P.seem(P(rich)(rich)) : (r \multimap h \multimap l) \multimap s}$$

$$\dfrac{\dfrac{\dfrac{\dfrac{[u : r]^1 \qquad \begin{matrix}\textbf{like}\\ \lambda x\lambda p.resemble(x,\ p) : r \multimap d \multimap l\end{matrix}}{\lambda p.resemble(u,\ p) : d \multimap l} \qquad \dfrac{[v : h]^2 \qquad \begin{matrix}\textbf{drinks}\\ drink : h \multimap d\end{matrix}}{drink(v) : d}}{resemble(u,\ drink(v)) : l}}{\lambda v.resemble(u,\ drink(v)) : h \multimap l}\multimap_{\mathcal{I},2}}{\lambda u\lambda v.resemble(u,\ drink(v)) : r \multimap h \multimap l}\multimap_{\mathcal{I},1}$$

$$\dfrac{\dfrac{\lambda P.seem(P(rich)(rich)) : (r \multimap h \multimap l) \multimap s \qquad \lambda u\lambda v.resemble(u,\ drink(v)) : r \multimap h \multimap l}{seem((\lambda u\lambda v.resemble(u,\ drink(v)))(rich)(rich)) : s}}{seem(resemble(rich,\ drink(rich))) : s}\Rightarrow_{\beta}$$

Figure 9.1: Proof for *Richard seems like he drinks*

However, the $resemble$ relation contributed by *like* provides a clue to the epistemic / perceptual distinction that arises between copy raising *seem* and the version of *seem* with a *that*-clause or infinitival complement (Matushansky 2002:221). This is shown by the following examples:

(9.80) a. Richard seems like he is baking.

b. It seems like Richard is baking.

(9.81) a. Richard seems to be baking.

b. It sesms that Richard is baking.

Suppose the speaker and hearer walk into Richard's kitchen and see evidence of baking (e.g., baking pans, utensils, flour, etc.). If Richard himself is absent, it would be appropriate for the speaker to utter either of the sentences in (9.81) or (9.80b). However, it would be inappropriate to utter (9.80a) unless Richard can actually be perceived. The resemblance relation points to an explanation of this asymmetry. If in (9.80a) the resemblance is between Richard and an event or situation of his baking, then Richard must be perceivable for the resemblance relation to be verified. Neither (9.81a) nor (9.81b) involves resemblance and therefore these only have an epistemic interpretation. Example (9.80b) involves a resemblance relation too, but it would have to be a relation between two events or situations: the situation witnessed and one of Richard baking. It can therefore be uttered appropriately in the absence of Richard, since it is not a resemblance relation involving him. Although the resemblance-based explanation of the epistemic / perceptual distinction is speculative, I think it is a promising avenue for future work.

It is nevertheless possible to treat the subject of copy raising verbs as thematic subjects without giving up the resource management account of copy raising pronouns as resumption. In order to do this, we just need to replace the relevant meaning constructor in the copy raising lexical entry in (9.77) with the following meaning constructor:

(9.82) $\lambda x \lambda P.seem(x,\ P(x)(x))$:

$(\uparrow \textsc{subj})_\sigma \multimap [(\uparrow \textsc{subj})_\sigma \multimap (\uparrow \textsc{gf}^{+})_\sigma \multimap (\uparrow \textsc{comp})] \multimap \uparrow_\sigma$

The sole difference between the meaning constructor above and the corresponding meaning constructor in (9.77) is that the meaning constructor above states that the SUBJECT is also the first argument of *seem*. The subject is thus treated thematically. However, I am quite uncertain what it means for the subject of *seem* to be thematic and I therefore think that an alternative explantion for the epistemic / perceptual distinction should be pursued, such as the one offered above in terms of the *resemble* relation.

9.4.1 Copy raising and scope

Recall from page 367 that copy raising verbs cannot take scope over their subjects, unlike raising verbs with infinitival complements. This observation, originally due to Lappin (1984), was extended to perceptual resemblance verbs by Potsdam and Runner (2002). The relevant data is repeated here:

(9.83) Many goblins seemed like they had hidden in the coal.
$many > seem$
*$seem > many$

(9.84) a. Many goblins looked like they had hidden in the coal.
$many > seem$
*$look > many$

b. Many goblins smelled like they had hidden in the coal.
$many > seem$
*$smell > many$

These examples only allow surface scope readings. For example, (9.83) cannot mean that it seemed like many goblins had hidden in the coal. The quantifier must take wide scope: (9.83) can only mean that many goblins are such that they seemed to have hidden in the coal.

Contrast (9.83) with the related infinitival version:

(9.85) Many goblins seemed to have hidden in the coal.
$many > seem$
$seem > many$

This example has both a reading with *many goblins* taking wide scope over *seem* and one where it takes scope under *seem*. I have demonstrated in previous work (Asudeh 2000, 2003b) that the following meaning constructor is appropriate for infinitival- and *that*-complement *seem*:

(9.86) $\lambda p.seem(p) : (\uparrow \text{CF})_\sigma \multimap \uparrow_\sigma$

This *seem* takes its complement function (a COMP or XCOMP) as its only argument. I show in the works cited above that this allows both wide and narrow scope for quantificational subjects.

This scope distinction is predicted by the compositional semantics of copy raising *seem*. The relevant meaning constructor is repeated here, instantiated mnemonically to resources contributed by (9.83) (p is the copy pronoun's resource):

(9.87) $\lambda x \lambda P.seem(P(x)(x)) : g \multimap (g \multimap p \multimap l) \multimap s$

The quantifier *many goblins* would contribute the following meaning constructor:

(9.88) $\lambda R \lambda S.many(x,\ R(x),\ S(x)) : \forall X.[(g \multimap X) \multimap X]$

The quantifier can only take its scope by finding a dependency on g. There are two such dependencies in (9.83), corresponding to the two predicates which take *many goblins* as a subject: *seem* and *like*. *Seem* contributes the meaning constuctor above, while *like* contributes the following schematic meaning constructor:

(9.89) $\lambda x \lambda p.resemble(x,\ p) : g \multimap h \multimap l$

The only way for the quantifier to scope under *seem* is if it takes the *like*-complement as its scope.

The partial proof corresponding to the quantifier taking scope over the *like*-complement is shown here (leaving aside the modifer *in the coal* and currying the function for *like*):

(9.90)

$$\dfrac{\dfrac{\overset{\textbf{many goblins}}{\forall X.[(g \multimap X) \multimap X]} \qquad \dfrac{\overset{\textbf{like}}{h \multimap g \multimap l} \qquad \dfrac{[p]^1 \qquad \overset{\textbf{hidden}}{p \multimap h}}{h}}{g \multimap l}}{l}\,[l/X]}{p \multimap l}\,\multimap_{\mathcal{I},1}$$

At this point there is no way to combine the result $p \multimap l$ with the premise contributed by copy raising *seem*. The copy raising verb's meaning constructor is also a dependency on g, but the only instances of g have been consumed.

The surface scope derivation is successful, however. The dependency on g in the copy raising verb's meaning constructor is satisfied using an assumption which is subsequently discharged to form the scope of the quantifier. This is shown in Figure 9.2. Note that $goblin^*$ represents the denotation of the plural common noun *goblins*. Notice that the scope results are maintained even if the subject of the copy raising verb is treated as a thematic argument, as in (9.82) above. The scope results follow from just the linear logic term associated with the meaning constructor and this term was identical in (9.82) to the one that I have been discussing.

$$
\dfrac{\begin{array}{c}\textbf{many goblins}\\ \forall X.[(g \multimap X) \multimap X]\end{array} \qquad \dfrac{\dfrac{\dfrac{\begin{array}{c}\textbf{seem}\\ g \multimap (g \multimap p \multimap l) \multimap s\end{array} \qquad \dfrac{[g]^3 \qquad \dfrac{\begin{array}{c}\textbf{MR}\\ [g \multimap (g \otimes p)] \multimap (g \multimap g)\end{array} \qquad \begin{array}{c}\textbf{they}\\ g \multimap (g \otimes p)\end{array}}{g \multimap g}}{g}}{(g \multimap p \multimap l) \multimap s} \qquad \dfrac{\dfrac{\dfrac{\dfrac{[g]^2 \qquad \begin{array}{c}\textbf{like}\\ g \multimap h \multimap l\end{array}}{h \multimap l} \qquad \dfrac{[p]^1 \qquad \begin{array}{c}\textbf{hidden}\\ p \multimap h\end{array}}{h}}{l}}{p \multimap l}\multimap_{\mathcal{I},1}}{g \multimap p \multimap l}\multimap_{\mathcal{I},2}}{s}}{g \multimap s}\multimap_{\mathcal{I},3}}{\mathit{many}(x\ ,\ \mathit{goblin}^*(x),\ \mathit{seem}(\mathit{resemble}(x,\ \mathit{hide\text{-}in\text{-}coal}(x)))) : s}[s/X]
$$

Figure 9.2: Proof for surface scope reading of *Many goblins seemed like they had hidden in the coal*

The situation for perceptual resemblance verbs is similar. When they license a thematic subject, they have control-like meaning constructors:

(9.91) $\lambda x \lambda P.look(x, P(x)) : (\uparrow \text{SUBJ})_\sigma \multimap ((\uparrow \text{SUBJ})_\sigma \multimap (\uparrow \text{XCOMP})_\sigma) \multimap \uparrow_\sigma$

The perceptual resemblence verb takes its subject as an argument and also applies its open complement to the subject. This will result in the following sort of semantics for, e.g., *Richard looks like he drinks*:

(9.92) $look(richard,\ resemble(richard,\ drink(richard)))$

In Asudeh (2000, 2003b), I demonstrate that such meaning constructors yield only surface scope for a quantificational subject of the verb. The reasoning is identical to what we just saw for copy raising *seem*: if the quantifier takes narrow scope, there is no way to satisfy the verb's dependency on the subject. On the other hand, if the quantifier scopes wide, the dependency can be handled by assumption and a succesful proof is possible.

9.4.2 Prospects for extending the analysis to other languages

At the beginning of section 9.1, I noted that copy raising is not just a quirk of English, but is actually quite widely attested cross-linguistically. Although I have only addressed copy raising in English, it should be apparent how the analysis could be extended to other languages. The crucial thing is for the copy raising verb to contribute a manager resource that consumes a copy pronoun's resource. Other details of the raising may vary. For example, many languages do not have the equivalent of the English prepositions *like* and *as* in copy raising. The exact compositional semantics of the copy raising verb will be slightly different for these languages. Preliminary work shows that certain languages that are closely related to English, in particular Swedish and Dutch, do have apparent copy raising constructions with similar prepositions. However, Swedish seems to allow the complements of copy raising verbs to lack copy pronouns (Ida Toivonen, p.c.). This would seem to indicate that the construction in question is not a true equivalent to English copy raising, but rather a very semantically bleached version of perceptual resemblance. Dutch requires a pronoun in copy raising, but otherwise patterns somewhat differently to English (van Egmond 2004). Much more work needs to be done on the typology of copy raising.

The resource management analysis of copy raising already shows potential in the analysis of copy raising in Irish, where it makes sense of a puzzling fact. Although Irish has the resumptive-sensitive complementizer *aN* and copy pronouns seem to be intuitively similar to resumptive pronouns, the neutral complementizer *go* is used to introduce its copy raising complement (McCloskey and Sells 1988:174–178):

(9.93) B'éigean daobhtha gur innis siad an scéal dó.
must to.them COMP told they the story to.him
They must have told him the story.
(McCloskey and Sells 1988:176, (65c))

(9.94) Ní cosuúil dó go gcuireann rud ar birth buaireamh air.
NEG.COP like to.him COMP puts thing any distress on.him
Nothing seems to bother him.
(McCloskey and Sells 1988:177, (68a))

The resource management theory predicts that the neutral complementizer *go* must be used in Irish copy raising. The theory assumes that the copy raising verb contributes a manager resource. This licenses the copy pronoun in the complement and allows proper composition. We saw in chapter 6 that the resumptive-sensitive complementizer *aN* also contributes a manage resource. This is how it licenses resumptive pronouns in unbounded dependencies. But if both the copy raising verb and the complementizer *aN* were present, then there would be two manager resources contributed. It would not be possible to satisfy the needs of both manager resources with a single copy pronoun. Therefore, the resumptive-sensitive complementizer cannot be used in copy raising and the neutral complementizer must be used instead.

Conclusion

I have shown in this chapter that the resource management theory of resumption extends to copy raising. The copy raising verb contributes a manager resource that requires a pronoun in the copy raising verb's complement. Thus, the mechanism that accounts for resumptive pronouns also accounts for resumption. I also showed that the associated meaning constructor for the copy raising verb accounts for the fact that the copy raising verb's subject cannot scope under the verb. Copy raising verbs were distinguished from perceptual resemblance verbs by the theory. The latter do not contribute manage resources. This correctly predicts that copy pronouns are obligatory for copy raising verbs, but that perceptual resemblence verbs can take complements without copy pronouns. Despite initial appearances, perceptual resemblance verbs and copy raising verbs are distinct, although similar, verb classes.

The similarities between the two verb classes were argued to follow from their identical syntax. Both copy raising verbs and perceptual resemblance verbs take predicative PP complements, headed by the prepositions *like* or *as*. These *like*-complements were thus assimilated to the general class of predicative complements to raising and perceptual resemblance verbs. The curious ability of both these verb classes to raise expletives that they cannot otherwise take as subjects (e.g., *There seemed like there was a riot*) was explained by positing that the prepositions *like* and *as* can exceptionally raise from their closed complements. The expletive *there* is raised from the complement of *like* or *as* to its subject position at f-structure and then raised again from that subject position to the subject of the copy raising or perceptual resemblence verb. Although it is convenient to describe the process using these procedural metaphors, the theory is purely declarative. The expletive is therefore really just occupying three f-structural subject positions at once. The reason that the expletive is only realized in two c-structural positions follows from the general LFG assumption that lexical projections cannot take DPs in their specifiers at c-structure. Since the *like*-complement is a PP, it follows that the expletive in its subject position at f-structure is not realized in c-structure.

I showed that the behaviour of expletives in copy raising and perceptual resemblance constructions — particularly doubled *there* expletives — challenges LFG's notion of open complements. It also challenges the adequacy of the Subject Condition (Baker 1983, Bresnan 2001:311):

(9.95) **The Subject Condition**:
Every predicator must have a subject.

Since subjects are only defined at functional structure in LFG, the Subject Condition is a requirement that every f-structure predicator has a SUBJECT. If the double-raising analysis of the doubled *there* examples is correct, the overt distribution of expletives does not follow from the Subject Condition. In particular, there is no explanation of why it is impossible to have an expletive occupy the three positions at f-structure but only be realized in just the highest position:

(9.96) *There seems like is a problem.

At f-structure the verb *is* does have a subject (the expletive), so the Subject Condition is satisfied. This points to the need for a c-structural correlate of the Subject Condition.

A c-structural subject requirement would seem to mirror the structural requirement of checking an EPP feature in the Minimalist Program (Chomsky 1995, 2000, 2001). There is thus some potentially interesting theoretical convergence. However, the EPP account is also challenged by the double *there* expletives. In particular, if the lower *there* checks its EPP feature in the lower clause, then there does not seem to be any way to raise it further to check an EPP feature in the upper clause. This indicates that the two *there* expletives are merged independently. But this does not explain why an upper *there* is licensed only if a lower *there* is present. Thus, the double expletive pattern is challenging for both theories and is a promising area for future work that might achieve a theoretical synthesis or at least form a further bridge between the two theories.

Chapter 10

Conclusion

10.1 Summary of the main results

The guiding hypothesis of this dissertation has been Resource Sensitivity:

(10.1) Natural language is universally resource-sensitive.

The formal theory behind the hypothesis was explored in detail in part I of the dissertation. In chapter 3, I distinguished between the above hypothesis, which I called more narrowly Linguistic Resource Sensitivity, and a notion called Logical Resource Sensitivity which derives from substructural resource logics. I showed that resource logics, which are characterized by the absence of the structural rules of *weakening* and *contraction*, yield a useful perspective on linguistic combinatorics, particularly that of phonology, syntax, and semantics. I argued that all of these systems are equally resource-sensitive in that no element of combination may be freely discarded or reused, but that they are order-sensitive to differing degrees. Thus, the structural rule of *commutativity*, which enables reordering of premises in a proof, was also shown to be relevant. I argued that semantics is not order-sensitive and that the resource logic that is appropriate for characterizing semantic combinatorics is therefore linear logic.

Although resource logics alone give some insight into linguistic combinatorics, I argued that Logical Resource Sensitivity on its own was not linguistically illuminating. I showed that the relationship between Logical and Linguistic Resource Sensitivity is affected by the choice of logical connectives. In particular, if conjunction is present, Logical Resource Sensitivity is no longer satisfactory for a characterization of linguistic combinatorics. I argued that conjunction was indeed necessary in the logical fragment. I showed that we can regain Linguistic Resource Sensitivity by imposing on the resource logic proof a goal condition that is motivated by linguistic theory. Thus, Linguistic Resource Sensitivity is founded on Logical Resource Sensitivity but requires input from linguistic theory. I showed that the Linguistic Resource Sensitivity for semantics and the syntax–semantics interface can be captured using Glue Semantics, which uses linear logic for semantic composition. I argued that a number of proposals in the literature constitute appeals to Resource Sensitivity and can possibly be eliminated, without losing their important insights.

The hypothesis of Resource Sensitivity is tested by cases of apparent resource deficit or resource surplus. Part II of the dissertation was an extended investigation of resumptive pronouns as resource surplus. I presented the resource management theory of resumption. It is based on the hypothesis of Resource Sensitivity and the theoretical assumption that resumptive pronouns are ordinary pronouns. The logic behind the resource management theory is simple. If a resumptive pronoun is an ordinary pronoun, then it constitutes a surplus semantic resource. If Resource Sensitivity is to be maintained, then there must be an additional consumer of the pronominal resource present. I introduced the concept of *manager resources* as consumers of pronominal resources. Since the resources in question are what determine semantic composition in Glue Semantics, the theory treats resumption as a problem of semantic composition.

Resumptive pronouns on the theory are just ordinary pronouns of the language in question that are licensed by manager resources. This means that the theory does not treat the term *resumptive pronoun* as a theoretical construct. Manager resources are specified lexically using Glue meaning constructors. The difference between languages with and without resumptive pronouns thus boils down to a difference in their lexical inventories. Languages with resumptive pronouns have manager resources as part of their complementizer system, while languages that do not have grammaticized resumptive pronouns lack manager resources. This upholds McCloskey's (2002) conjecture that grammaticized resumption is purely a matter of lexical inventories.

In chapter 4 I presented a detailed descriptive overview of resumptive pronouns based on the following seven characteristics:

A. Resumptive pronouns occur in unbounded dependencies.

B. Resumptive pronouns are interpreted as bound pronouns.

C. Resumptive pronouns are the ordinary pronouns of the language.

D. Resumptive pronouns and gaps have distinct syntactic distributions.

E. Resumptive pronouns display restrictions on their interpretation which gaps do not and which correlate with restrictions on the interpretation of non-resumptive pronouns.

F. Resumptive pronouns do not display certain key characteristics of gaps.

G. Resumptive pronouns resemble gaps in their interaction with certain grammatical phenomena.

I showed in chapter 5 that the resource management theory of resumptive pronouns explains the first six of these characteristics and has several other theoretical implications. The seventh, potentially problematic property has to do with reconstruction, parasitic gaps, and across-the-board extraction from coordinations. In chapter 7 I showed that the seventh property is also handled correctly by the theory in a manner that lends support to recent theories of parasitic gaps and ATB. I also showed that the original reconstruction facts were problematic and presented new data that supports the resource management theory and ordinary pronoun theories in general.

The resource management theory was applied to detailed analyses of Irish in chapter 6 and of Swedish and Hebrew in chapter 7. The analysis of Irish localized the manager resources that license resumptives in the lexical entry for the resumptive-sensitive complementizer *aN*. I gave a thorough treatment of both filler-gap and binder-resumptive dependencies. The analysis was extended from the core cases of Irish unbounded dependencies to the difficult "mixed chains" that have been recently discussed by McCloskey (2002). The complementizer *aN* and the gap-sensitive complementizer *aL* were each argued to have a dependency-passing and a dependency-grounding role. Each complementizer performs its roles through one of the two methods independently proposed in LFG's Extended Coherence Condition for integrating undounded dependencies (Bresnan and Mchombo 1987). *AL* performs filler passing and grounding through functional equality, whereas *aN* performs binder passing and grounding through anaphoric binding. The filler passing performed by *aL* explained its apparent successive-cyclic marking effects and several facts about the distribution of gaps and islands in Irish. The complementizer *aN* licenses a resumptive in its binder-grounding capacity, but otherwise just passes a binder-resumptive dependency up. The mixed chains were explained as an interplay between the complementizers in their passing and grounding roles. Lastly, the resource management theory of Irish resumptives was compared in detail to the recent Minimalist analysis of McCloskey (2002). I showed that there were many points of theoretical convergence, which is significant given the quite different starting points of the two theories. I argued that the resource management theory is to be preferred because it handles semantic composition correctly, whereas McCloskey's (2002) theory has serious problems with composition.

Chapter 7 continued the empirical investigation with analyses of resumptive pronouns in Swedish and Hebrew. Swedish resumptives have proven especially difficult to assimilate to other kinds of resumptives (McCloskey 1990). I presented new data on Swedish and showed how the theory brings Swedish resumptives in line with Irish and Hebrew resumptives, with the result that they do not constitute a different class of resumptive. The theory thus yields a unified account of resumptive pronouns in the three languages. It nevertheless leaves room for stating differences between the languages, too. In particular, I showed that the key difference between resumptive-licensing in the three languages is whether the manager resource occurs locally to the resumptive's binder at the top of the dependency (Irish, Hebrew) or locally to the resumptive pronoun at the bottom of the dependency (Swedish). Data from the *Ålandssvenska* dialect of Swedish was used in several of the arguments in the chapter. I argued that this dialect casts serious doubt on the empirical adequacy of Last Resort theories of resumption. I ended the chapter with a general argument against special pronoun theories of resumptives. The form of the argument is simple. If resumptives are not ordinary pronouns, then they should not be interpreted like ordinary pronouns. But in fact they are interpreted like ordinary pronouns, even in Swedish, which had previously been thought to provide the best case for a special pronoun theory of resumption. Furthermore, if resumptive pronouns are underlyingly gaps in particular, then they should be interpreted like gaps. However, they are not, even in Swedish. I therefore concluded that it is untenable to maintain that resumptive pronouns are underlying gaps or special pronouns. They are ordinary pronouns.

The unification of Swedish resumptives with Irish and Hebrew resumptives depended in part upon separating, following Engdahl (1982), true grammaticized Swedish resumptives from apparent resumptives that are processing effects. Chapter 8 provided a processing model for non-grammaticized resumptive pronouns. The model has both production and parsing components. I showed that the processing-resumptives in Swedish can be successfully explained as complexity-resumptives in the parsing model. Complexity-resumptives are resumptive pronouns that occur due to memory limitations for filler integration. These pronouns reactivate an inactive filler and are subsequently reanalyzed as gaps, although they are not underlyingly gaps in the grammar; they are initially inserted as ordinary pronouns.

Along with complexity-resumptives, I also identified two other kinds of processing-resumptives: island-resumptives, which occur inside islands, and ECP-resumptives, which occur in *that*-trace positions. A large part of the parsing section concerned incremental interpretation and intrusive pronouns in English. The theory treats intrusive pronouns as ungrammatical; this has been confirmed by recent experimental findings. However, parsing of sentences containing intrusive pronouns leads to partial interpretation that can nevertheless be informative. Whether the partial interpretation is informative depends on properties of the intrusive's binder or antecedent. If the intrusive pronoun is bound by an operator, e.g. a quantifier or *wh*-word, the resulting partial interpretation is uninformative. By contrast, if the intrusive is bound by a type e binder, such as a name, indefinite, or definite, partial interpretation is informative. This explains Sells's (1984) observation that intrusive pronouns cannot be operator-bound.

Chapter 8 also presented a production model for processing-resumptives. It explains why processing-resumptives occur in the first place, despite the fact that they are judged as ill-formed by speakers. I argued that processing-resumptives arise from incremental production. The production model is based on the notion of fragments in LFG (Bresnan 2001:79–81), which allow a definition of locally well-formed structures. In producing locally well-formed structures that are consistent with the production plan, speakers have two options. The first option is to integrate the filler, resulting in fully locally and globally well-formed structures. The second option is to insert pronouns and other nominals in positions where a filler ought to be integrated. This leads to local well-formedness, though the overall result is global ill-formedness. However, since production is incremental, such productions can nevertheless be uttered. Even though there are in general two methods for forming well-formed local structures — filler integration or insertion of new lexical material — only the lexical insertion method is available in island and ECP / *that*-trace environments, since fillers cannot be integrated in these positions due to separate constraints. Island- and ECP-resumptives are the only options for locally well-formed structures in these cases then. Although the result is locally well-formed, it is once again globally ill-formed due to the unintegrated filler.

Part III achieved a unification of resumptive pronouns and copy raising under the resource management theory of resumption (chapter 9). I showed that the obligatory pronouns in the complements of copy raising verbs are explained if the copy raising verb contributes a manager resource: the manager resource requires a pronominal resource to consume, therefore there must be a pronoun in the complement. I showed that the resulting compositional semantics derives the fact that copy raising subjects cannot take narrow scope with respect to copy raising verbs, even though the subjects of infinitival raising verbs can take narrow scope. The contribution of a manager resource distinguishes copy raising verbs from superficially similar perceptual resemblance verbs that do not require pronouns in their complements. These latter verbs are therefore not true copy raising verbs. Much of chapter 9 was devoted to explaining the similarities between the two verb classes. I argued that copy raising verbs and perceptual resemblance verbs have the same syntax, particularly with respect to complementation. Both verb classes can take predicative PP complements headed by the prepositions *like* or *as*. I argued that these prepositions can exceptionally raise the subject of their finite complement. This explains patterns of expletive doubling that occur with both copy raising and perceptual resemblance verbs.

10.2 A brief discussion of previous approaches

I have discussed several previous approaches to resumptive licensing and copy raising in the main body of the thesis, particularly in section 6.6 of chapter 6 and section 9.2 of chapter 9. Here I want to make some brief remarks about certain approaches that I have not mentioned explicitly. The remarks will consist of identifying aspects of these approaches that have already been discussed at length in the previous chapters.

There are a number of theories of resumption that can be characterized as transformational syntactic operator-binding theories; examples include McCloskey (1979, 1990, 2002), Borer (1984), Sells (1984), Demirdache (1991), Pesetsky (1998), and Boeckx (2003). In chapter 6 I discussed McCloskey (2002) in considerable detail. As McCloskey (2002) notes, the problem for this kind of theory is ensuring proper semantic composition. In particular, if the abstraction operation that the operator intitiates applies in intermediate positions, then the correct semantics is not derived. I argued in chapter 6 that even if the intermediate traces can be handled somehow, the Irish mixed chain cases constitute a challenge for the operator-binding approach with respect to semantic composition.

There are specific exemplars of the transformational operator-binding theories that treat resumption as involving movement. Recent examples are Pesetsky (1998) and Boeckx (2003). Movement analyses are challenged by the general island-insensitivity of resumptive pronouns, the lack of weak crossover effects, and lack of scope reconstruction effects. Boeckx (2003) is an extended movement treatment of resumptives that attempts to deal with the island issues. Boeckx (2003:151–157) also makes some remarks about weak crossover and reconstruction. It may be that these arguments can be met by movement analyses. However, there is another reason to assume that resumption is not movement and that has to do with form-identity effects. Merchant (2001) notes that moved *wh*-operators can have non-default case if the extraction site is a gap. This is explained on the standard transformational assumption that Case is assigned in the base position of filler-gap dependencies or by the standard assumption in declarative constraint-based theories like HPSG and LFG that the head of the filler-gap dependency simultaneously occupies the top and bottom of the dependency. Merchant (2001:136) observes that the binder in a binder-resumptive dependency by contrast cannot be case-marked (the "Case and resumptive-binding operator generalization"). If resumption is movement the lack of Case-marking is unexplained. This argument is pursued in detail by Merchant (2003).

A number of theories of resumptive pronouns invoke Last Resort mechanisms. Examples of such approaches include Shlonsky (1992), Pesetsky (1998), Aoun and Benmamoun (1998), Aoun et al. (2001) and Willis (2000). The Swedish dialect data presented in chapter 7 undermines the empirical adequacy of these approaches. In the *Ålandssvenska* dialect of Swedish, there is no *that*-trace filter, yet resumptive pronouns are also possible in the relevant positions. This is completely mysterious on a Last Resort account, which in general predicts that resumptive pronouns should occur only where gaps are blocked. This compounds the difficulty faced by such approaches with Hebrew, where both resumptives and gaps occur in direct object position. The Hebrew data lead Shlonsky (1992) to propose ambiguity in the Hebrew complementizer system. This account could be extended to the Swedish facts, too, but it is not independently motivated. Similarly, in Irish both gaps and resumptive pronouns are also permitted in direct object positions and in embedded subject positions. Once again, an ambiguous licenser could be proposed. However, if the cost of maintaining Last Resort is the postulation of lexical ambiguity in language after language, then I submit that the cost is too great. Matters would be different if there were good theoretical reasons to assume Last Resort, but the principle in fact suffers serious theoretical drawbacks as well. In particular, it is a transderivational principle and has the problems of all such principles (Jacobson 1998, Johnson and Lappin 1997, 1999, Potts 2001, 2002b, Pullum and Scholz 2001). There thus seems to be very little empirical or theoretical motivation for Last Resort theories of resumption.

There are also a number of prior non-transformational approaches to resumptive pronouns, including the GPSG accounts of Maling and Zaenen (1982) and Sells (1984), the HPSG account of Vaillette (2001, 2002), the Dynamic Syntax accounts of Kempson et al. (2001) and Cann et al. (2003), and the alternative LFG accounts of Zaenen (1983) and Falk (2002). Except for the Dynamic Syntax work and the GPSG account by Sells (1984), these approaches do not address the issue of semantic composition. I have to confess that I do not understand the Dynamic Syntax approach to resumption very well yet. However, given my current level of understanding there are a couple of points of concern. First, Cann et al. (2003) identify one possible locus of variation for resumption as differences in the tree construction operation *Merge*. This is a non-lexical point of variation, so the approach would seem to give up the lexical conjecture that resumptive-licensing is a matter of variation across lexical inventories. Another point of concern is that the construction mechanism itself should be a strong candidate for a universal aspect of language. We would then not expect it to vary. Second, Cann et al. (2003) identify another possible locus of variation as the relativizing element.

This would seem to be too narrow a locus, since it excludes other resumptive environments, notably *wh*-questions. The final locus of variation is the pronoun itself: certain pronouns do not make full semantic contributions. This may be appropriate for some resumptive pronouns, but it cannot form a general explanation for the reasons outlined in section 5.3 of chapter 5. It thus seems that there is no locus of variation for resumptive-licensing in the Dynamic Syntax account that is sufficiently general and also lexical.

The HPSG account of Vaillette (2001, 2002) runs afoul of some of the objections raised for movement-based analyses. Vaillette (2001, 2002) essentially generalizes the filler-gap mechanism of HPSG to cover resumptive pronouns. This fails to explain the asymmetries between filler-gap dependencies and binder-resumptive dependencies, although Vaillette addresses some of these points. A second drawback of Vaillette's approach is shared by the LFG account of Falk (2002). Both of these approaches treat resumptive pronouns as somehow different from ordinary pronouns. They are therefore special pronoun theories of resumption. On Vaillette's approach, resumptive pronouns have a feature RESUMP that stores their index and spreads equivalently to the SLASH feature of a gap. Presumably, non-resumptive pronouns lack the feature RESUMP or else have an empty RESUMP. On Falk's approach, pronouns can either provide a PRED 'pro' to their f-structure or else provide an equation that is appropriate for resumption. These approaches suffer the drawbacks of special pronoun approaches. First, they cannot explain why the resumptive pronouns in question have the same morphological exponence as non-resumptive pronouns. Second, they cannot explain why resumptives are interpreted exactly like ordinary pronouns. Falk (2002) is aware of the issue of ordinary pronoun interpretation and his resumptive pronouns share the interpretation of ordinary pronouns. However, because of the underlying lexical difference between resumptives and non-resumptives, the similarity is arguably only coincidental.

The recent transformational account of Boeckx (2003) is also a special pronoun theory, although this may not be immediately apparent. On this theory, pronouns are always the morphological realization of a D^0 with a null complement. However, resumptive pronouns are stranded by movement of their complement, which is their antecedent, whereas regular pronouns have a null complement in the sense of an absent complement. The complement to a resumptive pronoun is therefore a trace or copy of the antecedent, whereas the complement to a regular pronoun is just nothing. It is clear that the sense in which pronouns always have a null complement is therefore only valid at PF. At Logical Form there should be a difference between resumptive pronoun complements and regular pronoun complements. While Boeckx's theoretical assumptions possibly derive the equivalent PF / morphological exponence of resumptive and non-resumptive pronouns, the account does not predict why the two kinds of pronouns are also interpreted equivalently.

10.3 Directions for future work

A direction for future work that immediately suggests itself is to investigate more languages in terms of the resource management theory of resumption. The copy raising analysis could be tested for a start against data from the languages mentioned in chapter 9: Greek (Joseph 1976, Perlmutter and Soames 1979), Farsi (Ghomeshi 2001), Samoan (Chung 1978), Hebrew (Lappin 1984), Irish (McCloskey and Sells 1988), Haitian Creole (Déprez 1992), Igbo (Ura 1998), and Turkish (Moore 1998). The anlysis of resumptive pronouns should also be extended to data beyond Irish, Swedish and Hebrew. Many African languages have resumptive systems that seem to behave quite differently from the ones investigated here. The resumptive pronoun analysis should be tested against data from these languages, which include Igbo (Goldsmith 1981, Sells 1984), Swahili (Keach 1980, Sells 1984) , Vata (Koopman 1982, 1983), Yoruba (Carstens 1987, Sonaiya 1989, Cable 2003), and Edo (Beermann et al. 2002). Data from Vata and Yoruba seem to be especially challenging because resumptive pronouns in these languages do not seem to ameliorate weak crossover and island extractions in the ways that an ordinary pronoun theory would predict (Koopman and Sportiche 1982, 1986, Cable 2003). However, it should be borne in mind that Swedish was initially believed to undermine ordinary pronoun theories of resumption, too.

Vata is also interesting because of its predicate cleft construction, in which a focused verb is repeated in its base form (Koopman 1983):

(10.2) $\overline{\text{le}}$ à $\overline{\text{le}}$ sa̍ká
eat we eat rice
We are really EATING rice or
We are EATING rice
(Koopman 1983:38, (50a))

The focused, initial verb $\overline{le}$ is unmarked for tone (hence bearing mid tone). It occurs in a bare form without tense particles and cannot be accompanied by complements of the verb. It can, however, be inherently marked for aspect, as in the example above (Koopman 1983:38). Koopman (1983) treats the focused Vata verbs as the verbal equivalent of resumptive pronouns (“resumptive verbs”).

A similar focus construction, which Cho and Kim (2003) call the “Echoed Verb Construction”, occurs in Korean (Cho and Kim 2003, Cho et al. 2003):

(10.3) John-i sakwa-lul [mek-ki-nun mek-ess-ciman], amwu-eykey-to kwen-ha-ci
John-NOM apple-ACC eat-KI-CT eat-PAST-but, anyone-to-even recommend-do-COMP
anh-ass-ta
NEG-PAST-DECL
John ate the apples, but he didn't recommend them to anyone.
(Cho et al. 2003:(1a))

There are clear similarities to the Vata example. Cho and Kim (2003) note that the focused verb (*mek-ki-nun* in this example) is not fully inflected, but is otherwise identical to the main verb it duplicates. In both cases, the focused verb is a morphologically impoverished copy of the main verb.

If the focused verb provides another instance of the main verb's meaning constructor for semantic composition, then this will be a case of both resource deficit, since there will not be enough argument resources for both the focus verb and the main verb, and a case of resource surplus, since the focused verb's resource is potentially not required for the basic compositional semantics of the sentence. However, an alternative analysis suggests itself in which the focused verb is a semantically bleached "dummy" verb on a par with English do-support *do*. The lack of full morphology on the fronted verb indicates that it is not a full copy of the main verb, which makes a dummy verb analysis initially plausible.

The Vata construction lends further support to this sort of analysis. Koopman (1983:158) observes that the basic generalization concerning which verbs in Vata can be clefted is that ”any verb with a base form may occur in the predicate cleft construction”. In particular, verbs that lack a base form cannot be predicate-clefted. By "base form", Koopman means that the root of the clefted verb can be the input to morphological processes. Furthermore, as noted above, the clefted verb bears the segmental form of the cleft target, but does not bear its tonal specification, taking only mid tone. In (10.2) the main verb happens to bear mid tone. The following example makes the observation clearer, since the main verb bears falling tone:

(10.4) l̄ī O̍ lì sa̍ká
eat s/he ate rice
S/he ATE rice
(Koopman 1983:38, (50a))

This example also illustrates the lack of tense on the focused verb. The morphological conditions on the Vata predicate cleft verb strongly indicate that formation of the predicate-clefted verb is a lexical process, rather than a kind of syntactic copying. A lexical process is also plausible for the similar Korean construction. If we assume that the morphological process does not copy the semantics of the verb, i.e. its meaning constructor, then a dummy verb analysis based on sharing of partial information could be tenable.

The Vata and Korean phenomena bring up a number of important points. First, given the possibility of a dummy verb analysis, the constructions show that superficial similarity to resumptive pronouns is not sufficient to warrant a literal resumption analysis. Second, the cases exemplify the kind of investigation that needs to be carried out to test the hypothesis of Resource Sensitivity: the hypothesis is tested by cases of apparent resource deficit or resource surplus. Third, the constructions show that it is important to be careful in investigating the hypothesis: it must be clearly demonstrable that the phenomenon involves extra or missing resources. In the kind of resumption examined in the body of this thesis, this followed from the demonstration that resumptive pronouns are ordinary pronouns and the necessity for semantic composition of removing resumptive pronouns and copy raising pronouns at the proof level.

There are other examples that seem to involve similar uses of pronouns where the pronouns are arguably not surplus for semantic composition. For example, consider *such that* relatives. These have an apparently saturated complement that often contains a pronoun that may seem like a resumptive:

(10.5) Every polygon such that it has exactly three sides is a triangle.

However, is is not necessary for a *such that* relative to contain a pronoun (Pullum 1985:292, (1e)):

(10.6) The old crone had a manner such that even the children who saw her pass in the street would shudder and turn away.

In this sentence there is no anaphoric element in the relative clause that connects it to the relative head *a manner*.

Another example that initially seems like a case of pronominal resource surplus is the case of *marked topics* (Huddleston and Pullum 2002:1409):

(10.7) As for caviar, I don't like it.

Once again though, the pronoun is not obligatory and there need not be any anaphoric connection between the marked topic and the main clause:

(10.8) As for Best Picture, I can't stay up that late.

Neither marked topics nor *such that* relatives are a real case of resource surplus. The resources contributed in these constructions are proper to the clauses they occur in. This does not mean that the connection between the clauses is not a challenge for semantic composition — it clearly is.

A construction that is related to marked topics is left dislocation (Ross 1967). In left dislocation an anaphoric link between the dislocated nominal and the main clause seems to be obligatory:

(10.9) The Academy, it doesn't reward understated performances often.

(10.10) *The Academy, Sean Penn pleased many voters despite his "bad behaviour".

However, the anaphoric element in the main clause is not a bound pronoun. Although *Not many members of the Academy* can be a variable binder, as in (10.11), it cannot be left dislocated and bind a pronouns, as in (10.12).

(10.11) Not many members of the Academy said they voted for *Seabiscuit*.

(10.12) *Not many members of the Academy, they voted for *Seabiscuit*.

Resumptive pronouns are always bound pronouns. Therefore the anaphoric element in left dislocation is not a resumptive pronoun.

Furthermore, the anaphoric element need not be a conventional anaphor at all. For example, it can be a relational noun:

(10.13) The Smiths, neighbours never invite to parties.

The implicit argument of the relational noun is sufficient to establish the link between the main clause and the left-dislocated nominal. However, I have shown elsewhere (Asudeh 2003a) that relational nouns cannot function resumptively, even though their implicit arguments can be bound, as in (10.14):

(10.14) Most suburbanites know a neighbour.

Despite their ability to function as bound anaphors, relational nouns cannot function resumptively, as shown by the following Swedish data:

(10.15) Varje förortsbo som Maria vet att han arresterades försvann.
every suburbanite that Maria knew that he arrest.PASS vanished
Every suburbanite who Maria knew that he was arrested vanished.

(10.16) * Varje förortsbo som Maria vet att en granne arresterades försvann.
every suburbanite that Maria knew that a neighbour arrest.PASS vanished
Every suburbanite who Maria knew that a neighbour was arrested vanished.

There are therefore at least two compelling reasons to believe that the pronoun in left dislocations like (10.9) is not a resumptive pronoun. First, it is not a bound pronoun. Second, the linking element can be a relational noun and these cannot be resumptive, despite having bound readings. It seems that in left dislocation the resource contributed by the pronoun or other linking element is consumed in the clause it occurs in and does not constitute a surplus resource.

In sum, verb-doubling focus constructions of the kind found in Vata and Korean, *such that* relative clauses, marked topics, and left dislocations are all the kinds of candidate phenomena against which Resource Sensitivity needs to be tested. However, for all these cases preliminary investigation reveals that there may in fact not be any resource accounting problem. These are all good candidates for further work, though.

Other directions for future work come from the analyses proposed in the main chapters of the thesis. The analysis of Irish identified two roles for the complementizers involved in unbounded dependencies. One was grounding of the unbounded dependency, the other was passing of the unbounded dependency. The filler-gap complementizer *aL* performs filler passing and grounding via functional equality, whereas the complementizer *aN* performs resumptive-binder passing and grounding via anaphoric binding. This yields the classification of unbounded dependencies shown in Table 10.1.

	Passing	**Grounding**
Filler-gap dependency	Irish *aL*	*aL*
Binder-resumptive dependency	Irish *aN*	*aN*

Table 10.1: A typology of unbounded dependencies

This classification was essentially motivated by the successive-cyclic effects observed for *aL* and by the analyses of mixed chains. It would be interesting to see whether the classification can be understood as a general typology of unbounded dependencies and whether such a typology yields new perspectives on other languages. First, more languages need to be investigated to see if the passing and grounding roles are fulfilled by complementizers or if other elements can serve the roles of the Irish complementizers. Second, the general typology needs to be investigated to check if passing and grounding effects hold for unbounded dependencies in other languages. For example, neither Swedish nor Hebrew was analyzed as having a passing capacity. However, neither language was investigated in these terms. The passing role of *aL* seems to have correlates in many languages — those that show some kind of successive-cyclic marking of extraction paths (for recent overviews and references, see Bouma et al. 2001 and McCloskey 2002).

In section 6.6 of chapter 6 I discussed how the passing role of *aL* potentially explains several facts about the distribution of gaps in Irish. For example, it predicted the impossibility of extraction from prepositional object position without the appeal to an auxiliary notion of proper government (whereby Irish prepositions are not proper governors). I noted that the extraction path specified in the lexical entries for both *aL* and *aN* might have to be further restricted by off-path constraints. I concluded that a direction for future work is to examine the distribution of Irish carefully in light of the analysis of *aL* given here.

Another area of future work on Irish concerns mixed chains. The analysis was shown to predict the following extended mixed chain patterns:

(10.17) *aN* ... *go* ... *go* ... *aL* ... __ Pattern 1

(10.18) *aN* ... *aL* ... *aL* ... __ Pattern 1

(10.19) *aL* ... *aN* ... *go* ... *go* ... *Rpro* Pattern 2

(10.20) *aL* ... *aL* ... *aN* ... *Rpro* Pattern 2

(10.21) *aN* ... *aN* ... *go* ... *go* ... *Rpro* Pattern 3

(10.22) *aN* ... *go* ... *go* ... *aN* ... *Rpro* Pattern 3

Various combinations of these patterns and other patterns are also predicted. First, *aL* is predicted to repeat successive-cyclically if its lexical conditions on passing can be satisfied. Second, the lowermost *aN* is predicted to allow an unlimited number of following neutral *go* complementizers. However, all of these predictions are hard to test, because mixed chains strain the limits of speakers' grammatical competence (McCloskey 1990:195). Nevertheless, perhaps future work can reveal new ways to test longer mixed chains.

The chapter on Swedish and Hebrew presented new data on Swedish weak crossover and reconstruction and their interactions with resumptive pronouns. That investigation needs to be strengthened by looking at more data for both phenomena. I also presented the sketch of a proof-theoretic treatment of parasitic gaps. I hope to build on this sketch to develop a fuller theory of parasitic gaps.

The analysis of resumptive pronouns in general appealed to a binding-theoretic Highest Subject Restriction (McCloskey 1990). The HSR was argued to apply not just to Irish and Hebrew, as has previously been shown (Borer 1984, McCloskey 1990, Shlonsky 1992), but also to Swedish. To my knowledge, although various proposals have been made for how to capture the effects of the HSR (for example, the one made here and the one made by McCloskey 1990), no proposal has been made that explains why the HSR should hold. It cannot be a universal, because it does not seem to hold in Vata (Koopman 1982, 1983) or in Yoruba (Cable 2003). Comparative study of languages that do obey the HSR and languages that do not will hopefully reveal an explanation for what is otherwise essentially a stipulation.

The chapter on English copy raising analyzed several aspects of the syntax and semantics of copy raising and perceptual resemblance verbs. A lot of further work needs to be done in both these areas. For example, I noted that the resemblance relation that I gave as the denotation of *like* needs to be embedded in a theory with situations or events. In general, it is no small task to specify adequate truth-conditional semantics for *like* and *as*. The general syntax and semantics of the word *like* is a topic that is worth pursuing in its own right. *Like* can take both clausal and nominal complements and the phrases it heads can be either arguments and adjuncts. It will be quite challenging to attempt a unified explanation of this behaviour.

The semantics of perceptual resemblance verbs is also interesting in its own right. In chapter 9 I essentially treated them like control verbs. While this gets at the fact that their subject argument is thematic, it does not do justice to the full range of interpretations. In particular, there is an intriguing ambiguity revealed in the same class of perception verbs when they have simple predicative complements. Consider the following sentence:

(10.23) Pelle smells bad.

The overwhelmingly favoured interpretation of this sentence is that Pelle's odour is bad. However, it also has an additional reading that is swamped by the "malodorous reading". The other reading is that according to the perceiver's sense of smell, Pelle is bad (i.e., malicious, evil). If the perceiver is a human being, this reading seems unlikely, since we are not in general capable of determining whether someone is good or bad according to their scent. But if the perceiver is a dog for example, the reading becomes more acceptable:

(10.24) That stranger smelled bad to the dog.

This sentence can mean either that the dog found the stranger malodourous or that the dog thought that the stranger was a nasty customer. On one reading, the dog might simply wrinkle up his nose, on the other he would probably growl, etc. Similar ambiguities arise for the other perception verbs.

The two possible readings for (10.23) are further disambiguated if we use a predicative complement that can only readily be ascribed to sentient beings, such as *evil*. Consider the following alternative to (10.23):

(10.25) Pelle smells evil (to the dog).

Since it is strange to conceive of an odour as evil, this sentence only has the reading in which the predicate is ascribed to the subject, rather than to the subject's smell.

The two kinds of readings that are available for (10.23) are further distinguished by the following paraphrases:

(10.26) Pelle's smell is bad.

(10.27) Pelle smells like he is bad.

The first sentence can only mean that Pelle's smell is malodourous, since smells cannot be bad in the sense of maliciousness. The second sentence can only mean that Pelle himself is bad according to smell. The smell itself may not be particularly unpleasant. Suppose that we have reason to believe that cats (Pelle is a cat) that smell like roses are malicious (i.e., bad). Then *Pelle smells bad* in the sense represented by this paraphrase would not entail that his odour is bad.

The two readings of the perception verb can be represented with the same compositional semantics if a semantic head-switching analysis is adopted for one reading. The following two meaning constructors could for example represent the two readings for the verb *smell*, with the resource labels from example (10.23):

(10.28) $\lambda x \lambda P.smell_1(x,\ P(x)) : p \multimap (p \multimap b) \multimap s$

(10.29) $\lambda x \lambda P.P(smell_2(x)) : p \multimap (p \multimap b) \multimap s$

The ambiguity is entirely in the meaning language. In (10.28) $smell_1$ is both the syntactic and semantic head of the sentence and is a $\langle e, \langle \langle e, t \rangle, t \rangle \rangle$ function. In (10.29) $smell_2$ is the syntactic head but its predicative complement (e.g., *bad*) is the semantic head. $Smell_2$ in (10.29) denotes a type $\langle e, e \rangle$ function from individuals to their smells which applies to the subject.

The two alternative readings of (10.23) would be represented as:

(10.30) $smell_1(pelle, bad(pelle)) : s$

(10.31) $bad(smell_2(pelle)) : s$

The first meaning is appropriate as the denotation for *Pelle smells bad* in the sense of *Pelle smells like he is bad*. The second is appropriate for *Pelle smells bad* in the sense of *Pelle's smell is bad*. At this point the head-switching analysis is just a sketch. Further work needs to be done.

Two other avenues for future work were identified in chapter 9. The first concerned the perceptual / epistemic distinction between *seem* with an infinitival complement and *seem* with a predicative complement (Matushansky 2002). I proposed that the perceptual semantics for copy raising and perceptual resemblance verbs with *like*-complements had to do with the resemblace relation that is part of the proposed semantics for the preposition *like* or *as*. In order for the resemblance relationship to be stated felicitously, it must be perceivable. I noted, however, that this explanation does not obviously extend to predicative complements that are not headed by these prepositions. Nevertheless, future work might reveal a general solution that maintains the intuition behind the proposal.

Another avenue for future work identified in the chapter concerned expletives. I noted that double *there* expletives like the following are potentially problematic for both LFG's Subject Condition and for the EPP in the Minimalist Program:

(10.32) There seems like there's a party in the quad tonight.

The problem for LFG concerned ensuring c-structural realization of the shared expletive. The problem for Minimalism concerned establishing a link between the upper and lower instances of the expletive that explains why an upper *there* is not possible without a lower *there*. Future work on this phenomenon might be an opportunity for theoretical synthesis or at least further bridging between LFG and Minimalism.

Lastly, after I presented the processing model for resumptives I summarized several predictions of the processing model together with the resource management theory of resumption. I tried to be explicit and precise in the predictions. The predictions can hopefully therefore serve as the basis for substantial further work, especially experimental work that tests the processing model empirically.

Part IV

Appendices

Appendix A

Glue using Multiplicative Modality-free Intuitionistic Linear Logic (MILL)

In this appendix, I define the Glue logic in terms of the indicated fragment of linear logic. In the first section I define the meaning language, the fragment of linear logic, and the Glue logic that puts them together. The presentation follows Dalrymple et al. (1999b,a) and especially Crouch and van Genabith (2000). In the second section I present Prawitz-style natural deduction proof rules for the multiplicative ($\otimes$), modality-free (no ! or ? modalities) fragment of intuitionistic linear logic (MILL), following presentations by Crouch and van Genabith (2000), Benton et al. (1993), Troelstra (1992), Girard (1995), and Dalrymple et al. (1999a). In the third section I give the Curry-Howard term assignments for the meaning language, following the presentations of Glue meaning language term assignments by Dalrymple et al. (1999a) and Crouch and van Genabith (2000) and general presentations of Curry-Howard term assignments by Abramsky (1993), Benton et al. (1993), and Gallier (1995).

A.1 The Glue logic

⟨meaning⟩	::=	⟨meaning-const⟩	(constants)
	|	⟨meaning-var⟩	(variables)
	|	⟨meaning⟩(⟨meaning⟩)	(application)
	|	λ⟨meaning-var⟩.⟨meaning⟩	(abstraction)
	|	⟨meaning⟩ $\times$ ⟨meaning⟩	(product)
⟨type⟩	::=	⟨e-term⟩ | ⟨t-term⟩ ⟨t-var⟩	(atomic types)
	|	⟨type⟩ $\multimap$ ⟨type⟩	(linear implication)
	|	⟨type⟩ $\otimes$ ⟨type⟩	(multiplicative conjunction)
	|	$\forall$⟨t-var⟩$_1$.⟨type⟩	(universal quantification over terms from ⟨type⟩)
⟨glue⟩	::=	⟨meaning⟩:⟨type⟩	

A.2 Proof rules for MILL

	Elimination	Introduction
Implication ($\multimap$)	$\dfrac{\begin{matrix}\vdots\\ A\end{matrix} \qquad \begin{matrix}\vdots\\ A \multimap B\end{matrix}}{B}\multimap_{\mathcal{E}}$	$\dfrac{\begin{matrix}[A]^1\\ \vdots\\ B\end{matrix}}{A \multimap B}\multimap_{\mathcal{I},1}$
Conjunction ($\otimes$)	$\dfrac{\begin{matrix}\vdots\\ A \otimes B\end{matrix} \qquad \begin{matrix}[A]^1\ [B]^2\\ \vdots\\ C\end{matrix}}{C}\otimes_{\mathcal{E},1,2}$	$\dfrac{\begin{matrix}\vdots\\ A\end{matrix} \qquad \begin{matrix}\vdots\\ B\end{matrix}}{A \otimes B}\otimes_{\mathcal{I}}$
Universal ($\forall$)	$\dfrac{\begin{matrix}\vdots\\ \forall x.A\end{matrix}}{A[c/x]}\forall_{\mathcal{E}}$ c free for x	$\dfrac{\begin{matrix}\vdots\\ A[y/x]\end{matrix}}{\forall x.A}\forall_{\mathcal{I}}$ y free for x, y not free in A

A.3 Meaning language term assignments for MILL

	Elimination	Introduction
Implication ($\multimap$)	$\dfrac{\begin{matrix}\vdots\\ a : A\end{matrix} \qquad \begin{matrix}\vdots\\ f : A \multimap B\end{matrix}}{f(a) : B}\multimap_{\mathcal{E}}$	$\dfrac{\begin{matrix}[x : A]^1\\ \vdots\\ f : B\end{matrix}}{\lambda x.f : A \multimap B}\multimap_{\mathcal{I},1}$
Conjunction ($\otimes$)	$\dfrac{\begin{matrix}\vdots\\ a : A \otimes B\end{matrix} \qquad \begin{matrix}[x : A]^1 \ [y : B]^2\\ \vdots\\ f : C\end{matrix}}{\mathsf{let}\ a\ \mathsf{be}\ x \times y\ \mathsf{in}\ f : C}\otimes_{\mathcal{E},1,2}$	$\dfrac{\begin{matrix}\vdots\\ a : A\end{matrix} \qquad \begin{matrix}\vdots\\ b : B\end{matrix}}{a \times b : A \otimes B}\otimes_{\mathcal{I}}$
Universal ($\forall$)	$\dfrac{\begin{matrix}\vdots\\ t : \forall x.A\end{matrix}}{t : A[c/x]}\forall_{\mathcal{E}}$	$\dfrac{\begin{matrix}\vdots\\ t : A[y/x]\end{matrix}}{t : \forall x.A}\forall_{\mathcal{I}}$
	c free for x	y free for x, y not free in A

Appendix B

A fragment of Irish

Notes

[1] Recall that c-structure nodes / c-structure rule elements are optional (see chapter 2, section 2.1.2).

[2] The functional equality $(\uparrow \text{PRED FN}) \ = \ \text{pro}$ in (B.6) uses the decomposition of PRED proposed by Kaplan and Maxwell (1996) to specify that the rule element in question must be a pronoun (see Kaplan and Maxwell 1996:89). The rule is used to generate right-peripheral pronouns (Chung and McCloskey 1987; see chapter 6, section 6.1).

B.1 C-structure rules

(B.1)
$$\text{CP} \longrightarrow \begin{array}{c} \text{IP} \\ \uparrow = \downarrow \end{array}$$

(B.2)
$$\text{CP} \longrightarrow \left\{ \begin{array}{c} \text{XP} \\ (\uparrow \text{FOCUS}) = \downarrow \end{array} \;\middle|\; \begin{array}{c} \epsilon \\ (\uparrow \text{TOPIC PRED}) = \text{‘pro’} \\ \left(\begin{array}{c} (\text{ADJ} \in \uparrow) \\ REL_\sigma \end{array} \right) \end{array} \right\} \quad \begin{array}{c} \text{C}' \\ \uparrow = \downarrow \end{array}$$

(B.3)
$$\text{I}' \longrightarrow \begin{array}{c} \text{I}^0 \\ \uparrow = \downarrow \end{array} \quad \begin{array}{c} \text{S} \\ \uparrow = \downarrow \end{array}$$

(B.4)
$$\text{S} \longrightarrow \begin{array}{c} \text{DP} \\ (\uparrow \text{SUBJ}) = \downarrow \end{array} \quad \begin{array}{c} \text{XP} \\ \uparrow = \downarrow \end{array}$$

(B.5) $\text{VP} \longrightarrow \underset{\substack{(\uparrow \text{OBJ}) = \downarrow \\ ((\text{OBJ} \uparrow)\ \text{FINITE}) =_c -}}{\text{DP}} \quad \underset{\uparrow = \downarrow}{\text{VP}}$

(B.6) $\text{V}' \longrightarrow \underset{\substack{\uparrow = \downarrow \\ (\uparrow \text{FINITE}) =_c -}}{\text{V}^0} \quad \underset{(\uparrow \text{OBJ}) = \downarrow}{\text{DP}} \quad \underset{(\uparrow \text{COMP}) = \downarrow}{\text{CP}} \quad \underset{\substack{(\uparrow \text{OBJ}) = \downarrow \\ (\uparrow \text{PRED FN}) = \text{pro}}}{\text{DP}}$

(B.7) $\text{D}' \longrightarrow \underset{(\uparrow \text{SPEC}) = \downarrow}{\text{D}} \quad \underset{\uparrow = \downarrow}{\text{NP}}$

(B.8) $\text{NP} \longrightarrow \underset{\uparrow = \downarrow}{\text{NP}} \quad \underset{\downarrow \in (\uparrow \text{ADJUNCT})}{\text{CP}^*}$

B.2 Lexicon

(B.9) *an ('the')*: D^0 $(\uparrow \text{PRED}) = \text{'the'}$

$\lambda R \lambda S.\mathit{the}(x,\ R(x),\ S(x)) :$
$[((\text{SPEC}\ \uparrow)_\sigma\ \text{VAR}) \multimap ((\text{SPEC}\ \uparrow)_\sigma\ \text{RESTR})] \multimap$
$\forall X.[((\text{SPEC}\ \uparrow)_\sigma \multimap X) \multimap X]$

(B.10) *na ('the')*: D^0 $(\uparrow \text{PRED}) = \text{'the'}$

$\lambda R \lambda S.\mathit{the}(x,\ R(x),\ S(x)) :$
$[((\text{SPEC}\ \uparrow)_\sigma\ \text{VAR}) \multimap ((\text{SPEC}\ \uparrow)_\sigma\ \text{RESTR})] \multimap$
$\forall X.[((\text{SPEC}\ \uparrow)_\sigma \multimap X) \multimap X]$

(B.11) *rud ('thing')*: D^0 $(\uparrow \text{PRED}) = \text{'something'}$

$\lambda R \lambda S.\mathit{some}(x,\ R(x),\ S(x)) :$
$[(\uparrow_\sigma\ \text{VAR}) \multimap (\uparrow_\sigma\ \text{RESTR})] \multimap \forall X.[(\uparrow_\sigma \multimap X) \multimap X]$
$\mathit{thing} : (\uparrow_\sigma\ \text{VAR}) \multimap (\uparrow_\sigma\ \text{RESTR})$

(B.12) *cén ('which')*: D^0 $(\uparrow \text{PRED}) = \text{'which'}$

$\lambda R \lambda S.\mathit{Qu}(x,\ R(x),\ S(x)) :$
$[((\text{SPEC}\ \uparrow)_\sigma\ \text{VAR}) \multimap ((\text{SPEC}\ \uparrow)_\sigma\ \text{RESTR})] \multimap$
$\forall X.[((\text{SPEC}\ \uparrow)_\sigma \multimap X) \multimap X]$

(B.13) *mé ('I')*: D^0 $(\uparrow \text{PRED}) = \text{'pro'}$
$(\uparrow \text{PERS}) = 1$
$(\uparrow \text{NUM}) = \text{sg}$

$s : \uparrow_\sigma$

(B.14) *é ('him')*: D^0 $(\uparrow \text{PRED}) = \text{'pro'}$
$(\uparrow \text{PERS}) = 3$
$(\uparrow \text{NUM}) = \text{sg}$
$(\uparrow \text{GEND}) = \text{masc}$

$\lambda z.z \times z : (\uparrow_\sigma \text{ ANTECEDENT}) \multimap ((\uparrow_\sigma \text{ ANT}) \otimes \uparrow_\sigma)$

(B.15) *siad ('they')*: D^0 $(\uparrow \text{PRED}) = \text{'pro'}$
$(\uparrow \text{PERS}) = 3$
$(\uparrow \text{NUM}) = \text{pl}$

$\lambda z.z \times z : (\uparrow_\sigma \text{ ANTECEDENT}) \multimap ((\uparrow_\sigma \text{ ANT}) \otimes \uparrow_\sigma)$

(B.16) *Aturnae an Stáit ('Attorney General')*: D^0 $(\uparrow \text{PRED}) = \text{'attorney-general'}$

$a\text{-}g : \uparrow_\sigma$

(B.17) *an aimsir ('the time')*: DP $(\uparrow \text{PRED}) = \text{'time'}$

$the\text{-}time : \uparrow_\sigma$

(B.18) *an t-airgead ('the money')*: DP $(\uparrow \text{PRED}) = \text{'money'}$

$the\text{-}money : \uparrow_\sigma$

(B.19) *t-úrscéal ('novel')*: N^0 $(\uparrow \text{PRED}) = \text{'novel'}$

$novel : (\uparrow_\sigma \text{ VAR}) \multimap (\uparrow_\sigma \text{ RESTR})$

(B.20) *fir ('men')*: N^0 $(\uparrow \text{PRED}) = \text{'man'}$
$(\uparrow \text{NUM}) = \text{pl}$

$man^* : (\uparrow_\sigma \text{ VAR}) \multimap (\uparrow_\sigma \text{ RESTR})$

(B.21) *bhean ('woman')*: N^0 $(\uparrow \textsc{pred}) = \text{'woman'}$
$(\uparrow \textsc{num}) = \text{sg}$

$woman : (\uparrow_\sigma\ \textsc{var}) \multimap (\uparrow_\sigma\ \textsc{restr})$

(B.22) *mic léinn ('students')*: N^0 $(\uparrow \textsc{pred}) = \text{'student'}$
$(\uparrow \textsc{num}) = \text{pl}$

$student^* : (\uparrow_\sigma\ \textsc{var}) \multimap (\uparrow_\sigma\ \textsc{restr})$

(B.23) *scríbhneoir ('writer')*: N^0 $(\uparrow \textsc{pred}) = \text{'writer'}$

$writer : (\uparrow_\sigma\ \textsc{var}) \multimap (\uparrow_\sigma\ \textsc{restr})$

(B.24) *coinne ('expectation')*: N^0 $(\uparrow \textsc{pred}) = \text{'expectation'}$
$(\uparrow \textsc{subj pcase}) = \textsc{obl}_{source}$

$expectation :$
$(\uparrow\ \textsc{subj obj})_\sigma \multimap (\uparrow\ \textsc{comp})_\sigma \multimap \uparrow_\sigma$

(B.25) *mheas ('thought')*: I^0 $(\uparrow \textsc{pred}) = \text{'think'}$
$(\uparrow \textsc{finite}) = +$

$think : (\uparrow \textsc{subj})_\sigma \multimap (\uparrow \textsc{comp})_\sigma \multimap \uparrow_\sigma$

(B.26) *shíl ('thought')*: I^0 $(\uparrow \textsc{pred}) = \text{'think'}$
$(\uparrow \textsc{finite}) = +$

$think : (\uparrow \textsc{subj})_\sigma \multimap (\uparrow \textsc{comp})_\sigma \multimap \uparrow_\sigma$

(B.27) *mholann ('praise')*: I^0 $(\uparrow \textsc{pred}) = \text{'praise'}$
$(\uparrow \textsc{finite}) = +$

$praise : (\uparrow \textsc{subj})_\sigma \multimap (\uparrow \textsc{obj})_\sigma \multimap \uparrow_\sigma$

(B.28) *thuig ('understood')*: I^0 $(\uparrow \textsc{pred}) = \text{'understand'}$
$(\uparrow \textsc{finite}) = +$

$understand : (\uparrow \textsc{subj})_\sigma \multimap (\uparrow \textsc{obj})_\sigma \multimap \uparrow_\sigma$

(B.29) *bhfaighinn ('get')*: I^0
$(\uparrow \textsc{pred}) = \text{'get'}$
$(\uparrow \textsc{finite}) = +$
$(\uparrow \textsc{mood}) = \text{irrealis}$
$(\uparrow \textsc{obl pcase}) = \textsc{obl}_{source}$

$get\text{-}from :$
$(\uparrow \textsc{subj})_\sigma \multimap (\uparrow \textsc{obj})_\sigma \multimap (\uparrow \textsc{obl obj})_\sigma \multimap \uparrow_\sigma$

(B.30) *choimhlíonfadh ('confirm')*: I^0
$(\uparrow \textsc{pred}) = \text{'confirm'}$
$(\uparrow \textsc{finite}) = +$
$(\uparrow \textsc{mood}) = \text{irrealis}$

$confirm : (\uparrow \textsc{subj})_\sigma \multimap (\uparrow \textsc{obj})_\sigma \multimap \uparrow_\sigma$

(B.31) *raibh ('was')*: I^0
$(\uparrow \textsc{finite}) = +$
$(\uparrow \textsc{tense}) = \text{past}$
$(\uparrow \textsc{subj pers}) = 3$
$(\uparrow \textsc{subj num}) = \text{sg}$

$$\left(\begin{array}{l} (\uparrow \textsc{subj}) = (\uparrow \textsc{xcomp subj}) \\ be : (\uparrow \ \textsc{xcomp})_\sigma \ \multimap \ \uparrow_\sigma \end{array} \right)$$

(B.32) *rabh ('were')*: I^0
$(\uparrow \textsc{finite}) = +$
$(\uparrow \textsc{tense}) = \text{past}$
$(\uparrow \textsc{subj pers}) = 3$
$(\uparrow \textsc{subj num}) = \text{pl}$

$$\left(\begin{array}{l} (\uparrow \textsc{subj}) = (\uparrow \textsc{xcomp subj}) \\ be : (\uparrow \ \textsc{xcomp})_\sigma \ \multimap \ \uparrow_\sigma \end{array} \right)$$

(B.33) *ag súil ('hope')*: V^0
$(\uparrow \textsc{pred}) = \text{'hope'}$
$(\uparrow \textsc{finite}) = -$
$(\uparrow \textsc{aspect}) = \text{progressive}$

$hope : (\uparrow \ \textsc{subj})_\sigma \ \multimap \ (\uparrow \textsc{comp})_\sigma \ \multimap \ \uparrow_\sigma$

(B.34) *díleas ('loyal')*: A^0
$(\uparrow \textsc{pred}) = \text{'loyal'}$

$loyal\text{-}to : (\uparrow \textsc{subj})_\sigma \multimap (\uparrow \textsc{obl})_\sigma \multimap \uparrow_\sigma$

(B.35) *do'n Rí ('to-the King')*: PP $(\uparrow \text{PRED}) = \text{'king'}$

$the\text{-}king : \uparrow_\sigma$

(B.36) *agam ('at me')*: P^0

$(\uparrow \text{PCASE}) = \text{OBL}_{source}$
$(\uparrow \text{OBJ PRED}) = \text{'pro'}$
$(\uparrow \text{OBJ PERS}) = 1$
$(\uparrow \text{OBJ NUM}) = \text{sg}$

$s : (\uparrow\ \text{OBJ})_\sigma$

(B.37) *uaithi ('from her')*: P^0

$(\uparrow \text{PCASE}) = \text{OBL}_{source}$
$(\uparrow \text{OBJ PRED}) = \text{'pro'}$
$(\uparrow \text{OBJ PERS}) = 1$
$(\uparrow \text{OBJ NUM}) = \text{sg}$
$(\uparrow \text{OBJ GEND}) = \text{fem}$

$\lambda z.z \times z :$
$((\uparrow \text{OBJ})_\sigma\ \text{ANT}) \multimap (((\uparrow \text{OBJ})_\sigma\ \text{ANT}) \otimes (\uparrow \text{OBJ})_\sigma)$

(B.38) REL_σ:

$$\begin{array}{l}\lambda P \lambda Q \lambda x. Q(x) \wedge P(x) : \\ \quad [(\uparrow \text{TOPIC})_\sigma \multimap \uparrow_\sigma] \multimap \\ \quad\quad [[((\text{ADJ} \in \uparrow)_\sigma\ \text{VAR}) \multimap ((\text{ADJ} \in \uparrow)_\sigma\ \text{RESTR})] \multimap \\ \quad\quad\quad [((\text{ADJ} \in \uparrow)_\sigma\ \text{VAR}) \multimap ((\text{ADJ} \in \uparrow)_\sigma\ \text{RESTR})]]\end{array}$$

(B.39) *aL*: $\hat{\text{C}}$ $\{ (\uparrow \text{UDF}) = (\uparrow \text{COMP UDF}) \mid (\uparrow \text{UDF}) = (\uparrow \text{GF}) \}$

(B.40) *aN*: $\hat{\text{C}}$

$$\left\{\begin{array}{l} (\uparrow \text{UDF})_\sigma = ((\uparrow \text{GF}^+ \text{UDF})_\sigma\ \text{ANTECEDENT}) \\ \lambda P.P : ((\uparrow \text{GF}^+ \text{UDF})_\sigma \multimap \uparrow_\sigma) \multimap ((\uparrow \text{UDF})_\sigma \multimap \uparrow_\sigma)] \end{array}\right. \Bigg|$$

$$\left.\begin{array}{l} (\uparrow \text{UDF})_\sigma = ((\uparrow \text{GF}^+)_\sigma\ \text{ANTECEDENT}) \\ \lambda P \lambda y.y : \\ {[(\uparrow \text{UDF})_\sigma \multimap ((\uparrow \text{UDF})_\sigma \otimes (\uparrow \text{GF}^+)_\sigma)]} \multimap ((\uparrow \text{UDF})_\sigma \multimap (\uparrow \text{UDF})_\sigma) \\ \lambda P.P : ((\uparrow \text{GF}^+)_\sigma \multimap \uparrow_\sigma) \multimap ((\uparrow \text{UDF})_\sigma \multimap \uparrow_\sigma) \end{array}\right\}$$

B.3 Examples

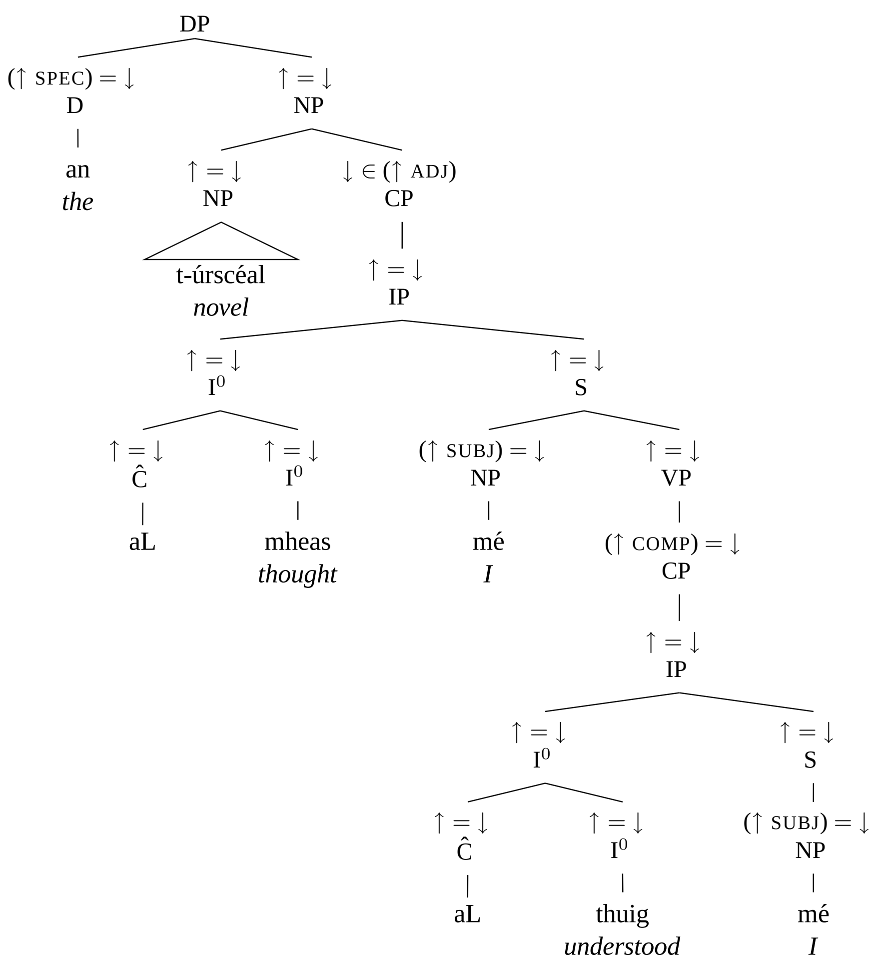
Relative clause filler-gap dependency (see pages 188–190)

(B.41)

an	t-úrscéal	aL	mheas	mé	aL	thuig	mé _
the	novel	*aL*	thought	I	*aL*	understood	I _

the novel that I thought I understood
(McCloskey 1979:17, (42c))

(B.42)



(B.43)

$$
n\left[\begin{array}{ll}
\text{PRED} & \text{‘novel’}\\
\text{SPEC} & \left[\begin{array}{ll}\text{PRED} & \text{‘the’}\\ \text{DEF} & +\end{array}\right]\\
\text{ADJ} & \left\{ t\left[\begin{array}{ll}
\text{PRED} & \text{‘think’}\\
\text{TOPIC} & p\left[\begin{array}{ll}\text{PRED} & \text{‘pro’}\end{array}\right]\\
\text{SUBJ} & i1\left[\begin{array}{ll}\text{PRED} & \text{‘pro’}\\ \text{PERS} & 1\\ \text{NUM} & \text{sg}\end{array}\right]\\
\text{COMP} & u\left[\begin{array}{ll}\text{PRED} & \text{‘understand’}\\ \text{TOPIC} & \\ \text{SUBJ} & i2\left[\begin{array}{ll}\text{PRED} & \text{‘pro’}\\ \text{PERS} & 1\\ \text{NUM} & \text{sg}\end{array}\right]\\ \text{OBJ} & \\ \text{TENSE} & \text{past}\end{array}\right]\\
\text{TENSE} & \text{past}
\end{array}\right]\right\}
\end{array}\right]
$$

(B.44)

1. $\lambda R \lambda S.the(x,\ R(x),\ S(x)) :$ $(v \multimap r) \multimap \forall X.[(n \multimap X) \multimap X]$ — Lex. **an (‘the’)**
2. $novel : v \multimap r$ — Lex. **t-úrscéal (‘novel’)**
3. $think : i1 \multimap u \multimap t$ — Lex. **mheas (‘thought’)**
4. $s : i1$ — Lex. **mé (‘I’)**
5. $understand : i2 \multimap p \multimap u$ — Lex. **thuig (‘understood’)**
6. $s : i2$ — Lex. **mé (‘I’)**
7. $\lambda P \lambda Q \lambda x.Q(x) \wedge P(x) :$ $(p \multimap t) \multimap [(v \multimap r) \multimap (v \multimap r)]$ — REL_σ

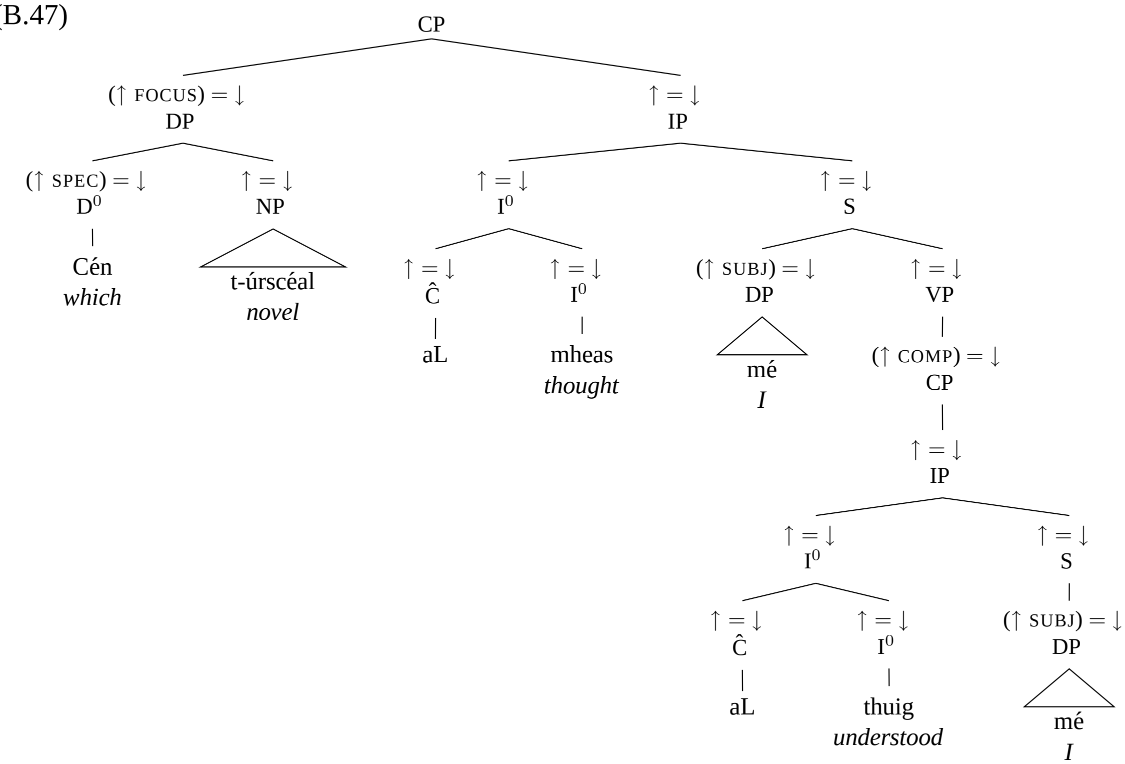
(B.45)

$$
\dfrac{
  \dfrac{
    \dfrac{
      \dfrac{
        \dfrac{
          \dfrac{
            \dfrac{
              \begin{array}{l} s : \\ \mathit{i2} \end{array}
              \quad
              \begin{array}{l} \mathit{understand} : \\ \mathit{i2} \multimap p \multimap u \end{array}
            }{
              \begin{array}{l} \mathit{understand}(s) : \\ p \multimap u \end{array}
            }
            \quad [y : p]^1
          }{
            \begin{array}{l} \mathit{understand}(s, y) : \\ u \end{array}
          }
          \quad
          \dfrac{
            \begin{array}{l} s : \\ \mathit{i1} \end{array}
            \quad
            \begin{array}{l} \mathit{think} : \\ \mathit{i1} \multimap u \multimap t \end{array}
          }{
            \begin{array}{l} \mathit{think}(s) : \\ u \multimap t \end{array}
          }
        }{
          \begin{array}{l} \mathit{think}(s, \mathit{understand}(s, y)) : \\ t \end{array}
        }
      }{
        \begin{array}{l} \lambda y.\mathit{think}(s, \mathit{understand}(s, y)) : \\ p \multimap t \end{array}
      }\multimap_{\mathcal{I},1}
      \quad
      \begin{array}{l} \lambda P \lambda Q \lambda z. Q(z) \wedge P(z) : \\ (p \multimap t) \multimap [(v \multimap r) \multimap (v \multimap r)] \end{array}
    }{
      \begin{array}{l} \lambda Q \lambda z. Q(z) \wedge \mathit{think}(s, \mathit{understand}(s, z)) : \\ (v \multimap r) \multimap (v \multimap r) \end{array}
    }
    \quad
    \begin{array}{l} \mathit{novel} : \\ v \multimap r \end{array}
  }{
    \begin{array}{l} \lambda z.\mathit{novel}(z) \wedge \mathit{think}(s, \mathit{understand}(s, z)) : \\ v \multimap r \end{array}
  }
  \quad
  \begin{array}{l} \lambda R \lambda S.\mathit{the}(x,\ R(x),\ S(x)) : \\ (v \multimap r) \multimap \forall X.[(n \multimap X) \multimap X] \end{array}
}{
  \lambda S.\mathit{the}(x,\ \mathit{novel}(x)\ \wedge\ \mathit{think}(s,\ \mathit{understand}(s,\ x)),\ S(x)) : \forall X.[(n \multimap X) \multimap X]
}
$$

Wh-question filler-gap dependency (see pages 190–192)

(B.46) Cén t-úrscéal aL mheas mé aL thuig mé __
which novel *aL* thought I *aL* understood I __
Which novel did I think I understood?
(McCloskey 1979:54, ∼(10))

(B.47)



(B.48)

$$
t\left[\begin{array}{ll}
\textsc{pred} & \text{‘think’} \\
\textsc{focus} & n\left[\begin{array}{ll} \textsc{pred} & \text{‘novel’} \\ \textsc{spec} & \left[\begin{array}{ll} \textsc{pred} & \text{‘which’} \end{array}\right] \end{array}\right] \\
\textsc{subj} & i1\left[\begin{array}{ll} \textsc{pred} & \text{‘pro’} \\ \textsc{pers} & 1 \\ \textsc{num} & \text{sg} \end{array}\right] \\
\textsc{comp} & u\left[\begin{array}{ll} \textsc{pred} & \text{‘understand’} \\ \textsc{focus} & \rule{3cm}{0.4pt} \\ \textsc{subj} & i2\left[\begin{array}{ll} \textsc{pred} & \text{‘pro’} \\ \textsc{pers} & 1 \\ \textsc{num} & \text{sg} \end{array}\right] \\ \textsc{obj} & \rule{3cm}{0.4pt} \\ \textsc{tense} & \text{past} \end{array}\right] \\
\textsc{tense} & \text{past}
\end{array}\right]
$$

(B.49)

1.	$\lambda S.Qu(x,\ novel(x),\ S(x)) :$ $\forall X.[(n \multimap X) \multimap X]$	Lex. **Cén t-úrscéal (‘which novel’)**
2.	$think : i1 \multimap u \multimap t$	Lex. **mheas (‘thought’)**
3.	$s : i1$	Lex. **mé (‘I’)**
4.	$understand : i2 \multimap n \multimap u$	Lex. **thuig (‘understood’)**
5.	$s : i2$	Lex. **mé (‘I’)**

(B.50)

$$
\begin{prooftree}
\AxiomC{$\lambda S.Qu(x,\ novel(x),\ S(x)) :$}
\noLine
\UnaryInfC{$\forall X.[(n \multimap X) \multimap X]$}
\AxiomC{$s :$}
\noLine
\UnaryInfC{$i2$}
\AxiomC{$understand :$}
\noLine
\UnaryInfC{$i2 \multimap n \multimap u$}
\BinaryInfC{$understand(s) :$}
\noLine
\UnaryInfC{$n \multimap u$}
\AxiomC{$[y : n]^1$}
\BinaryInfC{$understand(s,y) :$}
\noLine
\UnaryInfC{u}
\AxiomC{$s :$}
\noLine
\UnaryInfC{$i1$}
\AxiomC{$think :$}
\noLine
\UnaryInfC{$i1 \multimap u \multimap t$}
\BinaryInfC{$think(s) :$}
\noLine
\UnaryInfC{$u \multimap t$}
\BinaryInfC{$think(s, understand(s,y)) :$}
\noLine
\UnaryInfC{t}
\RightLabel{$\multimap_{\mathcal{I},1}$}
\UnaryInfC{$\lambda y.think(s, understand(s,y)) :$}
\noLine
\UnaryInfC{$n \multimap t$}
\RightLabel{$[t/X]$}
\BinaryInfC{$Qu(x,\ novel(x),\ think(s,\ understand(s,\ x))) : t$}
\end{prooftree}
$$

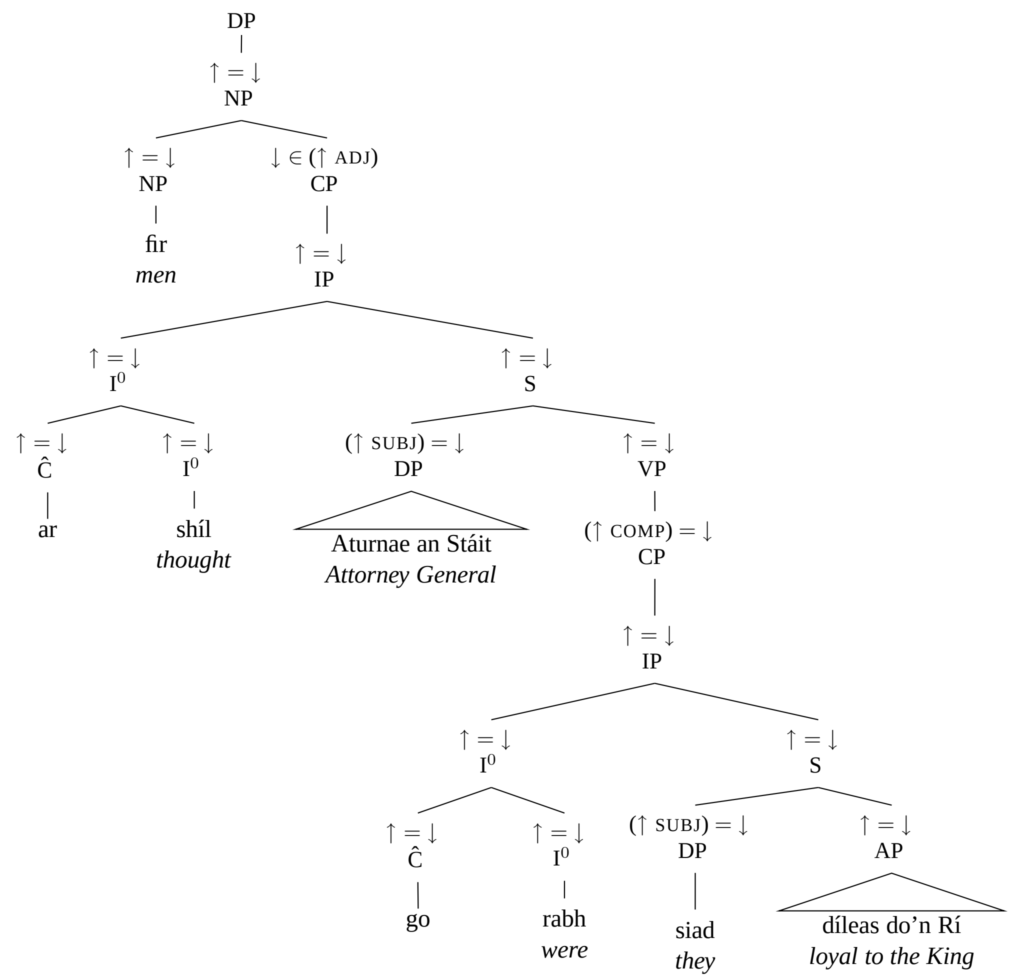
Binder-resumptive dependency (see pages 198–202)

(B.51)

fir	ar	shíl	Aturnae	an	Stáit	go	rabh	<u>siad</u>	díleas	do'n	Rí
men	*aN*	thought	Attorney	the	State	*go*	were	they	loyal	to-the	King

men that the Attorney General thought were loyal to the King
(McCloskey 2002:190, (16))

(B.52)



(B.53)

$$
m\left[\begin{array}{ll}
\textsc{pred} & \text{`man'} \\
\textsc{num} & \text{pl} \\
\textsc{adj} & \left\{ t\left[\begin{array}{ll}
\textsc{pred} & \text{`think'}\\
\textsc{tense} & \text{past}\\
\textsc{topic} & a\left[\begin{array}{ll}\textsc{pred} & \text{`pro'}\end{array}\right]\\
\textsc{subj} & g[\text{``Attorney General''}]\\
\textsc{comp} & l\left[\begin{array}{ll}
\textsc{pred} & \text{`loyal'}\\
\textsc{subj} & p\left[\begin{array}{ll}\textsc{pred}&\text{`pro'}\\ \textsc{pers}&3\\ \textsc{num}&\text{pl}\end{array}\right]\\
\textsc{obl} & k\left[\text{``to the King''}\right]
\end{array}\right]
\end{array}\right]\right\}
\end{array}\right]
\qquad p \xrightarrow{\sigma} p_\sigma\left[\textsc{ant}\quad a_\sigma\left[\ \right]\right]
\qquad a \xrightarrow{\sigma} a_\sigma
$$

(B.54)

1.	$men : v \multimap r$	Lex. **fir (‘men’)**
2.	$\lambda P \lambda Q \lambda x.Q(x) \wedge P(x) :$ $(a \multimap t) \multimap [(v \multimap r) \multimap (v \multimap r)]$	REL_σ
3.	$\lambda P \lambda x.x :$ $[a \multimap (a \otimes p)] \multimap (a \multimap a)]$	Lex. **ar (aN)**
4.	$\lambda P.P : (p \multimap t) \multimap (a \multimap t)$	Lex. **ar (aN)**
5.	$think : g \multimap l \multimap t$	Lex. **shíl (‘thought’)**
6.	$a\text{-}g : g$	Lex. **Aturnae an Stáit (‘Att. Gen.’)**
7.	$\lambda z.z \times z : a \multimap (a \multimap p)$	Lex. **siad (‘they’)**
8.	$loyal\text{-}to : k \multimap p \multimap l$	Lex. **díleas (‘loyal’)**
9.	$the\text{-}king : k$	Lex. **do’n Rí (‘to-the King’)**

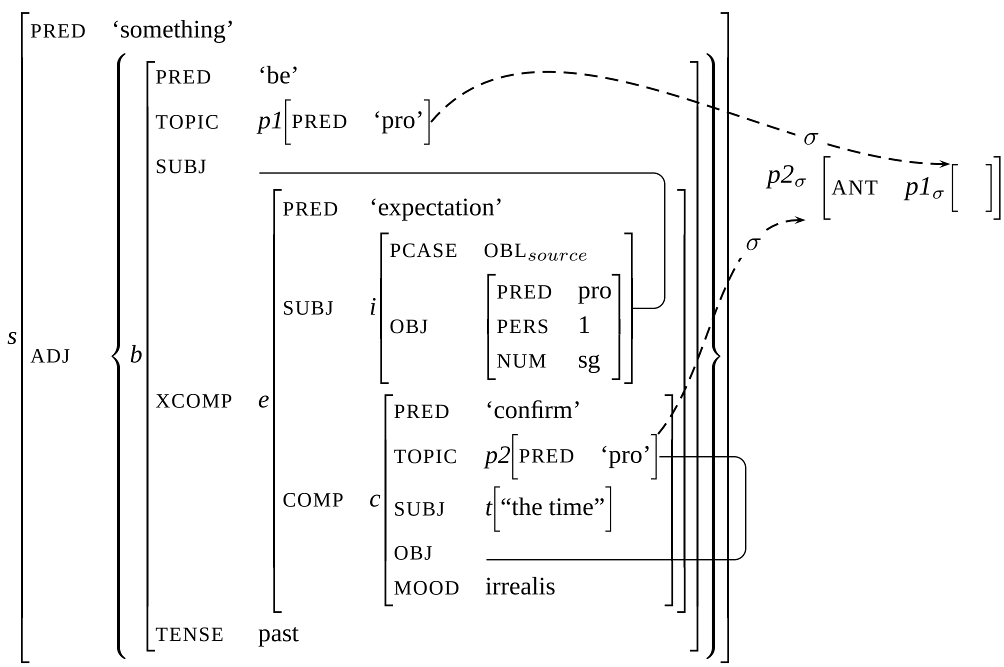
(B.55)

$$
\dfrac{\dfrac{\dfrac{\dfrac{\lambda P\lambda x.x : [a \multimap (a \otimes p)] \multimap (a \multimap a)] \quad \lambda z.z \times z : a \multimap (a \otimes p)}{\lambda x.x : (a \multimap a)} \quad [y : a]^1}{y : a} \quad \dfrac{\dfrac{\dfrac{\dfrac{\dfrac{\dfrac{\textit{the-king} : k \quad \textit{loyal-to} : k \multimap p \multimap l}{\textit{loyal-to}(\textit{the-king}) : p \multimap l} \quad [x : p]^2}{\textit{loyal-to}(x, \textit{the-king}) : l} \quad \dfrac{\textit{a-g} : g \quad \textit{think} : g \multimap l \multimap t}{\textit{think}(\textit{a-g}) : l \multimap t}}{\textit{think}(\textit{a-g}, \textit{loyal-to}(x, \textit{the-king})) : t}}{\lambda x.\textit{think}(\textit{a-g}, \textit{loyal-to}(x, \textit{the-king})) : p \multimap t}\multimap_{\mathcal{I},2} \quad \lambda P.P : (p \multimap t) \multimap (a \multimap t)}{\lambda x.\textit{think}(\textit{a-g}, \textit{loyal-to}(x, \textit{the-king})) : a \multimap t}\multimap_{\mathcal{I},1}}{\dfrac{\textit{think}(\textit{a-g}, \textit{loyal-to}(y, \textit{the-king})) : t}{\lambda y.\textit{think}(\textit{a-g}, \textit{loyal-to}(y, \textit{the-king})) : a \multimap t}\multimap_{\mathcal{I},1}} \quad \lambda P\lambda Q\lambda x.Q(x) \wedge P(x) : (a \multimap t) \multimap [(v \multimap r) \multimap (v \multimap r)]}{\dfrac{\lambda Q\lambda x.Q(x) \wedge \textit{think}(\textit{a-g}, \textit{loyal-to}(x, \textit{the-king})) : (v \multimap r) \multimap (v \multimap r) \quad \textit{man}^* : v \multimap r}{\lambda x.\textit{man}^*(x) \ \wedge \ \textit{think}(\textit{a-g}, \textit{loyal-to}(x, \textit{the-king})) : v \multimap r}}
$$

Pattern 1 (see pages 209–211)

(B.56) rud a raibh coinne agam a choimhlíonfadh __ an aimsir
thing *aN* was expectation at-me *aL* fulfill.COND __ the time
something that I expected time would confirm
(McCloskey 2002:196, ∼(28))

(B.57)



(B.58)

1. $\lambda R \lambda S.some(x,\ R(x),\ S(x))$: $(v \multimap r) \multimap \forall X.[(s \multimap X) \multimap X]$ — Lex. **rud (‘thing’)**
2. $thing : v \multimap r$ — Lex. **rud (‘thing’)**
3. $\lambda P \lambda Q \lambda y.Q(y) \wedge P(y)$: $(p1 \multimap b) \multimap [(v \multimap r) \multimap (v \multimap r)]$ — REL_σ
4. $\lambda P.P : (p2 \multimap b) \multimap (p1 \multimap b)]$ — Lex. **a (‘aN’)**
5. $be : e \multimap b$ — Lex. **raibh (‘was’)**
6. $expectation : i \multimap c \multimap e$ — Lex. **coinne (‘expectation’)**
7. $s : i$ — Lex. **agam (‘at-me’)**
8. $confirm : t \multimap p2 \multimap c$ — Lex. **choimhlíonfadh (‘confirm’)**
9. $the\text{-}time : t$ — Lex. **an aimsir (‘the time’)**

(B.59)

$$\dfrac{\dfrac{\dfrac{\textit{the-time} : t \qquad \textit{confirm} : t \multimap p2 \multimap c}{\textit{confirm}(\textit{the-time}) : p2 \multimap c} \qquad [x : p2]^1}{\textit{confirm}(\textit{the-time}, x) : c} \qquad \dfrac{\textit{expectation} : i \multimap c \multimap e \qquad s : i}{\textit{expectation}(s) : c \multimap e}}{\textit{expectation}(s, \textit{confirm}(\textit{the-time}, x)) : e}$$

$$\dfrac{\dfrac{\textit{expectation}(s, \textit{confirm}(\textit{the-time}, x)) : e \qquad \textit{be} : e \multimap b}{\textit{be}(\textit{expectation}(s, \textit{confirm}(\textit{the-time}, x))) : b}}{\lambda x.\textit{be}(\textit{expectation}(s, \textit{confirm}(\textit{the-time}, x))) : p2 \multimap b} \multimap_{\mathcal{I},1}$$

$$\dfrac{\lambda x.\textit{be}(\textit{expectation}(s, \textit{confirm}(\textit{the-time}, x))) : p2 \multimap b \qquad \lambda P.P : (p2 \multimap b) \multimap (p1 \multimap b)}{\lambda x.\textit{be}(\textit{expectation}(s, \textit{confirm}(\textit{the-time}, x))) : p1 \multimap b}$$

$$\dfrac{\lambda x.\textit{be}(\textit{expectation}(s, \textit{confirm}(\textit{the-time}, x))) : p1 \multimap b \qquad \lambda P \lambda Q \lambda y.Q(y) \wedge P(y) : (p1 \multimap b) \multimap [(v \multimap r) \multimap (v \multimap r)]}{\lambda Q \lambda y.Q(y) \wedge \textit{be}(\textit{expectation}(s, \textit{confirm}(\textit{the-time}, y))) : (v \multimap r) \multimap (v \multimap r)}$$

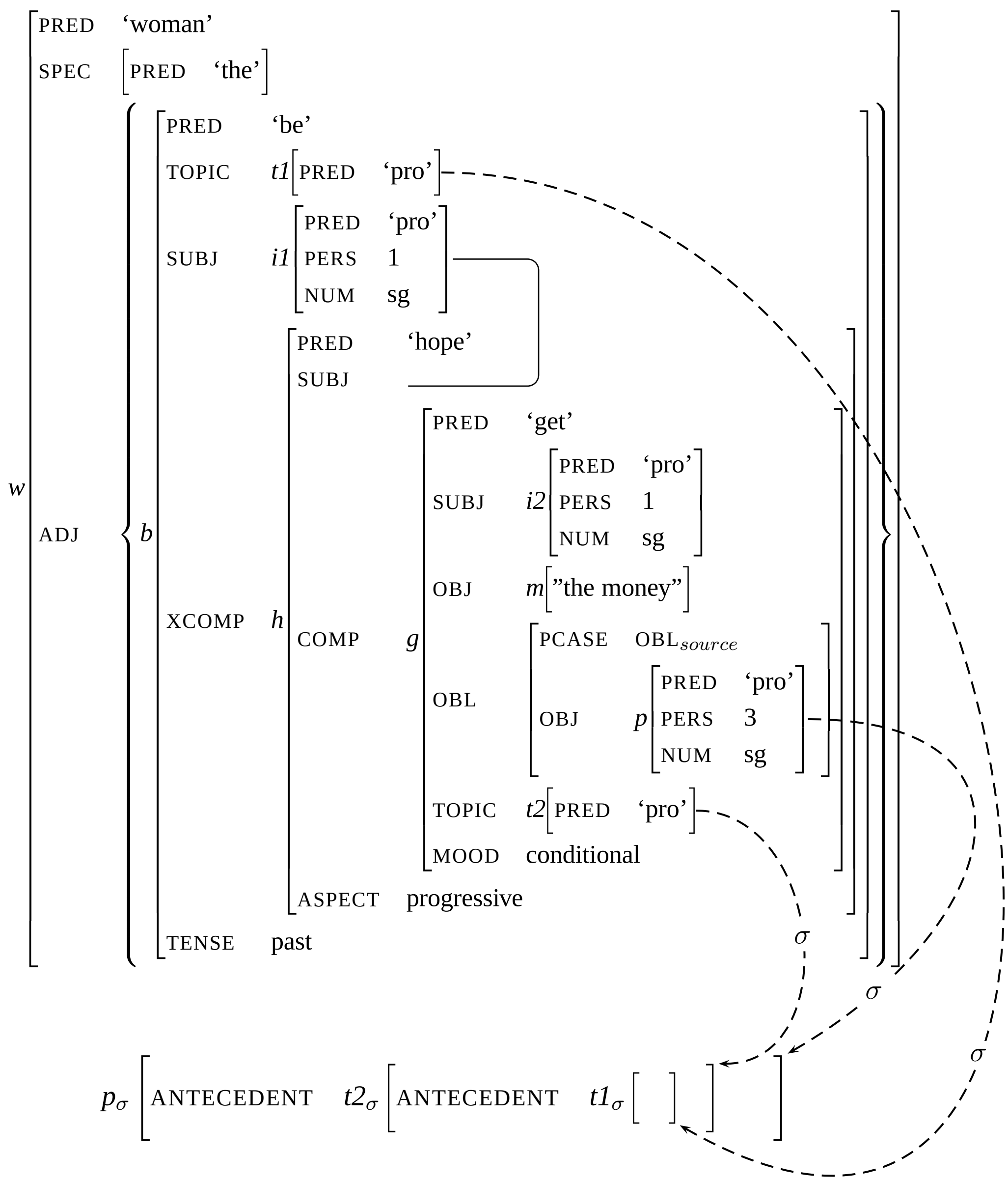
$$\dfrac{\lambda Q \lambda y.Q(y) \wedge \textit{be}(\textit{expectation}(s, \textit{confirm}(\textit{the-time}, y))) : (v \multimap r) \multimap (v \multimap r) \qquad \textit{thing} : v \multimap r}{\lambda y.\textit{thing}(y) \wedge \textit{be}(\textit{expectation}(s, \textit{confirm}(\textit{the-time}, y))) : v \multimap r}$$

$$\dfrac{\lambda R \lambda S.\textit{some}(x,\ R(x),\ S(x)) : (v \multimap r) \multimap \forall X.[(s \multimap X) \multimap X] \qquad \lambda y.\textit{thing}(y) \wedge \textit{be}(\textit{expectation}(s, \textit{confirm}(\textit{the-time}, y))) : v \multimap r}{\lambda S.\textit{some}(x,\ \textit{thing}(x)\ \wedge\ \textit{be}(\textit{expectation}(s,\ \textit{confirm}(\textit{the-time},\ x))),\ S(x)) : \forall X.[(s \multimap X) \multimap X]}$$

Pattern 3 (see pages 212–214)

(B.60) an bhean a raibh mé ag súil a bhfaighinn an t-airgead <u>uaithi</u>
the woman *aN* was I hope.PROG *aN* get.COND.1SG the money from-her
the woman that I was hoping that I would get the money from (her)
(McCloskey 2002:199, ∼(41))

(B.61)



(B.62)

1.	$\lambda R \lambda S.the(x,\ R(x),\ S(x)) :$ $(v \multimap r) \multimap \forall X.[(w \multimap X) \multimap X]$	Lex. **an (‘the’)**
2.	$woman : v \multimap r$	Lex. **bhean (‘woman’)**
3.	$\lambda P \lambda Q \lambda y.Q(y) \wedge P(y) :$ $(t1 \multimap b) \multimap [(v \multimap r) \multimap (v \multimap r)]$	REL_σ
4.	$\lambda P.P : (t2 \multimap b) \multimap (t1 \multimap b)]$	Lex. **a (‘aN’)**
5.	$be : h \multimap b$	Lex. **raibh (‘was’)**
6.	$s : i1$	Lex. **mé (‘I’)**
7.	$hope : i1 \multimap g \multimap h$	Lex. **ag súil (‘hope’)**
8.	$\lambda P.P : (p \multimap g) \multimap (t2 \multimap g)$	Lex. **a (‘aN’)**
9.	$\lambda P \lambda y.y :$ $[t2 \multimap (t2 \otimes p)] \multimap (t2 \multimap t2)$	Lex. **a (‘aN’)**
10.	$get\text{-}from : i2 \multimap m \multimap p \multimap g$	Lex. **bhfaighinn (‘get’)**
11.	$s : i2$	Lex. **bhfaighinn (‘get’)**
12.	$the\text{-}money : m$	Lex. **an t-airgead (‘the money’)**
13.	$\lambda z.z \times z : t2 \multimap (t2 \otimes p)$	Lex. **uaithi (‘from-her’)**

(B.63)

$$\frac{\dfrac{\dfrac{\dfrac{\mathit{get\text{-}from} : i2 \multimap m \multimap p \multimap g \qquad s : i2}{\mathit{get\text{-}from}(s) : m \multimap p \multimap g} \qquad \mathit{the\text{-}money} : m}{\mathit{get\text{-}from}(s, \mathit{the\text{-}money}) : p \multimap g} \qquad \lambda P.P : (p \multimap g) \multimap (t2 \multimap g)}{\mathit{get\text{-}from}(s, \mathit{the\text{-}money}) : t2 \multimap g} \qquad [x : t2]^1}{\mathit{get\text{-}from}(s, \mathit{the\text{-}money}, x) : g}$$

$$\frac{s : i1 \qquad \mathit{hope} : i1 \multimap g \multimap h}{\mathit{hope}(s) : g \multimap h}$$

$$\frac{\mathit{hope}(s) : g \multimap h \qquad \mathit{get\text{-}from}(s, \mathit{the\text{-}money}, x) : g}{\mathit{hope}(s, \mathit{get\text{-}from}(s, \mathit{the\text{-}money}, x)) : h}$$

$$\dfrac{\dfrac{\mathit{hope}(s, \mathit{get\text{-}from}(s, \mathit{the\text{-}money}, x)) : h \qquad \mathit{be} : h \multimap b}{\mathit{be}(\mathit{hope}(s, \mathit{get\text{-}from}(s, \mathit{the\text{-}money}, x))) : b}}{\lambda x.\mathit{be}(\mathit{hope}(s, \mathit{get\text{-}from}(s, \mathit{the\text{-}money}, x))) : t2 \multimap b} \multimap_{\mathcal{I},1}$$

$$\frac{[z : t2]^2 \qquad \dfrac{\lambda z.z \times z : t2 \multimap (t2 \otimes p) \qquad \lambda P \lambda y.y : [t2 \multimap (t2 \otimes p)] \multimap (t2 \multimap t2)}{\lambda y.y : t2 \multimap t2}}{z : t2}$$

$$\dfrac{\dfrac{\lambda x.\mathit{be}(\mathit{hope}(s, \mathit{get\text{-}from}(s, \mathit{the\text{-}money}, x))) : t2 \multimap b \qquad z : t2}{\mathit{be}(\mathit{hope}(s, \mathit{get\text{-}from}(s, \mathit{the\text{-}money}, z))) : b}}{\lambda z.\mathit{be}(\mathit{hope}(s, \mathit{get\text{-}from}(s, \mathit{the\text{-}money}, z))) : t2 \multimap b} \multimap_{\mathcal{I},2}$$

$$\frac{\lambda P.P : (t2 \multimap b) \multimap (t1 \multimap b) \qquad \lambda z.\mathit{be}(\mathit{hope}(s, \mathit{get\text{-}from}(s, \mathit{the\text{-}money}, z))) : t2 \multimap b}{\lambda z.\mathit{be}(\mathit{hope}(s, \mathit{get\text{-}from}(s, \mathit{the\text{-}money}, z))) : t1 \multimap b}$$

$$\frac{\lambda z.\mathit{be}(\mathit{hope}(s, \mathit{get\text{-}from}(s, \mathit{the\text{-}money}, z))) : t1 \multimap b \qquad \lambda P \lambda Q \lambda y.Q(y) \wedge P(y) : (t1 \multimap b) \multimap [(v \multimap r) \multimap (v \multimap r)]}{\lambda Q \lambda y.Q(y) \wedge \mathit{be}(\mathit{hope}(s, \mathit{get\text{-}from}(s, \mathit{the\text{-}money}, y))) : (v \multimap r) \multimap (v \multimap r)}$$

$$\frac{\mathit{woman} : v \multimap r \qquad \lambda Q \lambda y.Q(y) \wedge \mathit{be}(\mathit{hope}(s, \mathit{get\text{-}from}(s, \mathit{the\text{-}money}, y))) : (v \multimap r) \multimap (v \multimap r)}{\lambda y.\mathit{woman}(y) \wedge \mathit{be}(\mathit{hope}(s, \mathit{get\text{-}from}(s, \mathit{the\text{-}money}, y))) : v \multimap r}$$

$$\frac{\lambda R \lambda S.\mathit{the}(x,\ R(x),\ S(x)) : (v \multimap r) \multimap \forall X.[(w \multimap X) \multimap X] \qquad \lambda y.\mathit{woman}(y) \wedge \mathit{be}(\mathit{hope}(s, \mathit{get\text{-}from}(s, \mathit{the\text{-}money}, y))) : v \multimap r}{\lambda S.\mathit{the}(x,\ \mathit{woman}(x)\ \wedge\ \mathit{be}(\mathit{hope}(s,\ \mathit{get\text{-}from}(s,\ \mathit{the\text{-}money},\ x))),\ S(x)) : \forall X.[(w \multimap X) \multimap X]}$$

Appendix C

A fragment of Swedish

Notes

[1] Recall that c-structure nodes / c-structure rule elements are optional (see chapter 2, section 2.1.2).

C.1 C-structure rules

(C.1)
$$\mathrm{CP} \longrightarrow \left\{ \begin{array}{c} \mathrm{XP} \\ (\uparrow \textsc{udf}) = \downarrow \end{array} \middle| \begin{array}{c} \epsilon \\ (\uparrow \textsc{topic pred}) = \text{‘pro’} \end{array} \right\} \begin{array}{c} \mathrm{C}' \\ \uparrow = \downarrow \end{array}$$
$$\left(\begin{array}{c} (\uparrow\ \textsc{udf})_\sigma = ((\uparrow\ \textsc{gf}^+)_\sigma\ \textsc{antecedent}) \\ \\ \lambda P.P : ((\uparrow\ \textsc{gf}^+)_\sigma \multimap \uparrow_\sigma) \multimap ((\uparrow\ \textsc{udf})_\sigma \multimap \uparrow_\sigma) \end{array} \right)$$

(C.2)
$$\mathrm{C}' \longrightarrow \begin{array}{c} \mathrm{C}^0 \\ \uparrow = \downarrow \end{array} \quad \begin{array}{c} \mathrm{IP} \\ \uparrow = \downarrow \end{array}$$

(C.3)
$$\mathrm{C}^0 \longrightarrow \begin{array}{c} \mathrm{C}^0 \\ \uparrow = \downarrow \end{array} \quad \begin{array}{c} \hat{\mathrm{C}} \\ \uparrow = \downarrow \end{array}$$

(C.4)
$$\mathrm{IP} \longrightarrow \begin{array}{c} \mathrm{DP} \\ (\uparrow \textsc{subj}) = \downarrow \end{array} \quad \begin{array}{c} \mathrm{I}' \\ \uparrow = \downarrow \end{array}$$

(C.5)
$$\mathrm{I}' \longrightarrow \begin{array}{c} \mathrm{I}^0 \\ \uparrow = \downarrow \end{array} \quad \begin{array}{c} \mathrm{VP} \\ \uparrow = \downarrow \end{array}$$

(C.6)
$$\mathrm{VP} \longrightarrow \begin{array}{c} \mathrm{V}' \\ \uparrow = \downarrow \end{array} \quad \begin{array}{c} \mathrm{DP} \\ (\uparrow \textsc{obj}) = \downarrow \end{array} \quad \begin{array}{c} \mathrm{CP} \\ (\uparrow \textsc{comp}) = \downarrow \end{array}$$

C.2 Lexicon

(C.7) *vilken ('which')*: D^0 $(\uparrow \text{PRED}) = \text{'which'}$

$$\lambda R \lambda S.Qu(x,\ R(x),\ S(x)) :$$
$$[((\text{SPEC } \uparrow)_\sigma \text{ VAR}) \multimap ((\text{SPEC } \uparrow)_\sigma \text{ RESTR})] \multimap$$
$$\forall X.[((\text{SPEC } \uparrow)_\sigma \multimap X) \multimap X]$$

(C.8) *han ('he')*: D^0

$(\uparrow \text{PRED}) = \text{'pro'}$
$(\uparrow \text{PERS}) = 3$
$(\uparrow \text{NUM}) = \text{sg}$
$(\uparrow \text{GEND}) = \text{masc}$
$(\uparrow \text{CASE}) = \text{nom}$

$$\lambda z.z \times z : (\uparrow_\sigma \text{ ANTECEDENT}) \multimap ((\uparrow_\sigma \text{ ANT}) \otimes \uparrow_\sigma)$$

(C.9) *Maria*: D^0 $(\uparrow \text{PRED}) = \text{'Maria'}$

$$maria : \uparrow_\sigma$$

(C.10) *elev ('student')*: N^0

$(\uparrow \text{PRED}) = \text{'student'}$
$(\uparrow \text{NUM}) = \text{sg}$

$$student : (\uparrow_\sigma \text{ VAR}) \multimap (\uparrow_\sigma \text{ RESTR})$$

(C.11) *skulle ('would')*: I^0

$(\uparrow \text{TENSE}) = \text{future}$
$(\uparrow \text{MOOD}) = \text{irrealis}$
$(\uparrow \text{FINITE}) = +$

(C.12) *fuska ('cheat')*: V^0

$(\uparrow \text{PRED}) = \text{'cheat'}$
$(\uparrow \text{FINITE}) = -$

$$cheat : (\uparrow \text{SUBJ})_\sigma \multimap \uparrow_\sigma$$

(C.13) *trodde ('thought')*: C^0

$(\uparrow \text{PRED}) = \text{'think'}$
$(\uparrow \text{FINITE}) = +$
$(\uparrow \text{TENSE}) = \text{past}$

$$think : (\uparrow \text{SUBJ})_\sigma \multimap (\uparrow \text{COMP})_\sigma \multimap \uparrow_\sigma$$

(C.14) *att ('that')*: C^0

(C.15) $\emptyset$: C^0 $(\uparrow \text{UDF})$

$$\lambda P \lambda y.y : [((\uparrow \text{SUBJ})_\sigma\ \text{ANT}) \multimap [((\uparrow \text{SUBJ})_\sigma\ \text{ANT}) \otimes (\uparrow \text{SUBJ})_\sigma]] \multimap [((\uparrow \text{SUBJ})_\sigma\ \text{ANT}) \multimap ((\uparrow \text{SUBJ})_\sigma\ \text{ANT})]$$

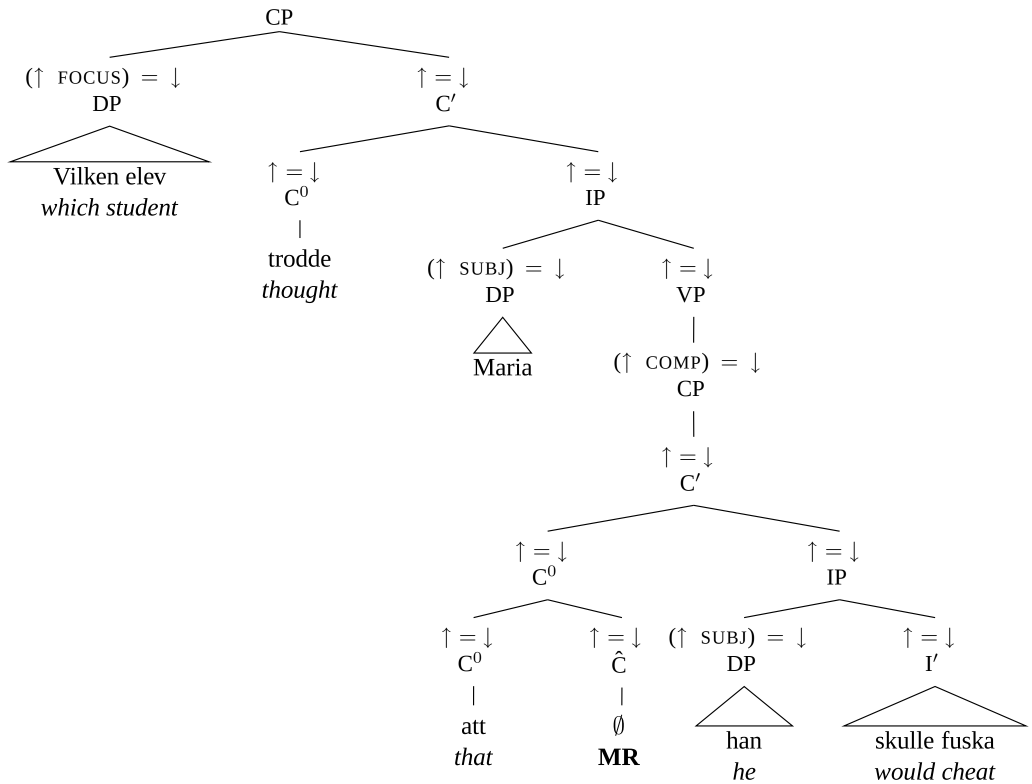
(C.16) $\emptyset$: $\hat{\mathrm{C}}$

$$\lambda P \lambda y.y : [((\uparrow \text{SUBJ})_\sigma\ \text{ANT}) \multimap [((\uparrow \text{SUBJ})_\sigma\ \text{ANT}) \otimes (\uparrow \text{SUBJ})_\sigma]] \multimap [((\uparrow \text{SUBJ})_\sigma\ \text{ANT}) \multimap ((\uparrow \text{SUBJ})_\sigma\ \text{ANT})]$$

C.3 Example: Binder-resumptive dependency (see pages 258–261)

(C.17) [Vilken elev]$_i$ trodde Maria att han$_i$ skulle fuska?
which student thought Maria that he would cheat
Which student did Maria think that (he) would cheat?

(C.18)



(C.19)

$$t\left[\begin{array}{ll}
\text{PRED} & \text{`think'}\\
\text{FOCUS} & s\left[\begin{array}{ll}\text{PRED} & \text{`student'}\\ \text{SPEC} & \left[\begin{array}{ll}\text{PRED} & \text{`which'}\end{array}\right]\end{array}\right]\\
\text{SUBJ} & m\left[\text{``Maria''}\right]\\
\text{COMP} & c\left[\begin{array}{ll}\text{PRED} & \text{`cheat'}\\ \text{SUBJ} & p\left[\begin{array}{ll}\text{PRED}&\text{`pro'}\\ \text{PERS}&3\\ \text{NUM}&\text{sg}\\ \text{GEND}&\text{masc}\\ \text{CASE}&\text{nom}\end{array}\right]\\ \text{TENSE}&\text{future}\\ \text{MOOD}&\text{irrealis}\end{array}\right]\\
\text{TENSE} & \text{past}
\end{array}\right]
\qquad \sigma \qquad p_\sigma\left[\begin{array}{ll}\text{ANTECEDENT} & s_\sigma\left[\ \ \right]\end{array}\right]$$

(C.20)

1. $\lambda S.Qu(x,\ student(x),\ S(x)) :$ $\forall X.[(s \multimap X) \multimap X]$ — Lex. **vilken elev (‘which student’)**
2. $\lambda P.P : (p \multimap t) \multimap (s \multimap t)$ — SpecCP
3. $think : m \multimap c \multimap t$ — Lex. **trodde (‘thought’)**
4. $maria : m$ — Lex. **Maria**
5. $\lambda P \lambda y.y : [s \multimap (s \otimes p)] \multimap (s \multimap s)$ — Lex. $\emptyset$ **(MR)**
6. $\lambda z.z \times z : s \multimap (s \otimes p)$ — Lex. **han (‘he’)**
7. $cheat : p \multimap c$ — Lex. **fuska (‘cheat’)**

(C.21)

$$
\dfrac{
\dfrac{
\dfrac{
\dfrac{\begin{array}{l}\lambda P \lambda y.y : \\ [s \multimap (s \otimes p)] \multimap (s \multimap s)\end{array} \quad \begin{array}{l}\lambda z.z \times z : \\ s \multimap (s \otimes p)\end{array}}{\lambda y.y : (s \multimap s)} \quad [z : s]^1
}{z : s}
\quad
\dfrac{
\dfrac{
\dfrac{
\dfrac{[x : p]^2 \quad \begin{array}{l} cheat : \\ p \multimap c \end{array}}{cheat(x) : c}
\quad
\dfrac{\begin{array}{l} maria : \\ m \end{array} \quad \begin{array}{l} think : \\ m \multimap c \multimap t \end{array}}{\begin{array}{l} think(maria) : \\ c \multimap t \end{array}}
}{\begin{array}{l} think(maria, cheat(x)) : \\ t \end{array}}
\;{\multimap_{\mathcal{I},2}}
}{\begin{array}{l} \lambda x.think(maria, cheat(x)) : \\ p \multimap t \end{array}}
\quad
\begin{array}{l} \lambda P.P : \\ (p \multimap t) \multimap (s \multimap t) \end{array}
}{\begin{array}{l} \lambda x.think(maria, cheat(x)) : \\ s \multimap t \end{array}}
}{\begin{array}{l} think(maria, cheat(z)) : \\ t \end{array}}
\;{\multimap_{\mathcal{I},1}}
}{\begin{array}{l} \lambda z.think(maria, cheat(z)) : \\ s \multimap t \end{array}}
\quad
\begin{array}{l} \lambda S.Qu(x,\ student(x),\ S(x)) : \\ \forall X.[(s \multimap X) \multimap X] \end{array}
}{Qu(x,\ student(x),\ think(maria,\ cheat(x))) : t}
\;[t/X]
$$

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