Anaphora and Argument Structure: Topics in the Syntax and Semantics of Reflexives and Reciprocals

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For my friends. They know.

Abstract

This thesis presents an examination of the syntactic and semantic properties of natural language reflexive and reciprocal expressions, which are commonly referred to as anaphors in syntactic theory. The work is carried out in the broader context of 'binding theory' and 'control theory'. Binding theory has two main aspects. The first aspect is to explain the distribution of nominal expressions in natural language sentences. The second aspect is to link this syntactic representation to a theory of natural language semantics, such that the semantics is constrained by the syntactic relationships between nominals. Control theory is about the interpretation of understood (phonetically null) arguments of complements to a certain class of predicates that are characterized semantically. The syntactic framework assumed is Head-driven Phrase Structure Grammar (HPSG). In this framework, binding theory and control theory are intimately tied together through the syntax of reflexives.

The binding and control theories developed here are based on a level of representation called 'argument structure'. Argument structure is construed as an abstract linking representation between the level of (lexical) semantics and the level of syntactically relevant grammatical relations. It is defined as a representation of the other expressions that a given word or phrase must combine with in order to be semantically and syntactically saturated. A strong interpretation of this definition is assumed here: all syntactically and semantically relevant arguments are present at the level of argument structure.

There are four main goals in this thesis: first, to extend and revise problematic previous versions of the theories of binding and control in HPSG; second, to examine the implications that these revisions and related phenomena have for the representation of argument structure; third, to develop a general program for the interpretation of the index notation used in binding theory; fourth, to test whether reciprocal expressions should be represented in the semantics as quantifiers or plurals.

The outline of the thesis is as follows. Chapter one presents an introduction to the issues involved and a brief discussion of the framework. The HPSG theories of binding and control are presented and formalized in chapter two. There are various problems that ensue which are discussed therein. In chapter three, an extended binding theory is presented. This theory consists of a simplified core, which solves certain of the problems noted in chapter two, and a new constraint on the distribution of anaphora called the Antecedent Closeness Constraint. The coverage of the extended binding theory is demonstrated. In chapter four, the interplay between argument structure and control theory is explored, and several new problems are discussed. A revised control theory is presented which deals with these problems, as well as the ones discussed in chapter two. The coverage of the revised control theory is presented. This includes a demonstration of the application of the Antecedent Closeness Constraint to controlled complements. The fifth chapter presents a program for interpreting indices, with specific reference to Discourse Representation Theory. The chapter ends with a discussion of logophoric reflexives in English. The sixth chapter presents a discussion of reciprocal interpretation, with specific attention paid to whether the reciprocal is a plural or a quantifier.

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Declaration

I declare that this thesis was composed by myself and that the work contained herein is my own, except where explicitly stated otherwise in the text.

(*Arshia Asudeh*)

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Chapter 1

Introduction

Binding theory is an attempt to state the conditions for referential dependency between expressions in a given language. That is, the theory attempts to state the possible relationships between noun phrases and their syntactic antecedents. However, these relationships are also semantically conditioned, since binding possibilities are always calculated relative to an interpretation. For example, the following sentence is grammatical so long as the pronoun and the proper noun are not construed as referring to the same person. However, it is ungrammatical if *she* is meant to refer to *Mary*.

(1.1) She thinks Mary is nice.

In other words, sentence (1.1) is grammatical only if the pronoun is construed deictically. However, if the name and the pronoun are switched, then the pronoun can still be understood deictically, but it can also refer to *Mary*:

(1.2) Mary thinks she is nice.

Because of this interaction between distribution and interpretation, binding theory is a key area of concern in investigations into the interface between syntax and semantics. Indeed, this topic has been an area of central concern in generative grammar almost from the beginning (Lees and Klima, 1963).

The central concern of this thesis is investigating a particular subdomain of binding theory: reflexives (e.g. *himself*) and reciprocals (e.g. *each other*). It is common usage in linguistic theory to group these items together under the heading of 'anaphora'.[1] However, it is impossible to provide any formal analysis of just this subdomain without embedding it in some formalized binding theory. The theory that I will be adopting, extending, and revising is the theory of

[1] While this is unfortunately confusing, since this term is used somewhat more generally in semantics and philosophy of language, I will continue to use the common terminology. Where appropriate, I will make the distinction by using the term 'syntactically (non)anaphoric', which should serve to make clear which usage of the term anaphor I'm adopting when discussing certain pronouns.

binding outlined by Pollard and Sag (1992, 1994) for Head-driven Phrase Structure Grammar (HPSG). Hence, the formal theory of syntax presupposed in this thesis is HPSG.

Recent work in HPSG (Manning, 1996, 1997; Manning and Sag, 1999) has defined the binding theory on a level of representation called argument structure, which in HPSG is represented as a list, ARG-ST. Argument structure is construed as a linking level between (lexical) semantics and syntax and the ARG-ST list therefore contains syntactically and semantically relevant arguments. In this thesis I am adopting a very strong notion of argument structure. Namely, the hypothesis is that the level of argument structure contains any and all arguments that are syntactically and/or semantically relevant. Thus, the argument structure will contain syntactic arguments that are semantically irrelevant, such as expletive pronouns, and semantic arguments that play no role in syntactic valency, such as dropped pronouns in pro-drop languages.

Argument structure is also the level of representation on which control theory is defined in HPSG. Control theory is concerned with the determination of the reference of null arguments in infinitival and gerund clauses. An example will make this more clear:

(1.3) Mary promised to eat the spinach.

In this sentence, the understood subject argument of *to eat* has *Mary* as its antecedent. The determination of the antecedent for these null arguments is the domain of control theory. It should be obvious that binding and control are related, for at least two reasons. First, as a theoretical decision in HPSG, they are both defined on the level of argument structure. Second, both theories (independently of any framework) deal with fixing coreferential dependencies between syntactic items, relative to an interpretation.

Thus, the syntactic portions of this thesis are broadly speaking about anaphora and argument structure. There are two related goals in this respect. The first goal is to extend and revise problematic previous versions of the theories of binding and control in HPSG. The second goal is to examine the implications that these revisions and related phenomena have for the representation of argument structure. Naturally, the problems and solutions proposed in meeting each goal are heavily intertwined. However, both binding and control are about distribution relative to interpretation. A third goal will therefore be to find some sort of sensible interpretation of binding possibilities. The fourth and final topic has specifically to do with the interpretation of reciprocals. This fourth goal is to determine whether reciprocals should be represented in the semantics as quantifiers or as plurals.

1.1 Outline of the Thesis

The HPSG theories of binding and control are presented and formalized in chapter two. In particular, Principle A, which is the portion of binding theory that deals with anaphora, is formalized as a feature structure constraint. I also outline various strengths of the theory of binding in HPSG, but at the same time I argue that the notion of ‘exempt anaphora’ is too permissive. Then I discuss various motivations for the level of argument structure, the place of the ARG-ST list in the feature structure geometry and various problems that ensue due to these necessary modifications.

In chapter three, an extended binding theory is presented. This theory consists of a simplified core, which solves certain of the problems noted in chapter two, and also provides another principle for long distance anaphora. The extension comes in the form of a new constraint on the distribution of anaphora called the Antecedent Closeness Constraint. This constraint deals with various instances of exempt anaphora, as I will demonstrate. The chapter concludes with a brief discussion of some residual problems.

The fourth chapter explores the interplay between argument structure and control theory, and several new problems are discussed. A revised control theory is presented which deals with these problems, as well as the ones discussed in chapter two. There are two major revisions. The first has to do with the membership of ARG-ST lists, which is necessarily complicated due to some recent work in HPSG. The second revision is to the control theory itself and involves placing additional restrictions on controllers. The coverage of the revised control theory is presented at the end of the chapter. This includes a demonstration of the application of the Antecedent Closeness Constraint to controlled complements.

The fifth chapter presents a program for interpreting the indices used in binding theory, with specific reference to Discourse Representation Theory. In particular, a construal of binding theory is assumed in which coindexation is added information and must therefore be added by a grammatical device and cannot be accidental. The chapter ends with a discussion of logophoric reflexives in English, which in the system presented here are the only instances of reflexives which are not coindexed with their antecedents by the grammar.

The sixth and final chapter presents a discussion of reciprocal interpretation, with specific attention paid to whether the reciprocal is a plural or a quantifier. The main means for testing this is by subjecting the reciprocal to various scope tests. These tests give a reasonably strong indication that the reciprocal does not behave like other quantifiers. As such, if its properties can be explained due to its being a kind of plural, we can conclude that it is in fact not a quantifier.

Chapter 2

Binding and Control in HPSG

2.1 Introduction

In this chapter, I review HPSG's binding theory, in particular Principle A. I will also show how recent extensions to HPSG cause certain auxiliary notions necessary to binding theory to be ill-defined. The result is that determining the proper antecedent of the subject of a controlled complement is now a problematic issue. Before turning to the discussion of control, I review the descriptive coverage of Principle A, and certain problems. Then, in section 2.5, I review the control theory presented in Pollard and Sag (1994), before going on to review the problems that occur due to recent work in HPSG. This will necessitate a brief foray into Manning's analysis of ergative languages (1996), which provides a considerable amount of motivation for a separate level of argument structure.

2.2 The Standard HPSG Binding Theory

The first step will be to fully and explicitly spell out HPSG's binding theory, as presented in Pollard and Sag (1992, 1994). This necessarily involves explicating all the auxiliary assumptions as well. The goal in this section is to set up Principle A as an HPSG constraint in terms of feature structures, since this principle deals with anaphors and is thus the main point of interest here. This explicit representation will then be the one assumed in the following sections.

Unlike more commonly known approaches to binding, whose descent can generally be traced back at least to Chomsky (1981) and Reinhart (1983), HPSG's binding theory is not stated in terms of the tree-configurational notion of c-command.[1] Rather, it can best be characterized as a thematic binding theory, although it is not defined on theta roles. The HPSG theory is defined on the obliqueness of verbal arguments on a valence list. The obliqueness hierarchy

[1]It is sometimes claimed (e.g. in Pollard and Sag 1994: 248ff.) that HPSG's binding theory is nonconfigurational. However, this isn't strictly speaking correct. Although it is true that HPSG's binding theory does not use tree configurations, it does crucially depend on precedence in a list and this *is* a configurational notion.

reflects the universal noun phrase hierarchy of Keenan and Comrie (1977) and is presented in (2.1). The item on the left is least oblique and "X < Y" means that X is less oblique than Y.

(2.1) Subject < Primary Object < Secondary Object < Obliques < Verbal/Predicative Complements

It should be noted that in HPSG, all arguments (not just 'VP-internal' ones) are called "complements", although their differing properties can be and are distinguished in other ways.

In the first two versions of HPSG[2], the arguments to a predicate were kept track of on a list called SUBCAT (for 'subcategorization'). The order of arguments on the SUBCAT list was determined by the hierarchy in (2.1). According to Pollard and Sag (1987: 118), the evidence for obliqueness ordering can come from these sources: constituent order generalizations, control theory, binding theory, and generalizations about lexical rules. However, it is important to realize that obliqueness does not necessarily reflect surface order, which is meant to be provided by linear precedence rules (Pollard and Sag, 1987). In English, the two happen to correspond very closely, but in other languages, such as German and Dutch, more complex linearization principles are necessary (Kathol, 1995; Reape, 1993).

The notion of command that HPSG uses for its binding theory is defined using obliqueness, and is known as *obliqueness-command* or *o-command* for short. In more recent work, the mnemonic has been changed to *a-command*, due to binding now being defined on the argument structure list ARG-ST.[3] Thus, the relation 'less oblique than' can be defined such that X is less oblique than Y if and only if X precedes Y on a SUBCAT (now ARG-ST) list. With this definition in mind, here is the version of a-command from Pollard and Sag (1994: 279, (117)):

(2.2) **Definition of A-Command**:
Let Y and Z be *synsem* objects, with distinct LOCAL values, Y referential. Then Y *a-commands* Z just in case either:

i. Y is less oblique than Z; or

ii. Y a-commands some X that subcategorizes for Z; or

iii. Y a-commands some X that is a projection of Z (i.e. the HEAD values of X and Z are token-identical).

[2]The first version is commonly referred to as HPSG1 and was presented in Pollard and Sag (1987). The second version is usually called HPSG2 and was presented in the first eight chapters of Pollard and Sag (1994). Chapter nine of the latter work featured several further revisions, and is typically referred to as HPSG3.

[3]A historical note is in order here to avoid potential confusion. The binding theory as developed in Pollard and Sag (1992, 1994) refers to o-command, o-binding, o-freeness, etc; these were mnemonics for obliqueness. But, Manning and Sag (1999) have argued for a new list for binding concepts to be defined on, ARGUMENT-STRUCTURE or ARG-ST for short. All the o-'s were changed to a-'s forthwith. While I will have more to say about the ARG-ST feature in later sections, I will just note that I have used the new terminology, but have also endeavoured to give the original sources for the principles, which are not construed to have changed in the literature (Manning et al., 1999; Manning and Sag, 1999)

Some further comments are necessary to make this definition fully explicit.

First, the stipulation of distinct LOCAL values[4] is mainly required for Principle C, which deals with nonpronominal noun phrases. Without the requirement of having distinct LOCAL values, certain dependencies — such as raising and *wh*-relatives — would be ruled out as ungrammatical (Pollard and Sag, 1994: fn. 5, fn. 28). Basically, this would happen because a nominal would a-command and a-bind its own gap, which is an HPSG Principle C violation. In short, in dealing solely with Principle A, this stipulation could be dropped, but I will maintain it here for the sake of thoroughness and compatibility with canonical versions of the theory. However, it is important to remember that the LOCAL values only have to be token distinct, not type distinct. Thus, the requirement on distinctness boils down to the requirement that the LOCAL values in question must not be structure shared.

Second, what does it mean for Y to be "referential"? This means that the value of its INDEX feature must be of type *referential*. The value of INDEX is of sort *index*, where the latter has the following partition:

(2.3)

index

ref(erential)   *it*   *there*

The sorts *it* and *there* are solely for expletive pronouns, as the sort names suggest. Therefore, all *nominal-object*s that are nonexpletive will have sort *referential* on their INDEX value. The result of the referentiality condition is that expletive pronouns cannot be binders, although nothing prevents them from being bound.

Third, X subcategorizes for Z just in case Z appears on X's SUBCAT list. This is no longer strictly possible, due to recent modifications to HPSG. In fact, due to the revisions in Manning and Sag (1999), the second clause causes tremendous difficulties for HPSG's theory of binding, as well as for its account of control. In section 2.5, I will explain why this is so by first explaining how the original interpretation given in Pollard and Sag (1994) interacted with the control theory and then proving that this interpretation is no longer available due to the revisions to the theory. In fact, I will show that the revisions have led to a situation in which (2.5ii) below no longer has a clear interpretation. But first I will continue to outline the original binding theory and Principle A in particular.

Suppose for the moment that we take the term 'subcategorizes for' to be defined on the ARG-ST list, which contains an item's arguments. This allows us to go through a simple example of a-command, using the following sentence:

(2.4) Gonzo said Craig likes Chrystale.

[4]The value of LOCAL is a feature structure of type *local* which contains syntactic and semantic information for a sign, but does not include information about dependents which are in noncanonical positions (i.e. dependents that would have been moved in GB terms).

By an application of clause (i), *Gonzo* a-commands the embedded sentence *Craig likes Chrystale*. Next, by applying clause (iii), *Gonzo* a-commands the verb *likes*, since the sentence is a projection of this verb. Lastly, by an application of clause (ii), *Gonzo* a-commands *Craig* and *Chrystale* (see also Pollard and Sag 1994: 279). Similarly, by an application of clause (i), *Craig* a-commands *Chrystale*, since it is less oblique than *Chrystale* on the argument structure of the verb *likes*. Lastly, *Chrystale* does not a-command anything, since it is not less oblique than any other element on any argument structure list.

For completeness, I have presented the whole definition of a-command. However, since we are mainly interested in Principle A, we principally need the notion of *local a-command*, which reflects the well-known domain restriction between anaphors and their antecedents. We get the definition of local a-command by dropping the third clause in (2.2) and changing all mention of a-command to local a-command:

(2.5) **Definition of Local A-Command**:
Let Y and Z be *synsem* objects, with distinct LOCAL values, Y referential. Then Y *locally a-commands* Z just in case either:

i. Y is less oblique than Z; or

ii. Y locally a-commands some X that subcategorizes for Z.

(Pollard and Sag, 1994: 278, (116))

The other terms remain the same, as do their explanations.

To continue the discussion of binding, we next need to define what it means for something to be bound in HPSG. The technical term is ‘a-binding’, which reflects the relation to argument obliqueness. Similarly, if something is not a-bound, it is ‘a-free’ (and the same goes for locally a-bound and locally a-free).

(2.6) Y a-binds Z just in case Y and Z are coindexed and Y a-commands Z.

(2.7) Y locally a-binds Z just in case Y and Z are coindexed and Y locally a-commands Z.
(Pollard and Sag, 1994: 254, (39))

But what does it mean for two objects to be coindexed? In HPSG, unlike in Government and Binding, an index is actually a path value on every nominal. Crucially, indices have an internal make-up and are the repository of the agreement (AGR) features (equivalent to ϕ-features), PERSON, NUMBER, and GENDER. Thus, HPSG is different from GB in that its indices are independently motivated and are used in the HPSG analyses of various phenomena, such as agreement, semantic roles, control, and relative clause constructions. Going back to our question, two objects are coindexed just in case they structure share their INDEX values.[5]

[5] Normally structure sharing is indicated via two tags of the form $\boxed{x}$, where x is instantiated to an integer and the two nodes that are structure shared each bear the tag. However, I will continue to use subscripted letters to represent coindexation, since this is less cumbersome and more in keeping with the historically common notation.

We are finally in a position to look at HPSG's binding principles.

(2.8) **HPSG Binding Theory:**

Principle A A locally a-commanded anaphor must be locally a-bound.

Principle B A personal pronoun must be locally a-free.

Principle C A nonpronoun must be a-free.

(Pollard and Sag, 1994: 254, (40))

Here the terms *anaphor*, *personal pronoun* and *nonpronoun* refer to the type of the term in question in the *nominal-object* type hierarchy:

(2.9)

- *nom-obj (nominal-object)*
  - *pron (pronominal)*
    - *ana (anaphoric)*
      - *refl (reflexive)*
      - *recp (reciprocal)*
    - *ppro (personal-pronominal)*
  - *npro (nonpronominal)*

I've indicated what the abbreviations stand for in brackets. Every nominal sign will have an object of sort *nom-obj* (or a subsort thereof) as the value of its CONTENT (see (3.7) in chapter 3). In fact, this hierarchy simply reflects the binding principles and intuitive or traditional groupings (e.g. the fact that anaphors and personal pronouns are traditionally both categorized as pronouns). The standard binding theory is now in place, but some examples are in order to illustrate how it works.

2.2.1 Examples

In this section, I will show how the binding theory just outlined accounts for the following sentences. In each case I also present the ARG-ST that the relevant nominal appears on:

(2.10) a. Chrystale$_i$ said Anne$_j$ put herself$_{*i/j}$ through college.

b. *put*: ARG-ST $\langle$NP$_j$, NP$_{*i/j}$:*refl*, PP$\rangle$

(2.11) a. [The boys]$_i$ told me that [Jay and Eddie]$_j$ tricked [each other]$_{*i/j}$.

b. *tricked*: ARG-ST $\langle$NP$_j$, NP$_{*i/j}$:*recp*$\rangle$

(2.12) a. Andrew$_i$ relies on himself$_i$.

b. *relies*: ARG-ST $\langle$NP$_i$, PP$_i$:*refl*$\rangle$

(2.13) a. Andrew$_i$ thinks Gonzo$_j$ relies on himself$_{*i/j}$.

b. *relies*: ARG-ST $\langle$NP$_j$, PP$_{*i/j}$:*refl*$\rangle$

(2.14) a. Gonzo$_i$ likes him$_{*i/j}$.

b. *likes*: ARG-ST ⟨NP$_i$, NP$_{*i/j}$:*ppro*⟩

(2.15) a. Craig$_i$ said Gonzo$_j$ chased him$_{i/*j}$.

b. *chased*: ARG-ST ⟨NP$_j$, NP$_{i/*j}$:*ppro*⟩

(2.16) a. Craig$_i$ said Gonzo$_j$ chased Craig$_{*i}$.

b. *said*: ARG-ST ⟨NP$_i$, S[HEAD $\boxed{1}$]⟩
$\boxed{1}$ *chased*: ARG-ST ⟨NP$_j$, NP$_{*i}$:*npro*⟩

(2.17) a. Craig$_i$ wanted to order the pizzas from Milano's.

b. *wanted*: ARG-ST ⟨NP$_i$, VP[ARG-ST ⟨NP$_i$:*refl*, NP⟩]⟩

In (2.10a), *herself* is an argument of *put*, the ARG-ST of which is shown in (2.10b). The reflexive is locally a-commanded by *Anne*, since they are on the same ARG-ST list and *Anne* precedes the reflexive. Principle A thus demands that the reflexive be locally a-bound by *Anne*. This means that the reflexive must be coindexed with *Anne* and not *Chrystale*. Example (2.11) illustrates this same effect, but with a reciprocal. The reciprocal is locally a-commanded by the NP *Jay and Eddie*, which means the reciprocal must be locally a-bound and *Jay and Eddie* is the only appropriate candidate. Thus, the coindexation with the coordinated NP is licensed, but the one with the higher NP, *the boys*, is not.

Sentences (2.12a) and (2.13a) illustrate an important property of HPSG's binding theory. In HPSG, 'case-marking' prepositions that are idiosyncratically selected by the verb inherit the CONTENT value of their NP complement (Pollard and Sag, 1994). This reflects the fact that these prepositions do not contribute to the semantics of the sentence. In effect, the preposition is only there to license the NP. Now, the fact that these PPs inherit their NP complement's CONTENT value entails that they inherit the index, since this is part of CONTENT. Thus, vis á vis binding, a case-marking preposition acts like the NP that it contains. In (2.12), this means that Principle A requires the reflexive to be bound by *Andrew*, since this NP locally a-commands the reflexive. Similarly, in (2.13) Principle A requires *Gonzo* to be the antecedent of *himself*.

Example (2.14) illustrates a Principle B violation. *Gonzo* locally a-commands the pronoun *him* and the coindexation means that it also locally a-binds the pronoun. However, Principle B states that a pronoun must be locally a-free, which means it cannot be locally a-bound. Thus, the only index assignment that the pronoun can have is one that is distinct from *Gonzo*'s. Likewise, Principle B does not prevent coindexation between *Craig* and *him* in (2.15), since *Craig* does not locally a-bind the pronoun.

The sentence in (2.16) provides an example of a Principle C violation. Since the first instance of *Craig* a-commands the second instance[6], the two instances of *Craig* cannot be

[6]See example (2.4) for an explanation of how a-command is established.

coindexed. If the two are coindexed, the second instance is a-commanded and also a-bound, contrary to Principle C, which says nonpronouns must be a-free.

Lastly, the application of the second clause of the local a-command definition in (2.5) is illustrated by (2.17).[7] The controlled complement has a reflexive subject, as argued for in Pollard and Sag (1994: 282), which is locally a-commanded by *Craig*. This occurs because *Craig* locally a-commands (is less oblique than) the VP, which subcategorizes for the reflexive. This entails that *Craig* locally a-binds the reflexive understood subject of the VP, according to Principle A.

2.2.2 Formalizing Principle A

I have now reviewed the standard binding theory and the requisite auxiliary definitions. I have also shown some examples of the theory's application. The last goal of this section is to formulate Principle A as a feature structure constraint. In general, rules in HPSG grammars should be and are formulable in this manner.[8] Since Principle A is formulated indirectly in terms of local a-command (through the definition of local a-binding), and a-command is defined disjunctively (see (2.5) above), the constraint formulation of Principle A is necessarily in two parts.

First, though, I will formulate the definition of local a-binding. After the two cases are formulated, they will be used to formulate Principle A. The first local a-binding case corresponds to a configuration in which the a-command is direct, whereas the second refers to one where a subcategorizer intervenes, as in (2.5ii). I assume the usual convention of using an ellipse (...) to represent zero or more list members. In addition, the notation $W*$ uses Kleene's star to indicate that zero or more other synsems may intervene between Z and its a-commander, Y. This will be important in formalizing Principle A, since an anaphor only needs to be a-bound by one of its local a-commanders.

[7] For the moment I am glossing over the fact that phrasal categories, such as VP, supposedly do not have ARG-ST lists; similarly, I am ignoring, for the sake of exposition, certain problems with the second clause of local a-command. I return to these issues in section 2.5.1.

[8] Rules that involve recursion, like Principle C, can be thought of as instantiating the set of feature structure constraints that the rule generates.

(2.18) **Local A-Binding**

a. **Case 1: Y is less oblique than Z**

$$
\textsc{arg-st}\ \langle \ldots,\ Y\begin{bmatrix} \textit{synsem} & \\ \textsc{local} & \boxed{1}\begin{bmatrix} \textit{local} & \\ \textsc{content} & \begin{bmatrix} \textit{nom-obj} & \\ \textsc{index} & \boxed{2}\begin{bmatrix} \textit{referential} & \\ \textsc{per} & \textit{person} \\ \textsc{num} & \textit{number} \\ \textsc{gend} & \textit{gender} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}, W^*, \ldots
$$

$$
\ldots,\ Z\begin{bmatrix} \textit{synsem} & \\ \textsc{local} & \boxed{3}\begin{bmatrix} \textit{local} & \\ \textsc{content} & \begin{bmatrix} \textit{nom-obj} & \\ \textsc{index} & \boxed{2} \end{bmatrix} \end{bmatrix} \end{bmatrix}, \ldots \rangle
$$

$\boxed{1} \neq \boxed{3}$

b. **Case 2: Y locally a-commands some X that subcategorizes for Z**

$$
\textsc{arg-st}\ \langle \ldots,\ Y\begin{bmatrix} \textit{synsem} & \\ \textsc{local} & \boxed{1}\begin{bmatrix} \textit{local} & \\ \textsc{content} & \begin{bmatrix} \textit{nom-obj} & \\ \textsc{index} & \boxed{2}\begin{bmatrix} \textit{referential} & \\ \textsc{per} & \textit{person} \\ \textsc{num} & \textit{number} \\ \textsc{gend} & \textit{gender} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}, W^*, \ldots
$$

$$
\ldots,\ X\begin{bmatrix} \textit{synsem} \\ \textsc{loc} \mid \textsc{cat} \mid \textsc{arg-st}\ \langle \ldots,\ Z\begin{bmatrix} \textit{synsem} & \\ \textsc{loc} \mid \boxed{3}\ \textsc{cont} & \begin{bmatrix} \textit{nom-obj} & \\ \textsc{index} & \boxed{2} \end{bmatrix} \end{bmatrix}, \ldots \rangle \end{bmatrix}, \ldots \rangle
$$

$\boxed{1} \neq \boxed{3}$

This second case is actually applied to a fairly restricted class of sentences. As Pollard and Sag (1994: 278) explain, this case entails that a referential nominal will locally a-bind the ARG-ST members of a more oblique unsaturated complement. In effect, this means that the reflexive subject of an equi control verb will be locally a-bound by an argument of the control verb, thus ensuring that control is entirely local and cannot skip clauses. For example, the second case of local a-command would ensure that the control target (i.e. the subject of the infinitival complement) in *Gonzo asked Chrystale to sing* would be locally a-commanded by *Chrystale*. I will not go into further details here, as it would complicate things unnecessarily, but I will return to this point when I subsequently discuss control. Therefore, it is useful to have case 2 in place, as well as being thorough.

An important thing to bear in mind about both cases in (2.18) is that these are not constraints on grammatical representations. That is, they are not constraints that result in ungrammaticality if they are not met. In fact, they are not even interpretable as constraints, since they are neither keyed to a type nor do they have a conditional form. What these cases should be read as is giving an explicit definition of local a-binding. They provide the argument structure configurations that define something as locally a-bound in a way that can be incorporated into subsequent constraints, such as Principle A, which I turn to now.

Principle A will correspondingly have two cases, the consequents of which incorporate the relevant case from (2.18).

(2.19) **Principle A** (first version)

Case 1: Y is less oblique than Z

$$\text{ARG-ST}\ \langle \ldots,$$

$$Y\begin{bmatrix} \textit{synsem} & \\ \text{LOCAL} & \boxed{1}\begin{bmatrix}\textit{local} & \\ \text{CONTENT} & \begin{bmatrix}\textit{nom-obj} & \\ \text{INDEX} & \begin{bmatrix}\textit{referential} & \\ \text{PER} & \textit{person}\\ \text{NUM} & \textit{number}\\ \text{GEND} & \textit{gender}\end{bmatrix}\end{bmatrix}\end{bmatrix}\end{bmatrix}, W^*, \ldots$$

$$\ldots,\ Z\begin{bmatrix} \textit{synsem} & \\ \text{LOCAL} & \boxed{3}\begin{bmatrix}\textit{local} & \\ \text{CONTENT} & \begin{bmatrix}\textit{ana} & \\ \text{INDEX} & \textit{referential}\end{bmatrix}\end{bmatrix}\end{bmatrix}, \ldots\rangle$$

$$\boxed{1} \neq \boxed{3}$$

$$\Downarrow$$

$$\text{ARG-ST}\ \langle \ldots, {}^{Y}\Big[\text{LOCAL} \mid \boxed{1}\ \text{CONT} \mid \text{INDEX}\quad \boxed{2}\Big], W^*, \ldots$$

$$\ldots, {}^{Z}\Big[\text{LOCAL} \mid \boxed{3}\ \text{CONT} \mid \text{INDEX}\quad \boxed{2}\Big], \ldots\rangle$$

$$\boxed{1} \neq \boxed{3}$$

This rule is a conditional and its interpretation is that any structure that satisfies the antecedent must also satisfy the consequent. Note that, for the sake of brevity, I have suppressed the types in the consequent. I will assume throughout that the corresponding parts of the antecedent and consequent have the same types. Also, the Y and Z mentioned in the local a-command definitions are superscripted onto the appropriate feature structures. This is solely for presentational clarity and should not be taken to be any sort of integral part of the constraint. Lastly, note that in the constraint formulation, the fact that the LOCAL values of the binder and bindee are distinct is captured through the use of path inequalities, as discussed in Carpenter (1992). The reader can verify, by comparing the constraint to the definitions given above, that this formulation indeed captures all the necessary information.

We can now turn to the second case of Principle A, which occurs due to the second clause of definition (2.5):

(2.20) **Principle A**

Case 2: Y locally a-commands some X that subcategorizes for Z

$$\text{ARG-ST} \ \langle \ldots, \; Y\begin{bmatrix} \textit{synsem} \\ \text{LOCAL} \ \boxed{1} \begin{bmatrix} \textit{local} \\ \text{CONTENT} \begin{bmatrix} \textit{nom-obj} \\ \text{INDEX} \begin{bmatrix} \textit{referential} & \\ \text{PER} & \textit{person} \\ \text{NUM} & \textit{number} \\ \text{GEND} & \textit{gender} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}, W^*, \ldots$$

$$\ldots, \; X\begin{bmatrix} \textit{synsem} \\ \text{LOC} \mid \text{CAT} \mid \text{ARG-ST} \ \langle \ldots, \; Z\begin{bmatrix} \textit{synsem} \\ \text{LOC} \mid \boxed{3} \ \text{CONT} \begin{bmatrix} \textit{ana} & \\ \text{INDEX} & \textit{ref} \end{bmatrix} \end{bmatrix}, \ldots \rangle \end{bmatrix}, \ldots \rangle$$

$$\boxed{1} \neq \boxed{3}$$

$$\Downarrow$$

$$\text{ARG-ST} \ \langle \ldots, \; Y\begin{bmatrix} \text{LOCAL} \mid \boxed{1} \ \text{CONTENT} \mid \text{INDEX} \ \ \boxed{2} \end{bmatrix}, W^*, \ldots$$

$$\ldots, \; X\begin{bmatrix} \text{LOC} \mid \text{CAT} \mid \text{ARG-ST} \ \langle \ldots, \; Z\begin{bmatrix} \text{LOC} \mid \boxed{3} \ \text{CONT} \mid \text{INDEX} \ \ \boxed{2} \end{bmatrix}, \ldots \rangle \end{bmatrix}, \ldots \rangle$$

$$\boxed{1} \neq \boxed{3}$$

I have now realized the goal of this section, which was to explain HPSG's Principle A and any auxiliary notions that were necessary and to reformulate the binding principle as a feature structure constraint. Next I turn to a discussion of the virtues and vices of this approach.

2.3 The Coverage of HPSG's Principle A and Certain Problems

The success or failure of any theory of binding crucially depends on what one considers the proper domain of binding theory to be. In the Government and Binding tradition (Chomsky, 1981, 1986a,b), the general tendency has been to treat all occurrences of anaphors, pronouns and nonpronominals (in HPSG terms, all *nominal-objects* with a *referential* INDEX) as being subject to binding theory. Over the years, this has lead to GB's binding theory becoming quite complex, with several baroque clauses and stipulations. Three examples are a) the *i-within-i condition*, which bans structures of the form $[_{X_i} \ldots Y_i \ldots]$, b) letting the agreement feature of Infl (AGR) be an honorary N for the purposes of binding, and c) requiring that counterfactual indexings be taken into account when evaluating a given coindexation.

Thus, one virtue of HPSG's binding theory is that it is considerably simpler, both in the sense of elegance and in the sense of economy, since it posits many less processes and entities. However, ultimately, its success must be evaluated on how well it captures the data. For canonical sentences like *John likes himself*, both theories fare equally well. Here is the GB Principle A, along with the necessary auxiliary notion of government.[9]

(2.21) **Government and Binding's Principle A**

Let I be an indexing of the NPs (and AGRs, if any) in an expression E, and Z an NP in E. Then:[10]

A If Z is +a and governed by G, then Z is A-bound (under I) in the least maximal projection M containing a subject and G for which there is an indexing J such that Z is A-bound[11] (under J) in M.

(2.22) **Definition of Government**

G *governs* Z just in case one of the following three conditions obtains:[12]

a. G and Z c-command each other, Z is a maximal projection, and G is either a lexical category (N, A, V, or P) or a projection of one. For the purposes of this definition, AGR counts as an N.

b. Z is the head of an element governed by G.

c. Z is the specifier (including subject) of an element governed by G.

(Pollard and Sag, 1994: 241; Chomsky, 1986b)

The clause starting "for which…" is necessary to rule *in* sentences such as

(2.23) My friends$_i$ found $[_{NP}$[each other's]$_i$ keys].

[9]Although the original source for these is Chomsky (1986b), the components of these definitions are somewhat scattered throughout that work. I have therefore used the formulations in Pollard and Sag (1994), since there the necessary parts are all presented together.

[10]In *Barriers*, Chomsky assigns features to the varieties of noun phrases. The features are ±a(naphoric) and ±p(ronominal). Reflexives and reciprocals are +a, with the result that the only GB binding principle that applies to them is Principle A.

[11]To be A-bound means to be bound by an item in argument position.

[12]X c-commands Y iff Y is contained in the closest maximum projection dominating X and Y is not contained in X.

Without the final clause, this sentence would be ruled out, since it would have to be bound in its NP. However, since *each other's* cannot be A-bound in this NP, this indexing is rejected, and the one illustrated in (2.23) is legitimated. Thus we see that the GB Principle A is already in danger of undergenerating and that a somewhat ad hoc stipulation is necessary to save it. But is this stipulation sufficient?

Pollard and Sag argue that it is not, because there are quite a few sentence types (1994: 245, (17)) which are still erroneously ruled out. In general, the sentences are ruled out because the configurational notion of c-command is too strong, or because the binding domain is larger than expected by GB's Principle A. Here is an example of each of these cases in turn:

(2.24) John suggested that [tiny gilt-framed portraits of [each other]$_i$] would make ideal gifts for [the twins]$_i$.

(2.25) [John and Mary]$_i$ knew that the journal had rejected [[each other's]$_i$ papers].

(Pollard and Sag, 1994: 245, (17d) , (17a))

Sentence (2.24) is a problem for two reasons. First, because the reciprocal is contained in the NP *tiny gilt-framed portraits of each other*, it is not c-commanded by its antecedent *the twins*. Second, even if the reciprocal were unembedded (or if picture NPs were somehow declared to be transparent), its antecedent still could not c-command it, because *the twins* is contained in the VP. Thus, the GB Principle A wrongly predicts this sentence to be ungrammatical. Sentence (2.25) is ruled out because the binding domain is calculated incorrectly. As we noted above, the counterfactual coindexation J mentioned in GB's Principle A predicts that a possessive reciprocal should not be bound in its NP, but rather in the next maximal projection up, which is its sentence. Then the prediction is that *the journal* is the only potential binder and binding fails due to a clash in number agreement. But in actuality (2.25) is just fine.

A different case of c-command being insufficient is provided by sentence (2.26), in which a semantically vacuous preposition blocks the c-command relation between antecedent and reflexive, since the antecedent NP is contained in a PP.

(2.26) Mary talked to John$_i$ about himself$_i$.

(Pollard and Sag, 1994: 246, (18a))

Again, perhaps the PP[to] could be treated as transparent. But GB does not have the mechanisms in place to do this in a principled way.

Thus we have seen that GB's Principle A, despite its complexity, rejects certain classes of grammatical sentences. HPSG's binding theory, while maintaining a simpler formulation, in some sense deals with these, although not in an altogether satisfactory manner. These are the ARG-ST lists for *portraits* and *papers* in the corresponding sentences above.

(2.24') [ARG-ST $\langle$NP$_i$:*ana*$\rangle$]

(2.25') [ARG-ST ⟨NP_i:*ana*⟩]

In each of these cases, nothing precedes the anaphor on its ARG-ST list. According to either the English formulation of HPSG's Principle A, given in (2.8) above, or the appropriate case of the constraint formulation, given in (2.19) above, these anaphors do not fall under HPSG's binding theory. The reason is that this Principle A only requires an anaphor to be locally a-bound if it is locally a-commanded, and thus none of the anaphors in these sentences meet this requirement. Pollard and Sag (1994: 257ff.) refer to such anaphors as *exempt* (from syntactic binding). They posit that such anaphors are resolved at the discourse level. Thus, HPSG's binding theory is a step better than GB's in this respect, since it doesn't fail to actually predict that such sentences are grammatical, but at the same time exempting such cases is more of a promissory note than a solution.

Most importantly, HPSG's Principle A basically has nothing at all to say about exempt anaphors; this amounts to the claim that the *only* thing that needs to be said about these anaphors is at the discourse level. However, we will see shortly that this is not true and that there are still some syntactic restrictions on even these anaphors. Furthermore, simply exempting certain cases does nothing for the long-standing intuitions of linguists that there is a canonical core to binding. In effect, without offering a theory of the resolution of such exempt anaphors, HPSG binding has *no* explanation for the phenomena. Giving no explanation for something is certainly not much better than giving the wrong explanation.

A second sort of data that is problematic for HPSG's Principle A is the well known case of long distance reflexives. Typologically, such items are not rare, and are found in such languages as Dutch, Danish, Norwegian, Icelandic, Japanese and Korean. Here is an example from Danish:[13]

(2.27) $John_i$ bad Anne om at ringe til sig_i.
John asked Anne for to call to self
John asked Anne to call him.
(Vikner, 1985: 11, (11))[14]

A reasonable analysis of *bad* is as an object equi verb. In this case, *bad* structure shares its object, *Anne*, with the subject of its complement VP, *ringe til sig*. The ARG-ST lists will therefore look like this:

(2.28) a. *bad*: ARG-ST ⟨NP_i, NP_j, VP[*inf*, ARG-ST ⟨NP_j, NP_i:*ana*⟩]⟩

b. *ringe* ARG-ST ⟨NP_j, NP_i:*ana*⟩

[13] In this example I'm momentarily glossing over the important fact that phrases do not have ARG-ST. See the discussion in section 2.5.1.

[14] Throughout his paper, Vikner uses subordinate clauses (e.g. sentence (2.27) preceded with the complementizer *at* ('that')). He does this to avoid complications from "verb second main clause movements" (Vikner, 1985: 7). However, since these linearization effects would not affect my analysis, I will gloss over this distinction whenever citing his examples.

Sentence (2.27) provides a direct counterexample to HPSG's Principle A, even with exempt anaphors. The reason is that it seems to present a clear case of an anaphoric pronoun that is locally a-commanded, but not locally a-bound. However, certain recent papers, such as Sells et al. (1987) and Reinhart and Reuland (1993), have questioned whether such long distance reflexives are pure anaphors on a par with English *herself*. These analyses suggest that long distance reflexives are in some respects more like nonanaphoric pronouns. Nonetheless, another binding principle is needed to handle these cases. I will review some of the recent suggestions along these lines in the next chapter, but first I will list the major cases of exempt anaphora in more detail.

2.4 Major Cases of Exempt Anaphora

Principle A of HPSG's binding theory treats any anaphor that does not have a less oblique coargument as exempt. Although what Principle A covers is a theoretical decision, it is clear that exempt anaphors are still subject to syntactic, semantic and discourse constraints. Thus, although these anaphors are exempt from HPSG's binding theory, they're not exempt from having anaphoric status. In other words, exempt anaphors still require interpretation relative to an antecedent. In chapter 3, I present my extended binding theory, which deals with these cases through an additional, motivated constraint.

The definition of an exempt anaphor is clear: any sign with *anaphor* as the value of its CONTENT feature that is not subject to Principle A is exempt. However, there is a limited number of configurations in which this argument structure obtains and it is useful to know what these are in discussing the revisions in the next chapter. Therefore, in this section I will present a review of the various major kinds of exempt anaphor constructions.

2.4.1 Picture Noun Phrases

So called "picture" noun phrases, like the examples in (2.29), have posed a long-standing problem for binding theory.

(2.29) a. $[_{\text{NP}}$ Gonzo's $[_{\text{N}}$ picture$]]$

b. $[_{\text{NP}}$ the $[_{\text{N}'}$ $[_{\text{N}}$ picture$]$ of Dorian Gray$]]$

c. $[_{\text{NP}}$ Andrew's $[_{\text{N}'}$ $[_{\text{N}}$ story$]$ about Gonzo$]]$

Example (2.29c) illustrates that the term "picture" noun phrase is strictly speaking too narrow, since there are other noun phrases which involve a similar structure. Here is a nonexhaustive list of picture NPs:

(2.30) **Picture Noun Phrases**

a. PP[*of*] complement
picture of, portrait of, photograph of, snapshot of, representation of, statue of, sculpture of

b. PP[*about*] complement
story about, lies about, rumours about, article about, report about, review about, movie about, film about, show about

A tentative generalization is that the *of* complement cases in (2.30a) are physical representations of something and there is a correspondence between the representation and the thing represented. For example, it makes sense to say whether someone's portrait looks like them or not. On the other hand, the *about* complement cases in (2.30b) do not have this kind of correspondence. Rather, the NP in the *about* complement is part of the representational content of the head noun (e.g. story). The generalization over both classes seems to be that they are representational and that the NP in the PP complement is part of the head noun's representational content. Thus, the term representational NP may be more appropriate, but I will continue to refer to them as picture NPs, as this is common usage.

These constructions have been problematic for binding theory because they provide an environment in which the complementarity of distribution between anaphors and personal pronouns breaks down.

(2.31) a. Gonzo knows pictures of himself are being circulated.

b. Gonzo knows pictures of him are being circulated.

Any binding theory which claims that anaphors and personal pronouns are in complementary distribution will necessarily rule out either (2.31a) or (2.31b).

Both binding theories that we have been looking at have a mechanism for dealing with this discrepancy. In the GB Principle A, recall that an anaphor must be bound in the least maximal projection containing a subject and for which there is also a counterfactual indexing in which the anaphor is bound. Now, in sentence (2.31a), the least maximal projection containing a subject and a governor of the anaphor is the embedded clause *pictures of himself are being circulated*. However, there is no actual or counterfactual index assignment in which *himself* is bound in this clause. Therefore, according to GB Principle A, the binding domain is the next clause up, as desired, and *Gonzo* serves as a legal antecedent. As for the pronoun, the counterfactual indexation is not part of Principle B. Thus, the pronoun's binding domain is only the embedded clause and it is indeed free in this clause. Of course, the stipulation of a counterfactual binding domain is unmotivated, since it is only needed to deal with cases like this one.

The HPSG binding theory gets around this problem in a slightly different manner. The solution in HPSG's Principle A is to treat the anaphor in (2.31a) as exempt; since it is on the ARG-ST list of *picture* and is not locally a-commanded, it does not have to be locally a-bound. Recall that the reason for the exemption is that the ARG-ST of a picture NP with a prepositional complement will contain only the PP complement:

(2.32) *picture*: [ARG-ST ⟨PP[*of*]:*ana*⟩]

Similarly, the pronoun in (2.31b) is locally a-free.

On the other hand, if the picture NP has a nominal in the specifier position, both accounts seem to correctly predict that the anaphor must be bound to this nominal. In the GB account, the governing category of the anaphor is now the picture NP, since there is a possible indexing that binds it in this NP. The HPSG account is that since the anaphor is locally a-commanded, it must be locally a-bound. A personal pronoun is correctly ruled out if it is bound to the specifier, on either theory, because then it is not free in its governing category (GB) or locally a-free (HPSG).

(2.33) Chrystale$_i$ knows Gonzo$_j$'s picture of himself$_j$/him$_{k/*j}$/*herself$_i$/her$_{i/k}$ is being circulated.

(2.34) *picture*: [ARG-ST ⟨NP$_j$, PP[*of*]$_{*j/k}$:*ppro*⟩]

An example of the ARG-ST list for *picture* in (2.33) would be as given in (2.34); the NP in this case would be *Gonzo* and the PP would be *of him*. The pronoun in the PP cannot be bound to *Gonzo*.

Pollard and Sag (1994: 266–272) make a convincing case for treating the anaphors in picture NPs without nominal specifiers as exempt. Their evidence, specifically with respect to picture NPs, is that there are discourse factors that seem to play an important role. For example, if there is no appropriate binder in the clause containing the picture NP, it is possible for the exempt anaphor to bind yet higher. Compare (2.35a) and (2.35b):

(2.35) a. *Bill suspected that Chrystale meant that a picture of himself would soon be on the post office wall.

b. Bill suspected that the silence meant that a picture of himself would soon be on the post office wall.
(Pollard and Sag, 1994: 270, (93c))

Sentence (2.35a) can only have the peculiar interpretation that Chrystale must be male. The anaphor cannot be anteceded by *Bill*. On the other hand, the anaphor in (2.35b) can have *Bill* as its antecedent, despite the fact that it has a noun phrase in the same position as *Chrystale*. But, the GB theory would wrongly rule the second sentence out, since the least maximal projection under which there is a potential binding is the sentential complement of *suspected*. Note that agreement features cannot be a factor in the notion of ‘potential binder’. That is, a GB analysis could not claim that *the silence* is not a potential binder because it does not agree with *himself*. If agreement facts were relevant here, then *Chrystale* in (2.35a) would not be a potential binder either and that sentence would erroneously be judged as grammatical.

But the most convincing case for treating anaphors in picture NPs as exempt is that certain picture NPs which are used in explaining someone’s point of view can even contain an anaphor whose antecedent is in a previous sentence.

(2.36) John$_i$ was going to get even with Mary. That picture of himself$_i$ in the paper would really annoy her, as would the other stunts he had planned.
(Pollard and Sag, 1994: 270, (94))

This last case is particularly convincing, since the sentence boundary is also the boundary for syntax. Processes that take place across sentence boundaries are generally analysed according to theories of text analysis or of discourse semantics, such as Discourse Representation Theory (Kamp and Reyle, 1993). The binding theory of GB, though, would wrongly rule the second sentence of (2.36) out, since the anaphor fails to be bound as required by GB’s Principle A.

But, it would be erroneous to conclude that an exempt anaphor complement of a picture NP is free to take its antecedent in a similar manner to the resolution of personal pronouns in discourse situations. In fact, an intervening potential binder for the anaphor results in the reappearance of the anaphor/personal pronoun distinction.

(2.37) John$_i$ was going to get even with Mary. The editor$_j$ was going to publish that picture of himself$_{*i/j}$/him$_{i/j}$ in the paper and that would really annoy her, as would the other stunts he had planned.

In this sentence, the NP *the editor* prevents the anaphor from binding to *John*. This occurs even though *editor* is a gender-neutral term. The anaphor *himself* actually binds to it so strongly that it forces the construal that the editor in question is male. Pollard and Sag (1994: 268–272) discuss this phenomenon under the rubric of “the Intervention Constraint”. This is a crucial part of the binding treatment presented in the next chapter, and will be discussed in more detail there.

2.4.2 Specifiers

Possessive anaphors are also exempt from HPSG’s Principle A. These are anaphors that are specifiers of noun phrases. In English, there are no possessive reflexives[15], but there are possessive reciprocals.

[15] At first glance, it may seem that *her own* and related items are possessive reflexives. However, these items behave more like pronouns, as shown by the following example:

(i) Jim resented the critique. After all, her own analysis had plenty of problems, too.

This example makes it clear that *her own* does not even need a linguistic antecedent (i.e. it can refer deictically).

(2.38) Chrystale and Alli like each other's mothers.

While *Chrystale and Alli* is clearly the antecedent of *each other* in this sentence, it does not locally a-command the reciprocal. The reciprocal is the sole member of the ARG-ST list of *mothers*. Since nothing precedes the reciprocal on this ARG-ST list, nothing locally a-commands it, and as a result the anaphor is not required to be locally a-bound according to Principle A.

Like other exempt anaphors, possessive anaphors can have an antecedent outside the clause that contains their NP:

(2.39) [John and Mary]$_i$ knew that [the journal had rejected [each other's]$_i$ papers].
(Pollard and Sag, 1994: 245, (17a))

The GB Principle A would predict that *the journal* must be the antecedent of the reciprocal and would thus wrongly rule this sentence out. But, the sentence is not ruled out by HPSG's binding theory, since the reciprocal is exempt from Principle A and no other principles are violated.

2.4.3 Controlled Complements

The HPSG Principle A presented in section 2.2 is the one given in Pollard and Sag (1994), except for being modified to work on ARG-ST instead of SUBCAT, following Manning and Sag (1999). Due to (2.20), the second clause of this Principle A, the understood subject of a controlled complement is locally a-bound. This will be made more clear in the following section on control theory. It will also be made clear that there are some serious problems with this in light of recent work in HPSG.

However, in the revised binding theory presented in the next chapter, these subjects will not be locally a-commanded, since there is no second clause in the revised Principle A. The locality requirement on controlled subjects will be derived using a separate constraint based on the Intervention Constraint. But, since these subjects are not locally a-commanded, they are technically exempt anaphors. In fact, in my revised system all and only coargument anaphors[16] are subject to Principle A. This entails that any anaphor that is not a coargument anaphor is exempt.

The two major classes of exempt anaphora in Pollard and Sag (1994) are anaphors in picture NPs without nominal specifiers and anaphors in the specifier position of NPs. A third class is added by the theory presented in the next chapter: the controlled NPs in the complements to control verbs. I now turn to control theory and the problems it poses for the formulation of Principle A given in section 2.2.

[16] A coargument anaphor is an anaphor that is bound by a less oblique member of its ARG-ST list.

2.5 Control Theory

The original motivation for the second clause of local o-command[17] was to ensure that the subject of an unsaturated complement is locally o-commanded. Such unsaturated complements occur as the VP complements to control verbs. They are unsaturated because they structure share a valence item with their controller, which is either the subject or object of the control verb, as appropriate. Here are sample control SUBCAT lists for the subject control verb *promise* and the object control verb *persuade*:

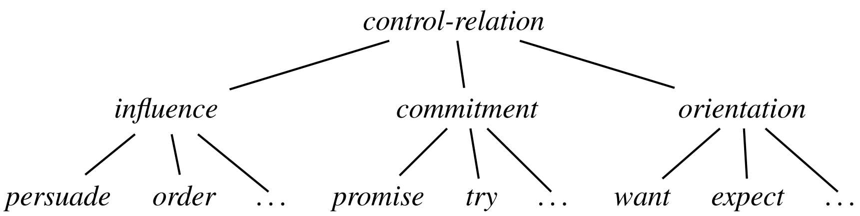
(2.40) a. *promise*: SUBCAT ⟨NP_i, (NP), VP[SUBCAT ⟨NP_i:*reflexive*⟩]⟩

b. *persuade*: SUBCAT ⟨NP, NP_i, VP[SUBCAT ⟨NP_i:*reflexive*⟩]⟩

The subject control verb *promise* has its subject coindexed with its VP complement, whereas for the object control verb *persuade* the coindexation is between its object and the subject of its VP complement.

The control relation, including whether there is subject or object control, is decided by the type of the verb on the *control-relation* hierarchy and by the control theory. The hierarchy is given in (2.41) and the control theory is given in (2.42)

(2.41) **Type hierarchy for control relations**



(Pollard and Sag, 1994: 287, (14))

(2.42) **Control Theory**

If the CONTENT of an unsaturated phrase is the SOA-ARG in a psoa whose relation is a control relation, then the subject SUBCAT element of that phrase is
(i) reflexive; and
(ii) coindexed with the INFLUENCED, COMMITTOR, or EXPERIENCER value in that psoa, according as the control relation is of sort *influence*, *commitment*, or *orientation*, respectively.
(Pollard and Sag, 1994: 302, (70))

Since I will demonstrate that this control theory has various problems, I will not attempt to formalize (2.42) any further.

It will make the discussion of Principle A's role in control more perspicuous if we look at an actual example and in so doing unravel what exactly Principle A contributes. Since I

[17] During this review of the control theory from Pollard and Sag 1994, I will temporarily revert back to the old nomenclature.

already introduced the SUBCAT of the object control verb *persuade*, the following will serve as an example:

(2.43) Gonzo persuaded Craig to call Kent Pizza.

The CONTENT of *persuade* here would then be:[18]

(2.44)
$$\begin{bmatrix} \textit{persuade} & \\ \text{INFLUENCE} & i \\ \text{INFLUENCED} & j \\ \text{SOA-ARG} & \begin{bmatrix} \textit{call} & \\ \text{CALLER} & j \\ \text{CALLED} & k \end{bmatrix} \end{bmatrix}$$

Now we are in a position to see how the binding and control theories interact under the old definitions.

The SUBCAT of *call* in this sentence satisfies the antecedent to the conditional in the control theory, (2.42). The VP of *call* is unsaturated, as shown in (2.40b), and its CONTENT is the SOA-ARG in the psoa of *persuade*, whose relation is a control relation — of type *influence* according to (2.41). Clause (2.42ii) is the main part of the control theory. In this case, because *persuade* has a *control-relation* of type *influence*, it guarantees that the SUBCAT element of the *call* VP is coindexed with the the value of the INFLUENCED feature of *persuade*. The lexical entry for *call* ensures that its subject is coindexed with the CALLER role and that its object is coindexed with the CALLED role. Similarly, the lexical entry for *persuade* ensures subject-INFLUENCER and object-INFLUENCED coindexation.

The role of Principle A in the control theory is to encode Manzini's Generalization (Manzini, 1983: 423):

(2.45) **Manzini's Generalization**
A PRO in an object sentence of a sentence S is bound in S.
(Manzini, 1983: 423, (20))

Pollard and Sag (1994: 298, (46)) give a formulation of the generalization that is in more HPSG-friendly terms.

(2.46) Nonsubject VP complements with unexpressed subjects must have a controller within the minimal clause that contains that complement.

[18] I follow the suggestion in Pollard and Sag (1994: 337–338) of treating the relations as subsorts of a higher relation supersort, rather than having an attribute RELATION. This will eventually be further modified to reflect the role names and relation hierarchy introduced in Davis (1996).

Pollard and Sag (1994: 298–302) have several arguments against (2.46) being true in all cases. The role of the binding theory is thus to ensure that it only holds in the canonical control relations which are captured by (2.42).[19]

Thus, it is not just the control theory itself, but rather control and Principle A that predicts the grammaticality patterns for the following sentences:

(2.47) a. Chrystale said Gonzo promised her to control himself.

b. Chrystale told Craig that Gonzo convinced her to pinch herself.

c. *Chrystale thought Craig asked Gonzo to call herself.

In (2.47a), the reflexive subject of *to control* is locally o-bound by the subject of *promised*, *Gonzo*, and can therefore locally o-bind *himself*. The same goes for (2.47b), except that in this case it is *her*, the object of *convinced*, that locally o-binds the reflexive subject of *to pinch*, which in turn locally o-binds *herself*. Finally, (2.47c) is out, because Chrystale does not locally o-bind the reflexive subject of *to call*, and therefore the anaphor *herself*, which is locally o-commanded by this subject, cannot be locally o-bound. The only local o-binding possible is with the subject, but *herself* cannot agree with this subject, since it is controlled by *Gonzo*.

But, the lexical entries of the verbs also guarantee that the second clause of the control theory is, in some cases, sufficient on its own to capture the locality requirement on controllers. This is more obvious when we examine the SUBCAT and control index assignments on our previous *persuade* example.

(2.48) *persuade*:

$$\left[\begin{array}{ll} \textit{local} & \\ \text{CAT} \mid \text{SUBCAT} & \langle \text{NP}_i, \text{NP}_j, \text{VP}\left[\text{SUBCAT}\ \langle \text{NP}_j{:}\textit{refl}\rangle\right]\rangle \\ \text{CONT} & \left[\begin{array}{ll} \textit{persuade} & \\ \text{INFLUENCE} & i \\ \text{INFLUENCED} & j \\ \text{SOA-ARG} & \left[\begin{array}{ll} \textit{call} & \\ \text{CALLER} & j \\ \text{CALLED} & k \end{array}\right] \end{array}\right] \end{array}\right]$$

There is no other way to satisfy the coindexation requirements between *persuade*'s SUBCAT elements and its *psoa* roles that also satisfies the second clause of the control theory.

However, this leaves Manzini's Generalization as only a contingent fact about lexical items. That is, as Pollard and Sag (1994: 296) write, "[The second clause of (2.42)] identifies in se-

[19]The exceptions to the generalization are accounted for in various ways, but examining the analyses at this point would take us too far afield.

mantic terms the controller of the unexpressed subject of a VP (or other predicative) complement, but it imposes no constraint on how the controller is realized or whether it must be realized at all". They invite us to consider a verb, *foobar*, which renders a sentence like the following grammatical.

(2.49) Mary$_i$ suspected that John would foobar Bill to call herself$_i$.

The relevant portions of the lexical entry for *foobar* would then look like this:

(2.50) *foobar*

$$\left[\begin{array}{ll} \textit{local} & \\ \text{CAT} \mid \text{SUBCAT} & \langle \text{NP}_i, \text{NP}_j, \text{VP}\left[\text{SUBCAT } \langle \text{NP}_k{:}\textit{refl}\rangle\right]\rangle \\ \text{CONT} & \left[\begin{array}{ll} \textit{foobar} & \\ \text{INFLUENCE} & i \\ \text{ROLE} & j \\ \text{INFLUENCED} & k \\ \text{SOA-ARG} & \left[\begin{array}{ll}\textit{call} & \\ \text{CALLER} & k \\ \text{CALLED} & l\end{array}\right]\end{array}\right]\end{array}\right]$$

This entry satisfies (2.42ii), since the subject of the unsaturated complement and the INFLUENCED role are coindexed. But, the actual controller is not a less oblique coargument of the unsaturated complement. Basically, there is nothing like theta theory in HPSG that requires a lexical entry to coindex its arguments with its semantic roles. Thus, if the subject of the unsaturated complement is not a locally o-bound reflexive, Manzini's Generalization is only met contingently, and not guaranteed. However, this is a deep, crosslinguistic generalization about the properties of Universal Grammar, which has yet to be seriously challenged. Therefore, the control theory should not just *happen* to satisfy; it should *guarantee* its satisfaction.

To sum up the historical discussion, the control theory of HPSG, as presented in Pollard and Sag (1994: 302), encodes Manzini's generalization by requiring that the subject of the unsaturated complement to a control verb be a reflexive. Manzini's locality requirement is then fulfilled by the second clause of Principle A: the reflexive subject is locally o-commanded and locally o-bound by an argument of the control verb.

2.5.1 Inverse Linking and Control

However, two subsequent changes in the theory have complicated matters. First, in chapter nine of Pollard and Sag (1994), a revision of HPSG is presented that separates the SUBCAT lists into SUBJ(ECT), COMPS(=COMPLEMENTS) and SPR(=SPECIFIER) valence lists. The SUBCAT list, which was now defined as the append of the SUBJ, SPR, and COMPS lists (in that order), was retained for binding purposes only. Second, in more recent work, the SUBCAT list was replaced by the ARG-S list (Sag and Godard, 1994; Manning et al., 1999), which has since been renamed ARG-ST (Manning and Sag, 1999; Bouma et al., 1998). However, unlike SUBCAT, ARG-ST is defined as an attribute of lexical signs. In other words, since ARG-ST is introduced by the type *word*, phrases do not have ARG-ST lists. This has the further consequence that the ARG-ST list does not change as a word's arguments are saturated.

In HPSG2 the Subcategorization Principle (Pollard and Sag, 1994: 34) ensured that the SUBCAT of a headed phrase was the SUBCAT of its head daughter, minus any SUBCAT elements that had been satisfied by complements to the head daughter. After the switch from SUBCAT to valence lists, the Valence Principle had the same effect. Thus, in HPSG3, as the various Immediate Dominance schemas put phrasal units together, the argument requirements of the head of the phrase are satisfied and taken off the appropriate valence list. For example, a simple transitive verb like *admire* will have one item on its SUBJ list and one on its COMPS list. The head-complement schema combines the verb with its complement, and the valence principle ensures that the resulting VP now has its COMPS list empty, since it is no longer looking for a direct object. Similarly, when the VP combines with a subject, the projection of the VP, which is S, inherits the empty COMPS list, but also has an empty SUBJ list, since that argument has now been found as well.

The ARG-ST list represents the argument structure of a lexical item, and is supposedly not inherited by the projections of the item in question. In addition, the kind of argument cancellation ensured by the Valence Principle does not apply to the ARG-ST, since the principle is defined to only apply to the valence lists SUBJ, SPR, and COMPS. The idea, which was presented in Manning (1996) and taken up in Manning and Sag (1999), is that the valence lists encode grammatical relations, while the ARG-ST list encodes argument structure. This idea is discussed in more detail below, but the division of labour is basically such that grammatical relations encode the syntactically relevant behaviour of arguments, while argument structure represents the underlying arity of a word. Thus, although the ARG-ST is still canonically defined as the append of the valence lists, there can be other relationships between the valence and ARG-ST lists. For example, in a pro-drop language, the null argument would not be realized on any valence list, since it is not a surface argument, but it would be realized on the ARG-ST list, since the argument has an interpretation. Similarly, the middle construction, as in *The vase broke*, could be analysed as having an argument structure with two arguments. *The vase* would be in second position on the ARG-ST list, but it would be linked to the SUBJ list, instead of the COMPS list. This treats *the vase* as the logical object, but the grammatical subject. Thus, the valence lists represent the link between arguments and their surface realization, whereas the ARG-ST list provides the link between arguments and their semantic interpretation.

But, the argument structure level is distinct from the semantic level, because it can contain syntactically relevant arguments that are semantically null. For example, if the ARG-ST list were to contain only semantic arguments, then it would not contain expletive subjects. It turns out, though, that expletives are relevant to certain of the generalizations that should be stated on the level of argument structure. Conversely, the understood object of an intransitive verb like *wash* in *John washed*, could be represented as a reflexive on the ARG-ST of *wash*, but it would not occur on the COMPS list, since intransitive *wash* is saturated and is not looking for a complement. Indeed, if argument structure is a linking level between semantics and grammatical relations, then we would expect it to contain *all* the grammatically and semantically relevant arguments.

Manning (1996) argues convincingly that a virtue of having both the valence lists and the ARG-ST lists is that we can use the former to encode grammatical relations, such as subject and object, and use the latter to encode the level of argument structure between semantics and grammatical relations. He argues that many unresolved problems regarding certain syntactically ergative languages, such as Tagalog and Inuit[20], can be explained if they are given an inverse linking between grammatical relations and argument structure. The linking rules for a syntactically accusative language like English would use a straight mapping.

(2.51) a. **Accusative Linking**

gr-structure		**a-structure**
SUBJ	⟵	a-subject (agent)
OBJ	⟵	patient

b. **Ergative Linking**

gr-structure		**a-structure**
SUBJ		a-subject (agent)
OBJ		patient

(Manning, 1996: 40)

The ergative linking pattern would cash out in HPSG by having the first member of a transitive verb's ARG-ST list coindexed with sole member of the COMPS list and letting the second member be coindexed with the sole member of the SUBJ list (Manning, 1996: 47)[21]. This first member of an ARG-ST list is called the 'a-subject' (Manning, 1996: 19). An ARG-ST list can have more than one a-subject, since Manning (1996) and Manning and Sag (1999) argue that

[20] Classifying these languages as syntactically ergative is not uncontroversial, but Manning's argument is precisely that if we make certain assumptions about linking, these languages fall into this class. As he points out, this solves a long-standing embarrassment in the study of ergativity, since syntactically ergative languages had been predicted to exist by most analyses, but only the Western Australian language Dyirbal could safely be assigned to this class.

[21] Manning (1996: 42, fn. 38) notes that there don't seem to be any ergative languages with ditransitive verbs that have two nonoblique internal arguments. That is, ditransitives are always marked with two core roles and a third oblique one. Presumably, these oblique complements would be on the COMPS list, but after the ergative subject.

operations that affect argument structure, such as passive and causativization, result in argument structure lists that are nested:

(2.52) ARG-ST $\langle XP_i, \ldots \langle XP_j, \ldots \rangle\rangle$

Thus, ARG-ST lists can contain other lists as members. Both XP_i and XP_j count as a-subjects, since they are each the first member on some ARG-ST list. As we will see, in certain cases, the least oblique (i.e. outermost) a-subject plays a privileged role. Manning (1996) calls this the maximum a-subject.

Having separate representations for grammatical structure and argument structure allows the assignment of distinct properties to the representations. In accusative languages like English, where the two levels coincide, the relevant distinctions will not be obvious. However, in syntactically ergative languages, there is a split between subject properties. The member of the SUBJ list — the subject of grammatical structure — has certain properties of the subjects of syntactically accusative languages, while the first member of the ARG-ST list — the subject of argument structure (a-subject) — has others:

(2.53)

Grammatical Structure Subject	**Argument Structure Subject**
Subcategorized element of every clause	Antecedent of reflexives
Relativization	Equi control target
Preferentially assigned specific/wide scope	Understood imperative addressee

(Adapted from Manning (1996: 12–14))

Thus, syntactically ergative languages motivate distinct levels of grammatical and argument structure, since there are separate generalizations that must be made at each of these levels.

Part of the motivation for the level of argument structure, as encoded by the ARG-ST list, is binding theory, as indicated by the mention of reflexives in (2.53). Manning (1997) and Manning and Sag (1999) present evidence from Toba Batak that involves the active voice (*mang-*) and objective voice (*di-*) constructions, as exemplified in the following sentences.[22]

(2.54) a. Mang-ida si Ria si Torus.
AV-see PM Ria PM Torus
Torus sees/saw Ria

b. Di-ida si Torus si Ria.
OV-see PM Torus PM Ria
Torus sees/saw Ria

(Manning, 1997: 80, (2a–b))

Evidence from prosody, adverb placement, relativization and coordination indicates that the final NP in each of these sentences is a VP-external subject at the level of grammatical structure (Manning, 1997; Manning and Sag, 1999). However, as indicated by the English translation,

[22] AV = active voice, PM = proper name marker, OV = objective voice.

in each case *Torus* is the logical subject, whether it is the grammatical subject (as in (2.54a)) or not (as in (2.54b)). This leads to the verbs having the following information in their lexical entries (Manning and Sag, 1999).

(2.55) a.

$$\begin{bmatrix} \text{PHON} & \langle \text{mang-ida} \rangle \\ \text{SUBJ} & \langle \boxed{1} \rangle \\ \text{COMPS} & \langle \boxed{2} \rangle \\ \text{ARG-ST} & \langle \boxed{1}\text{NP}_i, \boxed{2}\text{NP}_j \rangle \\ \text{CONT} & \begin{bmatrix} \textit{see} & \\ \text{SEER} & i \\ \text{SEEN} & j \end{bmatrix} \end{bmatrix}$$

b.

$$\begin{bmatrix} \text{PHON} & \langle \text{di-ida} \rangle \\ \text{SUBJ} & \langle \boxed{2} \rangle \\ \text{COMPS} & \langle \boxed{1} \rangle \\ \text{ARG-ST} & \langle \boxed{1}\text{NP}_i, \boxed{2}\text{NP}_j \rangle \\ \text{CONT} & \begin{bmatrix} \textit{see} & \\ \text{SEER} & i \\ \text{SEEN} & j \end{bmatrix} \end{bmatrix}$$

In each case the logical subject remains the same, but the active voice has an accusative linking pattern, whereas the objective voice has an ergative linking, resulting in the grammatical subject being realized differently in each case.

But, the binding facts are such that the logical subject can always bind the second NP on the ARG-ST list, no matter which NP is the grammatical subject (Manning, 1997: 83, (10a–b), (11a–b)).

(2.56) a. [Mang-ida diri-na] si John.
AV-saw self-his PM John
John$_i$ saw himself$_i$.

b. *[Mang-ida si John] diri-na.
AV-saw PM John self-his
**Himself$_i$ saw John$_i$.*

(2.57) a. *[Di-ida diri-na] si John.
OV-saw self-his PM John
**Himself$_i$ saw John$_i$.*

b. [Di-ida si John] diri-na.
OV-saw PM John self-his
John$_i$ saw himself$_i$.

A binding account that works on ARG-ST correctly predicts these grammaticality judgements. However, if binding were to be defined on the valence lists, only the active voice judgements would come out right. The objective voice judgements would be reversed. To get the correct results, a theory that defines binding on valence lists would have to assign the active and objective voice different phrase structures, but the various tests mentioned above indicate that they have the same phrase structure. Thus, the correct level for generalizations about binding is the level of argument structure, as encoded in the ARG-ST list in HPSG.

The table in (2.53) also states that it is the argument structure subject that is the target for equi control. However, the fact that the equi control target is the a-subject (the maximum a-subject, to be precise), causes problems for the formulation of control theory in Pollard and Sag (1994), which was given in section 2.5, (2.42). The control theory mentions the subject SUBCAT element of an unsaturated *phrase*. But, switching this to the a-subject of a phrase doesn't make any sense, since phrases do not have the feature ARG-ST and thus cannot have a-subjects. Crucially, changing the term 'subject SUBCAT element' to 'SUBJ element' does not generalize correctly to syntactically ergative languages. The following examples from Inuit should make this clear:[23]

(2.58) a. Miiqqat ____ Juuna ikiussallugu niriursuipput.
children.ABS [ERG Juuna.ABS help promise]
The children promised to help Juuna.

b. Miiqqat ____ qitissallutik niriursuipput.
children [ABS dance promise]
The children promised to dance.

The inverse linking for syntactically ergative languages dictates that in (2.58a) the control target will appear on the COMPS list, whereas in (2.58b) it will appear on the SUBJ list. Therefore, if the control theory were to specify that the control target is the SUBJ element, it would miss all ergative controllee cases, such as (2.58a). But, in both cases the controllee is the a-subject. Thus, the correct generalization, which the control theory should capture in order to be crosslinguistically valid, is that the control target is the maximum a-subject.

Manning (1996: 47–48) is aware of this problem and proposes two solutions to deal with it. The first solution is to make ARG-ST a head feature. Then it would be passed up to projections via the Head Feature Principle (HFP; Pollard and Sag (1994: 34)).[24] However, this harms the notion of locality that is standardly assumed in HPSG. Since the ARG-ST list contains *synsem*s and since *synsem*s contain the head feature, constituents will be able to "see" indefinitely far into their complements' arguments, and then these arguments' arguments, and so on recursively. Another solution that Manning proposes is to create a new head feature called MAX-A-SUBJECT. This would do less damage to locality, since phrases would only have a handle on the maximum a-subjects of their heads. But, there would still be a chain of maximum a-subjects available, and it is unclear whether there is any independent motivation for this.

One could imagine a third kind of solution that does not involve recursive chains of argument structure or maximum a-subjects. This solution is to restrict the stipulation to the control theory itself. The control theory would then be formulated like so:

[23] I have suppressed the gloss for irrelevant morphemes.

[24] The HFP is a crucial HPSG principle that dictates that the head value of a mother is token-identical with the head value of its head daughter.

(2.59) **Control Theory** (second version)
If the CONTENT of an unsaturated phrase is the SOA-ARG in a psoa whose relation is a control relation, then the maximum a-subject of **the head of the phrase** is
(i) reflexive; and
(ii) coindexed with the INFLUENCED, COMMITTOR, or EXPERIENCER value in that psoa, according as the control relation is of sort *influence*, *commitment*, or *orientation*, respectively.

The phrase does have a hold of its head, since the HEAD values of the head and its projection are token-identical due to the HFP. In fact, this is similar to the third, recursive clause of the a-command definition (see (2.2) in section 2.2), which mentions HEAD structure sharing as well. Although I will not formulate the control theory as a constraint, it is important to note that it would still result in an acyclic graph, since there is a path between the control verb's relevant psoa relation and the maximum a-subject of the head of the unsaturated phrase. Finally, due to the linking between the maximum a-subject of its head and the valence lists, the unsaturated argument will turn out to be the maximum a-subject every time. Thus, this control theory covers the control patterns in syntactically accusative languages, like English, and syntactically ergative languages, like Inuit.

However, there are various reasons for accepting Manning's first proposal, which was to percolate ARG-ST as a head feature. The first argument comes from unsaturated phrases. For example, VPs that are looking for a subject not only have the subject as a syntactic argument, but also as a semantic one. However, if the VP only has the subject on its SUBJ valence list, it does not possess it as a semantic argument. But, standard Montague semantics (e.g. Dowty et al. (1981)) treat the subject as a semantic argument of the phrase, which means there is some motivation for the VP having an argument structure link to semantics and taking the subject as its argument.

The second argument is that since certain phenomena are readily captured as dissociations between argument structure and valence lists, such as the cases of pro-drop and middle constructions mentioned above, certain generalizations no longer make sense if ARG-ST is not a feature on phrases. For example, given the following Farsi sentence, where the pronoun has been dropped, how do we define what the subject of the sentence is?

(2.60) Maryam did-am.
Maryam saw-1SG
I saw Maryam.

The subject has not combined with the head via the Head-Subject Schema (Pollard and Sag, 1994: 402), because the understood pro was never on the SUBJ list of the verb. The subject of this sentence is then the first member of the verb's ARG-ST list. But, this just amounts to saying that the subject of the sentence is the first member of the head's ARG-ST list. Since we need to refer to the ARG-ST of the head of the phrase, it makes sense to do so directly and in a principled manner, by percolating the actual list to the phrase.

The third argument comes directly from binding theory. Recall, the definition of a-command given in (2.2). It is repeated here for convenience:

(2.61) **Definition of A-Command**
Let Y and Z be *synsem* objects, with distinct LOCAL values, Y referential. Then Y *a-commands* Z just in case either:

i. Y is less oblique than Z; or

ii. Y a-commands some X that subcategorizes for Z; or

iii. Y a-commands some X that is a projection of Z (i.e. the HEAD values of X and Z are token-identical).

As example (2.4) illustrated, the third clause is necessary to ensure that the a-command extends indefinitely deep, as required by Principle C. However, if phrases have ARG-ST lists and if we understand 'subcategorizes for' to mean 'has an ARG-ST list containing', then the third clause can be scrapped, thus simplifying the binding theory.

The new definition would be

(2.62) **Definition of A-Command** (final version)
Let Y and Z be *synsem* objects, with distinct LOCAL values, Y referential. Then Y *a-commands* Z just in case either:

i. Y is less oblique than Z; or

ii. Y a-commands some X that subcategorizes for Z.

A-command will still work like before, as shown using example (2.4), repeated here as (2.63).

(2.63) Gonzo thinks Craig likes Chrystale.

The ARG-ST of *thinks* contains *Gonzo* and the subordinate S, in that order. By clause (2.62i), *Gonzo* a-commands the S. The argument structure of *likes* is ⟨*Craig*, *Chrystale*⟩, and by the Head Feature Principle this is also the ARG-ST of the S, since *likes* is its head. Then, by an application of clause (2.62ii), it follows that *Gonzo* a-commands *Craig* and *Chrystale*, since it a-commands the S that subcategorizes for each of these NPs.[25]

With ARG-ST a head feature, the control theory would then be formulated as follows:

[25] There has also been discussion on the HPSG List, an electronic discussion forum, that contains further arguments for making ARG-ST a head feature. The list is archived at http://eoan.stanford.edu/hpsg-l/archives.html and the pertinent messages are 189–207 (checked 17.08.98).

(2.64) **Control Theory** (third version)
If the CONTENT of an unsaturated phrase is the SOA-ARG in a psoa whose relation is a control relation, then the maximum a-subject of the phrase is
(i) reflexive; and
(ii) coindexed with the INFLUENCED, COMMITTOR, or EXPERIENCER value in that psoa, according as the control relation is of sort *influence*, *commitment*, or *orientation*, respectively.

The difference between this formulation and the one in (2.59) is that this one no longer refers to the head of the unsaturated phrase, since the phrase itself has a maximum a-subject, which is of course the same as its head's maximum a-subject.

The control theory has now successfully been recast in the necessary argument structure terms. But where does this leave the second clause of local a-command? For convenience I repeat the local a-command definition here:

(2.65) **Definition of Local A-Command**
Let Y and Z be *synsem* objects, with distinct LOCAL values, Y referential. Then Y *locally a-commands* Z just in case either:

i. Y is less oblique than Z; or
ii. Y locally a-commands some X that subcategorizes for Z.

In particular, the term that needs definition is 'subcategorizes for'. I assumed above that this term must be defined relative to ARG-ST lists, as far as general a-command is concerned, and I will argue this point further shortly. But first I will show that this notion does not make sense for local a-command as long as the second clause is present. Here I will not be making general claims about what it means in HPSG to subcategorize for something. I will only present arguments for what it must mean in the context of binding theory and for the a-command definitions in particular.

There seem to be two options for cashing out the meaning of this term relative to the a-command definitions.

(2.66) a. **The Valence List Option**
Y subcategorizes for X means X is on one of Y's valence lists.

b. **The Argument Structure Option**
Y subcategorizes for X means X is on Y's ARG-ST list.

But, as we will see, both these interpretations leave problems for the second clause of the local a-command definition, (2.65ii). It is important to bear in mind here that the obliqueness of coarguments is represented on the ARG-ST list and it is on this list that binding is defined.[26]

[26] As evident from the discussion so far in this section, Christopher Manning and his collaborators have gone to pains to show that this is indeed the case. See Manning (1996, 1997); Manning and Sag (1999); Manning et al. (1999).

Most importantly, where there is a discrepancy between the append of the valence lists and the ARG-ST lists, binding relations are still checked against the ARG-ST list, and not against the valence lists. Thus, the notions of command and binding needed must be stated on ARG-ST. This was the reason for changing the notions of o-command, o-bound and o-free to a-command, etc.

The valence list option suffices for local a-command. The second clause of local a-command is the one that mentions subcategorization, and this clause is motivated by control theory. But a controlled complement will always have some valence list unsaturated. In English, this would be the SUBJ list in every case, whereas in Inuit it could be either the SUBJ or the OBJ list. However, the second clause of the general a-command definition also mentions the term 'subcategorizes for'. And for these cases, the valence list option will not work. The reason is that many analyses (see the list in Bouma et al. (1998: 5)) crucially depend on discrepancies between valence lists and ARG-ST. However, even in these cases, the ARG-ST list still determines binding possibilities.

Furthermore, there is a conceptual problem here. We have seen evidence that binding theory should be defined on ARG-ST, and not on the valence lists. Therefore, argument structure is the level at which binding applies in current HPSG analyses. The question is why should our binding constraints mention valence lists, then? By mentioning valence lists, the binding constraints would effectively not be defined solely on argument structure, since they need information regarding grammatical structure as well. Thus, there is an empirical and a conceptual reason for rejecting the valence list option in (2.66).

This leaves us with only the argument structure option. As it stands, this option is undefined, at least for cases where Y is a phrase, since phrases do not have ARG-ST lists. In fact, it excludes precisely the control cases which motivated the second clause of local a-command. Suppose we follow Manning's suggestion and allow ARG-ST to be a HEAD feature, and thus propagate to phrases from their head daughters. But then the binding constraints would completely fall apart, because there would be no distinction between the arguments that the phrase is still looking for and those that it has already found. The following sentence and its ARG-ST lists provide an example.

(2.67) a. John$_i$ said Mary likes him$_i$.

b. ARG-ST ⟨NP$_i$, S[ARG-ST ⟨NP, NP$_i$:*ppro*⟩]⟩

According to the argument structure option, in this example *John* locally a-commands the pronoun *him*. This occurs because *John* locally a-commands its S complement, since the NP is less oblique than the S, and S subcategorizes for (according to the argument structure interpretation of this term) the pronoun *him*. Furthermore, the pronoun is a-bound because it is coindexed with *John*. Therefore, this sentence would be incorrectly ruled out by Principle B, which states that a personal pronominal (*ppro*) must be locally a-free (i.e. not locally a-bound).

Now, what if we were to adopt Manning's second suggestion of just having the maximum a-subject passed up via the Head Feature Principle? We still need the general interpretation of 'subcategorizes for' to be defined on ARG-ST due to general a-command requirements in (2.2). But then we would still be in a position where the second clause of the local a-command definition is undefined due to phrases not having an ARG-ST (even though they have a MAX-A-SUBJECT). We would then have to reformulate the second local a-command clause to 'Y locally a-commands Z if case Y locally a-commands some X that has Z as its MAX-A-SUBJECT value'. The immediate question is, why should the same term be defined differently in two related definitions? Thus, the second local a-command clause would now be completely stipulative. Secondly, it still doesn't work, since pronouns in subject position would still be locally a-commanded. It is possible to bar these cases by introducing the notion of unsaturated complement into the second clause: 'Y locally a-commands Z if case Y locally a-commands some unsaturated complement X that has Z as its MAX-A-SUBJECT value'. But, since 'unsaturated complement' for a phrase must be something on a valence list, we are once again referring to grammatical structure in the supposedly argument structure-only binding theory.

In conclusion, recent revisions to HPSG which have resulted in binding being defined on the ARG-ST list have also resulted in the second clause of the local a-command definition being stipulative at best and uninterpretable at worst. Since this clause is crucially used to derive locality constraints in control theory (i.e. Manzini's generalization), the control theory will no longer work properly either. In chapter 3, I present an extended binding theory with a simplified core that offers a reasonably concise solution to these problems. The solution proposed does away with the second clause of the local a-command definition entirely, and thus solves the problems we have been discussing in this section.

2.6 Conclusion

In this chapter, I provided a review and formalization of HPSG's Principle A and its auxiliary notions. I argued that recent advances in HPSG have created problems for the binding theory, especially as it applies to controlled complements. This necessitated a review of control theory and some of the reasons for treating binding and control on the level of argument structure. Overall, Principle A was found to have three problems: the treatment of exempt anaphora, long distance anaphora, and its contribution to control theory. In chapter 3 I present the extended binding theory mentioned above. Then, in chapter 4, I present a revised control theory and illustrate how this interacts with the binding theory that I develop.

Chapter 3

An Extended Binding Theory

3.1 Introduction

In this chapter I present a version of binding in HPSG which extends the theory discussed in the last chapter. By 'extension', I mean that I have added two constraints: one for anaphors, which constrains the distribution of exempt anaphora, and the second for long distance reflexives (following Xue et al. 1994), for which the standard HPSG binding theory has no analysis. However, I do not mean to imply by the term 'extended' that I have complicated the theory. In fact, quite the contrary. The actual core of binding theory has been substantially simplified.

In section 3.2, I present my reformulation of the HPSG binding principles and auxiliary definitions. These are the versions that are the result of the arguments in the previous chapter. There are also certain other modifications that anticipate changes to argument structure in the next chapter. But these modifications are small and are principally a matter of wording. These modifications, together with Principle Z, which handles long distance binding and is presented in section 3.2.1, constitute the simplified core of the binding theory.

The extension to binding comes in the form of the Antecedent Closeness Constraint (section 3.3). This is an additional constraint on the distribution of anaphors which handles many cases: certain gerundive and infinitival constructions (section 3.4.1), picture NP anaphors (section 3.4.2), and anaphors in specifier of NP position (section 3.4.3). In the next chapter, I will also illustrate how the Antecedent Closeness Constraint accounts for locality in control, since I do away with the second clause of local a-command, which has the result that Principle A does not apply to controlled subjects.

The final section of the chapter deals with a couple of cases which present residual problems. The first case is that of semantically contentful PPs that contain anaphors (section 3.5.1). The second case has to with coordination and split antecedents (section 3.5.2).

3.2 The Core Concepts and Principles

Before defining the binding principles I will present the necessary auxiliary concepts. In section 2.5.1 of the last chapter, I argued that the definition of a-command should be modified to work on ARG-ST lists. I also argued that once ARG-ST is treated as a head feature, the third clause of a-command is no longer necessary.

(3.1) **Definition of A-Command**
Let Y and Z be members of an ARG-ST list, with distinct LOCAL values, Y referential. Then Y *a-commands* Z just in case either:

i. Y is less oblique than Z; or

ii. Y a-commands some X that subcategorizes for Z (i.e. Z is on X's ARG-ST list).

I've changed the wording in the first sentence slightly. Due to changes in the membership of ARG-ST lists (see chapter 4), Y and Z will no longer necessarily be *synsem*s. Therefore, I just refer to them as members of an ARG-ST list. In addition, as discussed in section 2.5.1, the term 'subcategorizes for' is meant to be understood in terms of X having Z on its ARG-ST list.

I also argued that the interpretation of subcategorization that is necessary for binding theory leads to a situation in which the second clause of Pollard and Sag's local a-command is problematic. I will define local a-command without this second clause, since its effects will be derived by the Antecedent Closeness Constraint (see section 3.3 below).

(3.2) **Definition of Local A-Command**
Let Y and Z be members of an ARG-ST list, with distinct LOCAL values, Y referential. Then Y *locally a-commands* Z just in case:

i. Y is less oblique than Z.

Therefore, in order to formalize Principle A, there is now only the one feature structure to worry about.

Obliqueness is still to be understood in the same manner: Y is less oblique than Z if and only if Y precedes Z on some ARG-ST list. Coindexation has also remained unchanged; Y and Z are coindexed if and only if they structure share their INDEX values. This in turn means that the definitions for a-free and a-bound have remained the same.

(3.3) a. Y a-binds Z iff Y and Z are coindexed and Y a-commands Z.

b. Y locally a-binds Z iff Y and Z are coindexed and Y locally a-commands Z.

c. Z is a-free iff Z is not a-bound.

d. Z is locally a-free iff Z is not locally a-bound.

The formulation of the binding principles will remain the same (Pollard and Sag, 1994: 254), although I've changed the wording of Principle A slightly, to make its conditional nature more explicit:

(3.4) **HPSG Binding Theory**

Principle A If an anaphor (*ana*) is locally a-commanded, it must be locally a-bound.

Principle B A personal pronoun (*ppro*) must be locally a-free.

Principle C A nonpronoun (*npro*) must be a-free.

I've also added the type (from the *nominal-object* hierarchy) that the principles apply to in brackets. Again this is just to make the principles more explicit and for ease of subsequent discussion.

Due to the simplification in the definition of local a-command, there will only be one Principle A feature structure instantiation. Principle A now only has to encode the information that an anaphor that has a less oblique coargument must be bound.

(3.5) **Principle A** (final version)

$$
\text{ARG-ST}\ \langle \ldots,\ Y\begin{bmatrix} \textit{synsem} & \\ \text{LOCAL} & \boxed{1}\begin{bmatrix}\textit{local} & \\ \text{CONTENT} & \begin{bmatrix}\textit{nom- obj} & \\ \text{INDEX} & \begin{bmatrix}\textit{referential} & \\ \text{PER} & \textit{person}\\ \text{NUM} & \textit{number} \\ \text{GEND} & \textit{gender}\end{bmatrix}\end{bmatrix}\end{bmatrix}\end{bmatrix},
$$

$$
W^*, \ldots,\ Z\begin{bmatrix} \textit{synsem} & \\ \text{LOCAL} & \boxed{3}\begin{bmatrix}\textit{local} & \\ \text{CONTENT} & \begin{bmatrix}\textit{ana} & \\ \text{INDEX} & \textit{referential}\end{bmatrix}\end{bmatrix}\end{bmatrix}, \ldots\rangle
$$

$\boxed{1} \neq \boxed{3}$

$$\Downarrow$$

$$
\text{ARG-ST}\ \langle \ldots,\ {}^{Y}\big[\text{LOCAL}\ \boxed{1} \mid \text{CONT} \mid \text{INDEX}\ \ \boxed{2}\big],\ W^*, \ldots
$$

$$
\ldots,\ {}^{Z}\big[\text{LOCAL}\ \boxed{3} \mid \text{CONT} \mid \text{INDEX}\ \ \boxed{2}\big], \ldots\rangle
$$

$\boxed{1} \neq \boxed{3}$

Thus, Principle A no longer has to be expressed as a disjunction, since there is only one case.

I will continue to use the term ‘exempt anaphor’ to refer to nominals that are of type *ana* but not subject to Principle A. An anaphor will be exempt just in case either it is the first thing on its ARG-ST list, or the only items that precede it are expletives. Only arguments with *referential* indices can be a-commanders. Therefore, an expletive, which has an index of type *it* or *there*, will not locally a-command an anaphor. I will define exempt anaphors using the following feature structure. This is just for added clarity, as it will then be more obvious in subsequent discussion which anaphors are exempt and which ones are subject to Principle A.

(3.6) **Definition of Exempt Anaphor**

$$\text{ARG-ST} \left\langle \begin{bmatrix} \textit{synsem} \\ \text{LOCAL} \mid \text{CONT} \mid \text{INDEX} \quad \neg\ \textit{referential} \end{bmatrix}^{*}, \begin{bmatrix} \textit{synsem} \\ \text{LOCAL} \mid \text{CONTENT} \quad \textit{anaphor} \end{bmatrix}, \textit{synsem}^{*} \right\rangle$$

This definition uses the Kleene star in its standard theoretical linguistics interpretation, meaning ‘0 or more’. Thus, the definition states that if an anaphor is the first thing on its ARG-ST list, or if the only things preceding it are expletives, then it is exempt.

For the sake of clarity, here is a sample lexical entry for the anaphor *herself*.

(3.7)
$$\begin{bmatrix} \textit{word} & \\ \text{PHON} & \langle \text{herself} \rangle \\ \text{SYNSEM} & \begin{bmatrix} \textit{synsem} & \\ \text{LOCAL} & \begin{bmatrix} \textit{local} & \\ \text{CATEGORY} & \begin{bmatrix} \textit{cat} & \\ \text{HEAD} & \begin{bmatrix} \textit{noun} & \\ \text{CASE} & \textit{acc} \\ \text{ARG-ST} & \langle\rangle \end{bmatrix} \end{bmatrix} \\ \text{CONTENT} & \begin{bmatrix} \textit{reflexive} & \\ \text{INDEX} & \boxed{1} \begin{bmatrix} \textit{referential} & \\ \text{PER} & \textit{3rd} \\ \text{NUM} & \textit{sing} \\ \text{GEND} & \textit{fem} \end{bmatrix} \\ \text{RESTRICTION} & \{\} \end{bmatrix} \\ \text{CONTEXT} & \begin{bmatrix} \textit{context} & \\ \text{BACKGROUND} & \left\{ \begin{bmatrix} \textit{psoa} & \\ \text{RELATION} & \textit{female} \\ \text{INSTANCE} & \boxed{1} \end{bmatrix} \right\} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

The type of the index is *reflexive*, as required. I also assume that reflexives in English are marked for accusative case (Pollard and Sag, 1992, 1994), since they can never appear in nominative case positions.

I now have the core binding theory in place. The principles and many of the auxiliary definitions have remained essentially unchanged. However, the definitions of a-command and local a-command were significantly simplified and local a-command is now stated only in terms of obliqueness. This entails that an argument can only locally a-command a coargument; in turn, this means that all anaphors that have a less oblique coargument are subject to Principle A.

3.2.1 Long Distance Binding

In section 2.3 it was mentioned that the long distance binding that occurs in various languages causes problems for HPSG's Principle A. Recall our Danish sentence (2.27), repeated here as (3.8).

(3.8) John$_i$ bad Anne om at ringe til sig$_i$.
John asked Anne for to call to self
John asked Anne to call him.

The problem here is that *sig*, meaning roughly *him-/her-/itself*, needs an antecedent, and hence is a prime candidate as an anaphor, but is not locally a-bound by its local a-commander, *Anne*.

There is some evidence, though, that these long distance reflexives are not anaphors on a par with English *him/her/itself*. Sells et al. (1987) present an argument from the distribution of Dutch *zich*, which is a long distance reflexive, that such items are in some sense like syntactically nonanaphoric pronouns. They note that *zich*, which is unstressed, has the same distribution as unstressed pronouns. Here are some examples:

(3.9) a. Heeft zij zich/hem verdedigd?
Has she herself/him defended
Has she defended herself/him?

b. ??Zij heeft met opzet zich/hem gisteren niet verdedigd.
She has on purpose herself/him yesterday not defended.
She did not defend herself/him on purpose yesterday.

c. *Zich heeft ze goed verdedigd.
Herself has she well defended.
Herself, she has defended well.

(Sells et al., 1987: 181–182, (33–37))

Sentences (3.9a) and (3.9b) illustrate that *zich* is both grammatical and odd in the same places as the unstressed pronoun *hem*. Example (3.9c) illustrates that *zich* cannot be topicalized, since this position requires stress. The same is true of unstressed pronouns, although the stressed anaphor *zichzelf* can occur here.

In a similar vein, Reinhart and Reuland (1993) give pronouns and unstressed anaphors, which they call simplex expressions (SEs), the same structural analysis:

(3.10) a. $[_{NP}$ Pron $[_{N'} \ldots e \ldots]]$

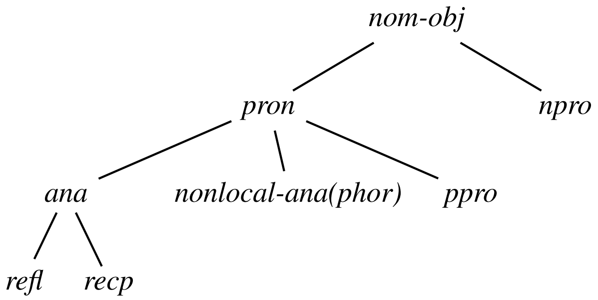
b. $[_{NP}$ SE $[_{N'} \ldots e \ldots]]$

(Reinhart and Reuland, 1993: 658, (1–2))

They postulate that the difference between SEs and pronouns is that the former lack ϕ-features and therefore "do not project an argument that can be interpreted independently" (Reinhart and Reuland, 1993: 658).

Thus, SEs are anaphoric in the sense of needing an antecedent, but otherwise distribute like unstressed pronouns. Since the HPSG *nominal-object* hierarchy is meant to reflect the referential properties of the *nominal-object* subtypes, we need a new type for SEs. I will give them the type *nonlocal-anaphor*. There is only one natural place for this type in the *nom-obj* hierarchy. These terms cannot be of type *anaphor*, along with reflexives and reciprocals, because Principle A is defined on this type and we do not want these nonlocal anaphors to be subject to Principle A, which imposes the requirement of locality. Similarly, we do not want them to be of type *ppro*, because Principle B, which states that *ppro*s should be locally a-free, is defined on this type and some long distance reflexives (such as Chinese *ziji*) can be bound locally. So *nonlocal-anaphor* should inherit from the type *pron*. The new *nominal-object* hierarchy should therefore be:

(3.11)



This captures the fact that nonlocal anaphors are still pronominals, while distinguishing them from anaphors and personal pronominals.

Now that we have the type in place, we need a new binding principle for *nonlocal-ana*. This has previously been provided in Xue et al. (1994) and Branco and Marrafa (1999). The first paper set a precedent for calling this Principle Z (presumably for the Chinese long distance reflexive *ziji*, since this was the topic of the paper). Here is the Principle Z from Xue et al. (1994: (38)).[1]

(3.12) **Principle Z**
Nonlocal anaphors must be a-bound.

This constraint is fairly general, but requires that nonlocal anaphors must always be a-bound.

By contrast, the Principle Z of Branco and Marrafa (1999) and the version (independently) motivated in Manning and Sag (1999) is a conditional which states that "an a-commanded nonlocal anaphor must be a-bound".[2] Branco and Marrafa argue that this yields the correct binding facts for Portuguese *ele próprio* ('he own') and associated forms, since these items can be exempt if they are not a-commanded:

(3.13) Ele próprio pagou a conta.
He own paid the bill.
He paid the bill
(Branco and Marrafa, 1999: 8, (12))

However, this gets the wrong results for Danish, where the long distance reflexive *sig* has a possessive counterpart, *sin*. Since *sin* would be the first thing on its ARG-ST list, it is exempt from a conditional Principle Z (like local anaphors in specifier position; see section 2.4.2). But,

[1] Xue et al. use o-command, o-bound, etc., instead of the corresponding 'a-' terms. They also call the kind of anaphor in question Z-pronouns, but this is only perspicuous in certain cases, like that of Chinese *ziji*, so I have replaced their term 'Z-pronoun' with my term 'nonlocal anaphor'.

[2] The original wording is "An o-commanded anaphoric pronoun must be o-bound".

Germanic simplex expressions in general cannot refer independently (Reinhart and Reuland, 1993) and this is confirmed by the ungrammaticality of the following Danish sentence.[3]

(3.14) Anne$_i$ bad pigen$_j$ [P$_j$ rede sin$_{i/j/*k}$ seng].
Anne told girl.the make SE bed
Anne$_i$ told the girl$_j$ to make her$_{i/j/k}$ bed.

I will therefore adopt the Principle Z in (3.12), which is stricter than the conditional version and gets the right results for Danish.[4]

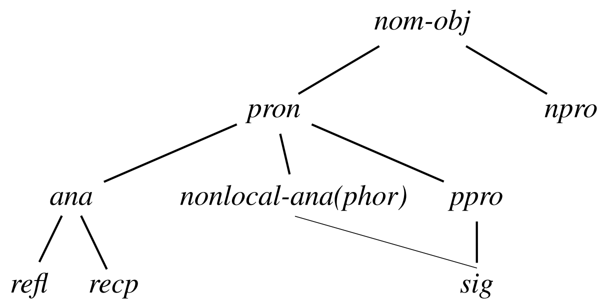
However, even the principle in (3.12) is not strict enough, since it is clear that many non-local anaphors are subject to additional constraints. One common constraint is that nonlocal anaphors are subject-oriented (i.e. their antecedents must be subjects; see Reuland and Koster 1991).[5] Indeed, this constraint on subject orientation holds for Danish (Vikner, 1985). Yet even with this added constraint on antecedents, Principle Z fails to completely account for the Danish facts. Since local a-binding is a subcase of a-binding, this principle wrongly predicts that the Danish nonlocal anaphor *sig* can be locally a-bound, which it cannot in general.

(3.15) *Peter$_i$ fortalte Michael$_j$ om sig$_i$.
Peter told Michael about SE
Peter$_i$ told Michael about himself$_i$.
(Vikner, 1985: 10, (10))

Thus, like a pronoun, the simplex expression *sig* must be locally a-free.

One possible solution is to say that *sig* is subject to both Principle B and Principle Z. This would mean having *sig* inherit from the types *nonlocal-ana* and *ppro*, as in this inheritance hierarchy.

(3.16)



This would entail that *sig* must be locally a-free, since it inherits from *ppro* and is therefore subject to Principle B. Similarly, it must be a-bound, since it inherits from *nonlocal-ana* and is

[3]The judgements reported in this example are for North Jutlandic Danish. Other dialects may disprefer the *i* binding.

[4]Although I do not have the informants to test this systematically, it should also be noted that *ele próprio* patterns suspiciously like English *he himself*, which I do not take to be an anaphor. Thus, it may turn out that *ele próprio* is a pronominal construction, in which case it is unsurprising that it can occur in exempt positions.

[5]In HPSG terms, Manning (1996) discusses such anaphors as being a-subject-oriented, meaning they must be bound by an element that is first on some ARG-ST list.

subject to Principle Z. In general, this yields the right results and accords with the data reported above about the distribution of nonlocal anaphors and unstressed pronouns.

However, there are some exceptions to the generalization that SEs must be locally a-free. As the arguments of certain verbs, they can occur in positions where they are locally bound (on either HPSG or GB's definition). Coindexed pronouns cannot occur in these environments, as the following sentences from Danish and Dutch illustrate.

(3.17) a. Martin$_i$ vasker sig$_i$/ham$_{*i/j}$.
Martin$_i$ washes self$_i$/him$_{*i/j}$
Martin$_i$ is washing himself$_i$/him$_{*i/j}$.

b. Martin$_i$ wast zich$_i$/hem$_{*i/j}$.
Martin$_i$ washes self$_i$/him$_{*i/j}$
Martin$_i$ is washing himself$_i$/him$_{*i/j}$.

But, it turns out that the environments in which SEs can be seemingly locally bound are limited.

In fact, it could be argued that this is only a case of homophony, and not an actual use of the type *nonlocal-anaphor*. This is confirmed by the fact that the string *sig* also turns up in contexts where there is no object argument, as in certain intransitives:[6]

(3.18) a. Peter sov over sig.
Peter slept over SE
Peter slept over.

b. Marie er doven af sig.
Marie is lazy of SE
Marie is lazy by nature.

c. Rikke fortalte mig at hun vil skynde sig.
Rikke told me that she will hurry SE
Rikke told me that she will hurry.

These are clearly intransitive constructions, as no NP other than *sig* can go in the SE slot without causing ungrammaticality. Thus, the *sig* in these constructions is acting as a kind of expletive object, with no reference back to the "antecedent". In fact, there is no antecedent, because this is not an instance of the lexical item *sig* that is a nonlocal anaphor.

As for the transitive cases, like *vaske*, a possible analysis would be that there are two lexical entries for these verbs. One entry is a normal transitive verb and inherits from the appropriate type for these verbs in the lexical hierarchy. The second entry inherits from a special type for reflexive verbs that stipulates that its argument structure object is a reflexive which gets mapped to the same expletive *sig* on the COMPS list. This is similar in spirit to the solution in Reinhart and Reuland (1993) which involves postulating two distinct lexical items for such verbs. Whatever the solution adopted, it is the reflexive constructions that are the exceptions

[6]The verbs used in these examples are from Vikner (1985), but all the sentences except the first one are my own.

(Vikner, 1985). In general *sig* must be locally a-free and its distribution is explained in a hierarchical lexicon that has this reflexive inherit from both the type for nonlocal anaphors and the type for pronouns. This has the effect of making *sig* subject to two binding principles (B and Z) and explains its distribution outside these exceptional reflexive constructions.

In this section I illustrated the need for a fourth binding principle, Principle Z. I adopted the formulation of this principle that requires a-binding in all cases, as this is motivated by the data available to me. Lastly, I illustrated how the Danish simplex anaphor *sig* can be analysed as inheriting from both the types *nonlocal-anaphor* and *ppro*, which explains its distribution. The seeming exceptions to this are cases where there is either a) no true reflexivity, and therefore no true *sig*, or b) a lexical ambiguity.

3.3 The Antecedent Closeness Constraint

The most important difference between my Principle A and the one discussed in the last chapter, which was a formalization of Pollard and Sag's Principle A, is that there is no longer any second clause that extends local a-command to cover controlled complements. Thus, I require some other device to ensure the locality of control relations. This is where the Antecedent Closeness Constraint (ACC) comes in. The ACC is the third and final constraint that is relevant to establishing the antecedent-anaphor relationship in my theory. But, unlike the extended Principle A, it is independently motivated and is also used outside of control theory.

The ACC is based on the Intervention Constraint (IC)[7], which was first discussed with respect to 'Super Equi-NP Deletion' (Grinder, 1970, 1971; Kimball, 1971; Jacobson and Neubauer, 1976). This construction contains an anaphoric relation between a noun phrase controller and the unexpressed subject of a gerund or infinitive. In the examples I mark the position of the understood subject with 'P', but this is only for presentational purposes.[8]

(3.19) a. Chrystale$_i$ claimed [that [P$_i$ smearing herself with mud] was fun].

b. Gonzo$_i$ said [that it was difficult [P$_i$ to satisfy himself]].

I have used reflexives in these examples to accentuate the anaphoric relationship between the matrix subject and the understood subject of the gerund or infinitive.

[7]While discussing the history of the ACC, I will continue to refer to the Intervention Constraint as this is what it was called in the literature cited.

[8]There is an apparent wrinkle in this data. It is not possible to assume that the understood subject is always a reflexive, due to examples like the following:

(i) Chrystale$_i$ claimed that smearing her$_i$ with mud was fun.

This sentence is grammatical, but it has the construal that someone other than Chrystale smeared mud on her. If the understood subject were a reflexive bound to *Chrystale*, this would result in a Principle B violation (the pronoun would be locally a-bound by the understood subject) and the sentence would not be possible. The fact that it is possible indicates that the understood subject in this sentence is in fact not a reflexive coindexed with *Chrystale*. In general, gerunds and infinitivals in subject position can optionally have arbitrarily referring (i.e. pronominal) understood subjects (Pollard and Sag, 1994: 297).

Grinder (1970), who was the first to discuss these constructions in detail, noticed that not all instances of Super Equi-NP are grammatical, as exemplified by the following sentences which are highly similar to those in (3.19).

(3.20) a. *Chrystale$_i$ claimed that Craig said [that [P$_i$ smearing herself with mud] was fun].

b. *Gonzo$_i$ said that Chrystale complained [that it was difficult [P$_i$ to satisfy himself]].

The ungrammaticality of these sentences — compared to those in (3.19) — stems from the inclusion of an NP closer to the anaphor with which it cannot agree. Similarly, if we were to change the anaphors in (3.20a) and (3.20b) to *himself* and *herself* respectively, the sentences would be grammatical, albeit with different construals. This led Grinder (1970: 302, (23)) to observe that Super Equi is subject to the following constraint:

(3.21) **The Intervention Constraint** (first version)
Super Equi-NP deletion between NP^a and NP^b is blocked if there exists a possible controller NP^c in the deletion path.

Since Grinder's analysis was transformational, he defined 'being on the deletion path' of two NPs as intervening between them (in terms of linear order) at the point that the deletion transformation applies.

Jacobson and Neubauer (1976) observed that the Intervention Constraint seems to hold for picture NPs, too:

(3.22) a. John thought that a picture of himself/herself[9] was given to Mary.

b. John thought that Mary was given a picture of *himself/herself.

(Jacobson and Neubauer, 1976: 435, (17a–b))

In sentence (3.22a), *John* can serve as the antecedent of *himself*, but in sentence (3.22b) this antecedent-anaphor relationship is blocked by the presence of the intervening NP *Mary*.

Pollard and Sag (1992, 1994) take the position that the IC is a "processing based factor that interacts with grammatical constraints in such a way as to render unacceptable a family of sentences that are otherwise grammatical" (1994: 269). However, they do not provide any evidence for the claim that the IC is a processing constraint. As such, it is just as reasonable to say that it is in fact a grammatical constraint. But there is also independent evidence for this. First, processing constraints can be overcome with practice or through the use of external representations (e.g. pencil and paper). For example, centre embeddings like the following are assumed to be grammatical but subject to processing constraints.

(3.23) The linguist the psychologist the cognitive scientist likes likes likes traces.

[9] Actually, I don't find this sentence grammatical with *herself*. However, these are the judgements given by Jacobson and Neubauer. I will discuss this case further below.

For most speakers of English (including linguists) this sentence is virtually undecipherable. However, it obeys the rules of English grammar and it is perfectly grammatical. In general, centre embeddings become easier with practice, and it is also much easier to decipher the sentence by writing it down and marking it up (I leave this as an exercise for the reader). However, IC violations do not become better with practice or with the use of external aids to work them out. Second, it may seem obvious, but processing constraints usually arise due to processing difficulties. Thus, (3.23) is especially difficult because the NPs have to be kept track of and then matched up with the corresponding predicate. Furthermore, the first NP does not correspond to the first verb, but rather the outermost one (hence the name centre embedding). However, I fail to see what the processing difficulty is in matching an anaphor with its antecedent in a sentence in which there *is* only one possible antecedent for the anaphor. Why should the sentence *John thought that Mary was given a picture of himself* be difficult to process when the only possible antecedent is *John* and the only other possible antecedent does not even agree with the anaphor? It seems trivially simple to tell what the antecedent is meant to be, but the sentence is ungrammatical anyway. The third reason for assuming that the IC is a grammatical constraint and not a processing constraint is that Jacobson and Neubauer (1976) use the IC as a diagnositc for determining whether rules are cyclic or postcyclic, after showing that the IC itself is cyclic. Even though models of grammar with cyclic rule application have now largely been abandoned, it is unheard of to use a processing constraint as a syntactic diagnostic. Furthermore, if the IC applies cyclically, it could not be a processing constraint, since processing constraints either apply postsyntactically or, at the very least, postcyclically. The choice in this matter depends on whether one assumes that syntax is autonomous and processing constraints apply to the output of the syntactic component, or that syntax is incrementally affected by processing constraints.

Thus, I take it that there is plenty of evidence for treating the IC as a grammatical constraint, and no evidence for treating it as a processing constraint. The fact that it is a grammatical constraint means that the IC should be formulable as a constraint in HPSG. Of course, Grinder's definition of the IC does not make sense in a nontransformational theory such as this. In terms that are more amenable to HPSG, the Intervention Constraint states that an exempt anaphor cannot skip over a potential binder in its clause to take a higher one. But, what exactly is meant by a potential binder? Minimally, in HPSG terms, this must be a *nominal-object*, since these are the only entities that enter into syntactic binding relations. Furthermore, the binder's INDEX must be of sort *referential*, since expletive subjects cannot be binders. This fact is reflected by the grammaticality of the following example.

(3.24) John said there was a picture of himself in yesterday's paper.

Although *there* intervenes between *John* and *himself*, it is not a potential binder, since its index is of sort *there*, not *referential*. Thus, the potential binder must meet the usual requirements on antecedents.

As the following examples illustrate, there also seems to be a kind of animacy requirement (Pollard and Sag, 1994: 268) for the intervening binder, and quantified (and expletive) intervenors also do not trigger the IC. The relevant potential intervenor is italicized in these examples.

(3.25) a. Bill$_i$ suspected that *the silence* meant that [a picture of himself$_i$] would soon be on the post office wall.

b. Bill$_i$ thought that *nothing* could make [a picture of himself$_i$ in the *Times*] acceptable to Sandy.

c. Bill$_i$ suspected that *there* would soon be [a picture of himself$_i$] on the post office wall.

d. Bill$_i$ knew that *it* would take [a picture of himself$_i$ with Gorbachev] to get Mary's attention.

(Pollard and Sag, 1994: 268, (87d), (88a,c,d))

As just mentioned, in the HPSG binding theory, it is not surprising that expletives are not intervenors, since they do not have *referential* indices and cannot normally be binders.

As far as quantifiers go, the animacy requirement covers the appropriate ones. For example, if we replace *nothing* in (3.25b) with *no one* or *everyone*, the quantifier is an intervenor:

(3.26) a. *Bill$_i$ thought that *no one* could make [a picture of himself$_i$ in the *Times*] acceptable to Sandy.

b. *Bill$_i$ thought that *everyone* could make [a picture of himself$_i$ in the *Times*] acceptable to Sandy.

It seems that the animacy requirement can be extended to quantifiers if it is understood to apply to their restriction. The quantifiers *no one* and *every one* have restrictions that refer to people and hence count as animate. On the other hand, *nothing* is restricted to quantify over things, which are not necessarily animate. In fact, according to standard HPSG, the quantified NP inherits the CONTEXT information of the noun (Pollard and Sag, 1994: 333), resulting in the quantified NP being marked for animacy like other NPs.

Thus, we can conclude that the Intervention Constraint should only apply if the intervening noun phrase a) satisfies normal conditions on antecedents (i.e. it is a *nominal-object* with a *referential* index), and b) is animate. In normal English, we could formulate the HPSG-friendly IC as follows:

(3.27) **The Intervention Constraint** (second version)
No potential binder may intervene between an anaphor and its antecedent. A potential binder is an animate, referential nominal.

This formulation is pretty good, except that the notion of intervention must be made a little more precise still.

In fact, the IC must be restated such that the relative order of potential binders that are on the same ARG-ST list does not matter, as the following sentence illustrates.

(3.28) a. John told Mary that some compromising pictures of himself are available online.

b. John heard from Mary that some compromising pictures of himself are available online.

If *Mary* in sentences (3.28a) and (3.28b) were an intervening potential binder, we would expect the sentences to be ungrammatical. The fact that they are grammatical indicates that the IC is not in force here. Sentence (3.28b) also illustrates that point of view is not in effect here, as the point of view reported is Mary's, but the anaphor is still grammatical.

We can now reformulate the Intervention Constraint appropriately.

(3.29) **The Intervention Constraint** (third version)
No potential binder may intervene between an anaphor and its antecedent. A potential binder is an animate, referential nominal that is not a coargument of the antecedent.

Now that the informal version of the IC is in place, I will reformulate it as a constraint in HPSG. But, since my constraint is based on closeness of an antecedent and not intervention, I will call it the Antecedent Closeness Constraint instead. It will be comparable to the other binding constraints we've been looking at. However, because the ACC needs to refer to a-command, which is defined recursively, the ACC itself cannot be formulated as a feature constraint directly; only instances of structures that do or do not satisfy the ACC can be given as feature structure constraints.

(3.30) **The Antecedent Closeness Constraint**
If an anaphor Z has one or more close potential antecedents,
then there is a close potential antecedent Y, such that
$Y\begin{bmatrix}\text{INDEX} & \boxed{1}\end{bmatrix}$ and $Z\begin{bmatrix}\text{INDEX} & \boxed{1}\end{bmatrix}$.

(3.31) **Definition of Close Potential Antecedent**[10] (CPA)
Y is a close potential antecedent of Z if and only if

a. Y a-commands Z; and

[10]In this definition, nothing guarantees that Z is of type *anaphor*. Thus, any argument can have a close potential antecedent. However, the ACC itself refers to Z being an anaphor. This makes the notion of CPAs general and extensible to other phenomena should further work motivate this.

b. There is no X such that

i. Y nonlocally a-commands X; and

ii. X a-commands Z; and

iii. X
$$\begin{bmatrix} \text{LOC} & \begin{bmatrix} \text{CONT} \mid \text{INDEX} & \boxed{1} \\ \text{CONX} & \begin{bmatrix} \text{BACKGROUND} & \left\{ \begin{bmatrix} \textit{animate\_rel} \\ \text{INSTANCE} & \boxed{1} \end{bmatrix} \right\} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Although there is something like intervention in the definition of close potential antecedent, the ACC itself does not really mention intervention. In fact, it guarantees that an anaphor selects a close potential antecedent, rather than ruling out derivations that display bindings that cross a potential antecedent, as the literature on IC originally intended. In this sense, closeness applies more generally than intervention. Since intervention is a ternary relation (i.e. it only makes sense to talk about something intervening between two other things), if there is a situation that only involves two objects, intervention is undefined. However, closeness is only binary, which means that this notion applies so long as there are at least two things. The importance of this distinction will become obvious shortly.

Furthermore, the ACC only gives positive conditions. There is no mention of ungrammaticality. That is, a literal feature structure translation of the English formulation of the IC would show the intervening binder between the anaphor and an (illicit) antecedent and then mark the structure as ungrammatical (*). However, such a representation would be highly ambiguous. By marking the whole structure as ungrammatical, we would fail to specify what *part* of it is the source of the ungrammaticality. Any of the pieces of information in the structure could be leading to the ungrammaticality, but we wish to specify that it is the intervening binder that is the culprit. Furthermore, it is not possible to put the ungrammaticality marker on anything within the feature structure, like so:

(3.32)
$$\begin{bmatrix} \text{BACKGROUND} & {}^{*}\left\{ \begin{bmatrix} \textit{animate\_rel} \\ \text{INSTANCE} & \boxed{1} \end{bmatrix} \right\} \end{bmatrix}$$

This kind of representation is simply undefined in HPSG. There is no definition of star within an AVM. Of course, it would be possible to treat it as a convention, similarly to the star outside the entire feature structure, which is not defined in the theory either. However, this would still leave us with an idiosyncratic constraint that doesn't pattern like related binding constraints or any other constraint in HPSG. In fact, stating that an anaphor must be bound by its closest binder and stating that no potential binder may intervene between an anaphor and its actual binder amount to the same thing. Therefore, the constraint as formulated here will cover the correct intervention cases, as shown shortly.

It may seem at first that the ACC and Principle A interfere with each other, since they both apply to the same type (*anaphor*). While it true that in local a-command situations the two constraints are partially redundant, they require the same thing with regard to the INDEX of the anaphor, and there is therefore no problem. A couple of examples will show this more clearly.

(3.33) a. Gonzo spoke to Julie about himself.

b. Gonzo spoke to Craig about himself.

c. *spoke*: ARG-ST ⟨NP, PP[*to*], PP[*about*]⟩

According to the definitions in (3.30–3.31), both *Gonzo* and *Julie* in (3.33a) qualify as CPAs for the anaphor *himself*.[11] However, the ACC only requires that there be one CPA that structure shares its INDEX with that of the anaphor. The CPA *Gonzo* can satisfy the ACC with this re-entrancy. On the other hand, *Julie*, although it is a CPA, cannot structure share its INDEX with the INDEX of *himself* due to unification failure on the GENDER index feature. Therefore, the derivation with *Julie* as the antecedent of *himself* is blocked. Similarly, although *Julie* is a potential local a-binder for Principle A, the INDEX unification fails. But, Principle A can still be satisfied on the *Gonzo* indexation. It turns out, then, that the ACC and Principle A make the exact same demands for (3.33a).

The second case, (3.33c), is slightly different. According to Principle A, the anaphor must structure share its INDEX value with the INDEX of *Gonzo* or that of *Craig*. The INDEX of the anaphor must be re-entrant with that of the antecedent and this requirement can be satisfied on either coindexation. The ACC also requires that the anaphor be coindexed with either *Gonzo* or *Craig*, since these are both CPAs. However, only when the anaphor is coindexed with either *Gonzo* or *Craig* by *both* Principle A and the ACC is the sentence grammatical. For example, if Principle A requires coindexation of the anaphor with *Gonzo* and the ACC requires coindexation of the anaphor with *Craig*, there will be a three way coindexation. However, any three way coindexation will be ruled out by Principle C, since *Gonzo* would a-bind *Craig*. Thus, any cases of potential conflict between Principle A and the ACC are filtered out.

A bad consequence of this is that there is some redundancy in the grammar. For reasons of elegance and economy, it is better to eliminate redundancy if possible. This would mean reducing one of these two constraints to the other. However, as things stand now, this will not work. The ACC cannot be reduced to Principle A, because the application of the latter is much more restricted than that of the former. Principle A applies only to coargument anaphora, whereas the ACC applies to all anaphora. Likewise, it is not possible to reduce Principle A to the ACC, because then sentences like the following would be deemed grammatical.

(3.34) *Andrew said the rain soaked himself.

[11] These PPs are analyzed as case-marking PPs (Pollard and Sag, 1994: 264). Recall from section 2.2.1 that such PPs inherit the index of their NP.

According to the ACC and the definition of CPAs, *the rain* does not block *Andrew* from being a CPA for the reflexive. With no other constraint (i.e. Principle A) in force, the grammar would predict that this sentence is grammatical. This does not entail that the these two constraints cannot ultimately be collapsed, but I will leave this as a potential avenue for further work.

Now I will demonstrate application of the ACC where Principle A does not apply — in cases of exempt anaphora. In the following sentence, the ACC stipulates that the anaphor contained in the picture NP is coindexed with *Chrystale*, because *Chrystale* is a close potential antecedent, since it a-commands the reflexive[12] and there is no intervening a-commander that meets the requirements outlined in the second clause of the definition of close potential antecedent. In fact, in this case there is no X that is closer than *Chrystale* at all, as shown by the ARG-ST lists in (3.35b).

(3.35) a. Chrystale$_i$ likes photos of herself$_i$.

b. *likes*: ARG-ST $\langle$NP[*Chrystale*]$_i$, NP[*photos of herself*$_i$]$\rangle$
photos: ARG-ST $\langle$PP[*of herself*]$_i$$\rangle$

The lexical entry for the anaphor guarantees that it must unify with its antecedent on the agreement features in INDEX, which it does in this case. And, as desired, if we were to replace *Chrystale* with *Andrew* or any other non-female NP, such as the pronoun *it* used to refer to, say, a pet fish, the corresponding sentences would be ruled out, due to this same agreement requirement.

This also entails that an example Jacobson and Neubauer (1976) judged as grammatical is deemed to be ungrammatical by the ACC. This example was presented in (3.22a) above, but I repeat it here for convenience.

(3.36) *John thought that a picture of herself was given to Mary.

The only CPA in this sentence is *John*. However, *herself* cannot be coindexed with *John* due to unification failure for the feature GENDER. I have checked this sentence with informants, who have uniformly judged it to be bad. In fact, for me it forces the construal that John is female. This is more obvious when a gender-neutral name or description is used instead.

(3.37) a. Kim thought that a picture of herself was given to Mary.

b. The professor thought that a picture of herself was given to Mary.

These sentences are fine, but both have a construal that the higher subject is female, which indicates that the reflexive is binding to this NP.

[12] *Chrystale* a-commands the picture NP by a-command clause (i). The reflexive's index is structure shared with the case-marking PP[*of*], which is on the ARG-ST of the picture NP. By an application of a-command clause (ii), it follows that *Chrystale* a-commands the reflexive, since *Chrystale* a-commands something that subcategorizes for the reflexive.

Examples (3.35–3.37) illustrate that the ACC as formulated here applies whenever there is sufficient locality, even if there is no intervention. Thus, if the notion of 'closeness' as formulated above is used, the ACC applies to cases like these. However, if intervention were specifically mentioned, these cases would not be covered, because the antecedent does not intervene between the reflexive and anything else, since there is no other potential antecedent between the actual antecedent and the reflexive.

In this section I have formulated the Antecedent Closeness Constraint as a further constraint on the anaphor-antecedent relationship. The ACC requires anaphors to be coindexed with a close potential antecedent, as defined in (3.31). The CPA must be referential, as required by the definition of a-command. Furthermore, in simple sentences like *Chrystale likes photos of herself*, the ACC predicts, as is the case, that the reflexive is bound by the next higher NP. However, if there is another closer but inanimate potential antecedent, the ACC does not force coindexation with the inanimate argument. Thus, unlike GB's Principle A, my constraints for anaphors, the HPSG Principle A and the ACC, do not undergenerate by predicting binding with the closest antecedent in all cases. In this manner, the ACC covers the cases discussed in Pollard and Sag (1992, 1994) as exempt anaphors. This will be more obvious in the next section, where I illustrate in more detail the coverage of the ACC with respect to exempt anaphora.

3.4 Coverage of the Extended Binding Theory

There are four major cases of exempt anaphora to cover. Three of these, picture NPs, specifiers of NPs, and controlled complements were briefly outlined in section 2.4. The fourth, Super Equi-NP deletion, has just been added. It is clear that control and Super Equi are related phenomena, and this relationship will be made evident by the role the ACC plays in control, which is similar to its role in Super Equi. But, I will leave the discussion of the ACC and control until the next chapter, which deals with control theory. For now, though, I will demonstrate how the ACC gets the correct results for instances of Super Equi, picture NPs, and specifiers.

3.4.1 Super Equi-NP Deletion

The original motivation for the Antecedent Closeness Constraint was Super Equi-NP deletion. First I will examine examples that are predicted to be grammatical by the Antecedent Closeness Constraint and show how these work. Sentences (3.38a) and (3.38b) appeared as (3.19a) and (3.19b) in the discussion of Super Equi-NP deletion at the beginning of section 3.3.

(3.38) a. Chrystale$_i$ claimed [that [P$_i$ smearing herself with mud] was fun].

b. Gonzo$_i$ said [that it was difficult [P$_i$ to satisfy himself]].

c. John$_i$ thought [that it was likely [to be illegal [P$_i$ to undress himself]]].

d. Mary$_i$ knew [that there would be no particular problem in [P$_i$ getting herself a job]].

e. John$_i$ thought [that Proposition 91 made [P$_i$ undressing himself] illegal].

(Pollard and Sag, 1994: 269, (91b–c), (92a))

In sentence (3.38a), the understood subject on the ARG-ST of *smearing* is exempt, since it is not locally a-commanded. The CPA of the understood subject is *Chrystale* and the ACC correctly predicts that *Chrystale* must be the antecedent of P$_i$ and these arguments are coindexed. The situation in (3.38b) is similar, except that the CPA of *himself* is *Gonzo*. Expletive *it* cannot serve as a CPA, due to not having a *referential* index — and thus not being an a-commander — and it therefore also fails to block *Gonzo* being a CPA. Sentence (3.38c) gives another example of an expletive *it* not serving as a CPA, but the sentence also illustrates that the CPA can be a longer distance away, over a raising predicate. In example (3.38d), the matrix subject is again the CPA of the understood gerund subject, because the closer NP is an expletive *there*, with an index of type *there*, which is not *referential*.

Example (3.38e) is the most crucial example. In this example, both *John* and *Proposition 91* are CPAs. The latter is a CPA because a) it a-commands the understood subject P, and b) there is no X such that i) *Proposition 91* nonlocally a-commands X, ii) X a-commands P, and iii) X is animate. This predicts that *Proposition 91* could be the antecedent of P (assuming the reflexive were changed to *itself*), but I presume that in this case this reading is out due to pragmatics. However, *John* is also a CPA: *John* a-commands the P, and there is no X that satisfies the conditions just mentioned. Although *Proposition 91* is nonlocally a-commanded by *John* and a-commands P, it is inanimate and therefore fails to block *John* as a CPA. This example illustrates that inanimate NPs can still be close potential antecedents, but they let the next higher NP be a CPA as well. If the next higher NP is inanimate, then this NP again lets the next higher NP be a CPA, and so forth. This predicts that sentences like the following are grammatical.

(3.39) Gonzo$_i$ moaned that the records showed that Proposition 91 made [[P$_i$ undressing himself in public] illegal].

Indeed, this sentence is perfectly fine, although a bit long.

In fact it is possible to construct situations in which the closer, inanimate argument can be a CPA, while allowing a higher argument to be a CPA, and in which both CPAs are pragmatically possible binders.

(3.40) a. John teaches “embodied cognitive logic”. He claims [a good formal logic]$_i$ should make [P$_i$ describing itself easy].

b. John teaches “embodied cognitive logic”. He$_i$ claims a good formal logic should make [P$_i$ describing himself easy].

Of course, it's a stretch to think of cases where inanimate things can be the subjects of causatives as well as the subject of the causative complement, but sentence (3.40a) illustrates that, insofar as this is possible, an inanimate NP can serve as a CPA. And it does this without blocking binding by the animate, pronominal subject of *claims*, allowing the coindexation in (3.40b). Thus, the ACC makes correct, if delicate, predictions about possible antecedent-anaphor relationships for exempt anaphors.

Next I turn to cases that are ruled out by the ACC.

(3.41) a. *Chrystale$_i$ claimed that Craigze said that [[P$_i$ smearing herself with mud] was fun].

b. *Gonzo$_i$ said that Chrystale complained that [it was difficult [P$_i$ to satisfy himself].

c. *John thought that Mary was surprised by [the fact that [P$_i$ criticizing himself was hard]]. (Jacobson and Neubauer, 1976: 435, (15b))

In sentence (3.41a) *Chrystale* cannot be a CPA according to the definition in (3.31), since *Craig* is nonlocally a-commanded by *Chrystale* while simultaneously being animate and a-commanding P. In fact, the CPA for the understood subject is *Craig* and the ACC requires that the INDEX of *Craig* and the INDEX of the understood subject be re-entrant; therefore, P is actually coindexed with *Craig* and the sentence is out due to unification failure on the GENDER feature of the Super Equi target and that of the reflexive *herself*. However, since *Craig* is coindexed with P, a pronoun *her* that is anaphoric (in the discourse sense) on *Chrystale* would yield a grammatical sentence. A similar scenario obtains in (3.41b), except that the CPA is one clause further removed, since *it* cannot be a potential antecedent. Likewise, sentence (3.41c) is out for the same reasons as (3.41a), but the CPA *Mary* is further removed in the structure from the understood subject of *criticizing*. However, *Mary* is still the only CPA, and thus must be coindexed with P.

3.4.2 Picture NPs

With respect to picture NPs, Principle A and the ACC predict that the sentences in (3.42) are grammatical.

(3.42) a. Simon likes himself.

b. Daisy likes photos of herself.

c. Simon said Gonzo$_i$ likes photos of himself$_i$.

d. Elvis said there should be pictures of himself for sale at Graceland.

e. Gonzo was sure that the delay indicated that a picture of himself was coming through on the fax.

f. Andrew hoped that something would prevent a picture of himself in the *Real Estate Guide* from being seen by his friends.

Sentence (3.42a) is grammatical because it satisfies the constraints for Principle A and the ACC. On the other hand, since the anaphor in (3.42b) is not locally a-commanded, it is exempt from Principle A. But, it is subject to and satisfies the ACC. Like sentence (3.35) above, *Daisy* is the close potential antecedent for *herself* and there are no agreement problems, so the INDEX of *Daisy* and the INDEX of *herself* are structure shared. Similarly, sentence (3.42c) satisfies the ACC on the construal indicated, since the reflexive is coindexed with its close potential antecedent, *Gonzo*. The only CPA in (3.42d) is *Elvis*, since the expletive *there* is not a CPA and also does not block a higher argument from being a CPA. In sentences (3.42e) and (3.42f), *the delay*, and *something* respectively don't meet the animacy requirement in the ACC. Assuming that nominals have an appropriate marking of the relation *animate* in their lexical entries, the lexical entries for *the delay* and *something* would have the following information in their CONTEXT|BACKGROUND set.[13]

(3.43) $\begin{bmatrix} \textit{non-animate\_rel} & \\ \text{INSTANCE} & \textit{index} \end{bmatrix}$

Therefore, sentences (3.42e) and (3.42f) would fail to unify with the constraint on X in the third clause of the CPA definition, (3.31), due to conflicting background information. This has the result that the first CPA in these sentences is *Gonzo* and *Andrew* respectively.

Now I will turn to the sentences in (3.44), which are predicted by Principle A and the ACC to be ungrammatical.

(3.44) a. *Simon hurt herself.

b. *Gonzo said Chrystale sent a photo of himself to *Strange Goatee Digest*.

c. *Simon$_i$ said Gonzo likes photos of himself$_i$.

Sentence (3.44a) is a straightforward Principle A violation.[14] Although it satisfies the antecedent of Principle A, the consequent requires structure sharing of the antecedent and anaphor's INDEX values and this fails due to unification failure on the feature GEND. Sentence (3.44b) is also ruled out due to a gender mismatch, but this time by the Antecedent Closeness Constraint. The close potential antecedent of *himself* is *Chrystale*, but there is unification failure due to the agreement features on the indices. *Gonzo* is not a close potential antecedent, since there is an X, *Chrystale*, that fulfills the blocking conditions in (3.31). Sentence (3.44c) would be ruled out by Principle C. The ACC requires coindexation between the reflexive and *Gonzo*; if *Simon* is also coindexed with the reflexive, *Simon* will a-bind *Gonzo*.

3.4.3 Specifiers

The last major case of exempt anaphora, other than subjects of controlled complements which I discuss in the next chapter, are anaphors in specifier position. In English, this is restricted to

[13]The *index* value on INSTANCE would be structure shared with the nominal's CONT|INDEX value.

[14]It also violates the ACC, due to the redundancy between these constraints. See the discussion in section 3.3.

reciprocals. The ACC makes the correct predictions about the following sentences.

(3.45) a. [John and Mary]$_i$ knew that [the journal had rejected [each other's]$_i$ papers].

b. *[Hank and Peggy]$_i$ said that [Bobby ate [each other's]$_i$ apple brown betty].

c. [Hank and Peggy]$_i$ said that [[Bobby and Khannie]$_j$ like [each other's]$_{*i/j}$ wrestling moves].

In (3.45a) *the journal* refers to a publication, which is clearly inanimate. This means that both *John and Mary* and *the journal* are CPAs (since *the journal* is not animate it does not block the higher NP being a CPA). However, *the journal*'s index cannot be unified with the index of *each other's*, leaving only the higher NP as a CPA. The ACC is satisfied by coindexing this NP with the reciprocal. Example (3.45b) illustrates that an animate CPA prevents the higher NP from being a CPA, even if it cannot satisfy the ACC. This is directly predicted by the ACC, due to the definition of close potential antecedent. Since *Bobby* fulfills the condition on blocking in (3.31), *Hank and Peggy* is not a CPA. Therefore the sentence is ungrammatical, due to unification failure on the NUMBER feature of *Bobby* and *each other*'s indices. The last example shows that an animate CPA with the right index features (i.e. plural number), binds the reciprocal and prevents the higher NP from binding the reciprocal. Thus, the ACC gets the correct grammaticality results for these reciprocal cases as well.

3.5 Residual Problems

There are two cases which the theory I have developed here, and equally the standard versions of HPSG binding, do not have satisfactory accounts for. The first case is that of PPs which are headed by semantically non-null prepositions. The second case has to do with coordination and split antecedents.

3.5.1 Semantic and Predicative Prepositions

So far, the prepositional phrases discussed have been instances headed by 'case-marking' prepositions. These are prepositions that are used by certain verbs to mark their complements, but that don't have a strong semantic contribution. Due to the lack of semantic content, these PPs are analyzed in HPSG as taking the CONTENT value of their NP, which means they also get the index of the NP.

However, there are clear cases of prepositions that do have semantic content, typically temporal or spatial information. Here are some examples:

(3.46) a. Gonzo put the remote [$_{PP}$ on the TV].

b. Craig arrived [$_{PP}$ before Chrystale].

c. Andrew pulled the blanket [$_{PP}$ over himself].

When a preposition has semantic content, it must contribute this content to any higher phrases that include it. Therefore, it cannot simply take on the CONTENT value of its noun phrase.

It has been observed in the literature[15] for some time now that these semantic PPs provide another case where the complementarity between anaphors and pronouns breaks down.

(3.47) a. Gonzo$_i$ placed little flags near him$_i$.

b. Gonzo$_i$ placed little flags near himself$_i$.

c. [Gonzo and Andrew]$_i$ placed [little flags]$_j$ near each other$_{i/j}$.

d. [Gonzo and Andrew]$_i$ placed [little flags]$_j$ near them$_{?i/*j}$.

e. [Gonzo and Andrew]$_i$ placed [little flags]$_j$ near themselves$_{i/\#j}$.

The examples cited in the literature (e.g. Kuno 1987; Reinhart and Reuland 1993) are invariably like (3.47a) and (3.47b). For Government and Binding theory, it is the pronominal example in (3.47a) that is surprising, since the pronoun *him* is c-commanded by *Gonzo* and bound in its local domain.

In HPSG, the differences are reconcilable, but not in a particularly satisfying manner. The argument structure for the preposition *near* can either be one-place or two-place. The argument that is always present is the internal complement.

(3.48) a. *near*: ARG-ST ⟨NP⟩

b. *near*: ARG-ST ⟨NP, NP⟩

If the one place argument structure is chosen, the pronoun is locally a-free, which predicts the grammaticality of (3.47a). Similarly, an anaphor would be exempt from Principle A (but not from the ACC).

However, assigning these prepositions a one-place argument structure makes two incorrect predictions. First, assuming a canonical linking between argument structure and the valence lists, it predicts that the external argument of the preposition can be dropped. But this always leads to clear ungrammaticality (e.g. **Gonzo placed near him*). An exponent of this idea may say that the external argument is on the valence list of the PP, but not on its ARG-ST list. This makes the wrong predictions, though, since in actual fact the *internal* argument is the one that can be dropped on occasion.

(3.49) a. With hurricane Andrew near, everybody was starting to panic.

b. *With near Miami, everybody was starting to panic.

Furthermore, the proposal for a mismatch between such prepositions' ARG-ST and valence lists should be rejected on theoretical grounds, since it makes a total farce out of the idea of argument structure: if this is meant to be a linking level between semantics and syntax, then *all*

[15] See Kuno 1987 for a particularly thorough review and for further references.

arguments, whether syntactic or semantic, must be on the ARG-ST. If expletive pronouns are on the ARG-ST (Manning, 1996), then surely full NPs are, too.

The second wrong prediction is that the external argument is irrelevant to the argument structure of the preposition. But this is nonsense, since these prepositions are clearly relational (i.e. *near* is a relation between two things). Furthermore, these prepositions can be used predicatively, as illustrated in (3.49a) and in (3.50):

(3.50) a. With hurricane Andrew near Miami, everybody was starting to panic.

b. Hurricane Andrew was near Miami, and everybody was starting to panic.

To be predicative, the PP has to be predicated *of* something.

Therefore, empirical and theoretical considerations point to choosing the two-place argument structure in (3.48b) as the correct one for such PPs. Notice that this does not mean that the external argument of the preposition is not an argument of the verb. Rather it means that there is argument sharing, analogous to control. This means that HPSG binding theory predicts the pronoun to be grammatical, but the anaphors to be ungrammatical, since they are locally a-commanded but not locally a-bound (a Principle A violation). This is exactly the opposite prediction to GB's.

The data becomes even trickier when we consider plural pronouns and anaphors (3.47c–e), which to my knowledge has not been done in the literature.[16] The first puzzle is why the pronoun *them* in (3.47d) is worse than its singular counterpart and its reflexive counterpart in (3.47e). It could be attributed to some sort of intervention effect of the plural, since a nonplural intervenor makes the sentence better:

(3.51) Gonzo and Andrew placed the little flag near them.

But, this offers no explanation for the lack of the blocking effect for the similarly plural (3.47c) and (3.47e).

Likewise, the fact that the anaphoric reciprocal and plural reflexive can be bound to either the matrix subject or the external argument of the PP poses a serious difficulty for both HPSG and GB's binding theories. Furthermore, this is not a peculiarity of the reciprocal or of plurality, since singular reflexives can exhibit the same behaviour.

(3.52) Gonzo$_i$ folded the blanket$_j$ over himself$_i$/itself$_j$/*it$_j$.

For an HPSG analysis, for example, this entails that the PP argument structures cannot be dealt with as just exceptions to Principle A, as there are instances where they are not exceptions after all.

One possible solution would be to make the stipulation that a reflexive or reciprocal complement of a semantic preposition must be a-bound, rather than locally a-bound. This would

[16]For instance, Kuno (1987), which is a book all about exceptions to generative binding theories, does not have a single mention of plurals or plurality in its otherwise extensive index.

mean that the anaphor in question could either take its local a-commander (the external argument of the PP) or a higher a-commander (such as the matrix subject). In this sense, these anaphors would not be the mirror image of Principle B, but rather would be instances of Principle Z. As it stands, this analysis is independently unmotivated, though.

Lastly, I turn to the consequences of this data for the Antecedent Closeness Constraint. If the PP is taken to be two-place in its argument structure, as I've argued that it should be, and if the external argument is shared with the verb, the ARG-ST for the sentences in (3.47) will be like this:

(3.53) *placed*: ARG-ST $\langle$NP, $\boxed{1}$NP, PP[ARG-ST $\langle\boxed{1}$, NP$\rangle$]$\rangle$

Recall that Y is a CPA for Z if there is no X such that i) Y nonlocally a-commands X, ii) X a-commands Z, and iii) X is animate. Therefore, the ACC predicts that the matrix subject can only be a CPA if the external argument of the preposition is inanimate, since the matrix subject nonlocally a-commands the PP's external argument.

This prediction is partly borne out by the data:

(3.54) a. Bill$_i$ placed his guard$_j$ near himself$_{?i/\#j}$.

b. Bill$_i$ placed his guard$_j$ near him$_{i/*j}$.

(3.55) a. Bill$_i$ placed his phone$_j$ near himself$_i$.

b. Bill$_i$ placed his phone$_j$ near him$_i$.

In (3.54a), there is a weird interpretation that Bill placed his guard near his guard. However, this is also the strongest interpretation, which results in the sentence being anomalous. Yet I do not find (3.54a) completely bad; yet, it is certainly worse than the clearly inanimate case in (3.55). It is not clear that this prediction matters, though, since I still assume the HPSG Principle A, which gets the wrong results anyway.

In this section I have demonstrated the problems that semantic and predicative PPs present for binding theory. Both GB's and HPSG's binding theories make wrong predictions for this data. GB predicts that the pronoun should be ungrammatical and the anaphor grammatical, while HPSG makes the opposite prediction. Furthermore, I showed that there are cases, both plural and singular, where an anaphor can bind optionally to either the matrix subject or the external argument of the PP. The plural cases pose a further puzzle, since a plural pronoun is markedly worse than either a reciprocal or a reflexive. Lastly, I showed that the ACC makes some sort of contribution here, but it is not clear that animate intervenors completely block CPA transfer to the higher NP. Thus, much more work has to be done in HPSG on the argument structure of prepositions and their interaction with binding theory.

3.5.2 Split Antecedents and Coordinated NPs

The second and last problematic phenomenon that I will discuss essentially has to do with coordination and plurality. Again, I do not have a solution to this problem, but I do think that it has to be dealt with eventually.

Pollard and Sag (1994: 245, (17h–k)) give the following sentences as proof of why the notion of exempt anaphora is useful.

(3.56) a. Iran$_i$ agreed with Iraq$_j$ that [each other's]$_k$ shipping rights must be respected. (k = Iran and Iraq)

b. John$_i$ told Mary$_i$ that there were some pictures of themselves$_k$ inside. (k = John and Mary)

c. John$_i$ asked Mary$_i$ to send reminders about the meeting to everyone on the distribution list except themselves$_k$. (k = John and Mary)

However, the ACC (incorrectly) predicts that the first two sentences are ungrammatical. In each case, only one of the higher NPs (i.e. the arguments of *agreed* and *told*) would be selected as a CPA and there would be unification failure on the NUMBER feature.

In fact, this is a more general problem than Pollard and Sag claim, since it is not just a phenomenon restricted to exempt anaphora:

(3.57) a. John told Mary to nominate themselves for the two top spots.

b. John asked Mary to get themselves invited to Bill's party.

Therefore, the problem of split antecedents is not just a problem for the theory here, but also for the standard HSPG binding theory. Of course, this doesn't explain the phenomenon, but it does show that this is not a parochial weakness of my theory and that binding theory has to work better with the notion of plurality.

A similar problem is caused by coordinated NPs (Reinhart and Reuland, 1993). In object position, coordinated NPs seem to be transparent to binding, whereas in subject position they are not.

(3.58) a. John and Mary sent *himself/*herself/*him/*her/themselves the e-mail as well.

b. Mary sent John and herself/*her the e-mail.

I take the problem with split antecedents and the problem with coordinated NPs to be opposite aspects of an overarching problem with plural binding.

Thus, a more mature binding theory will hopefully one day be able to deal with the properties of split and coordinated NPs. However, for the moment I can offer no concrete solution to these cases.

3.6 Conclusion

In this chapter, I have outline an extended binding theory. The core of the theory comprises a simplified version of the binding theory presented in Pollard and Sag (1994), along with a principle (Z) for dealing with long distance anaphors. The extension to this core came in the form of the Antecedent Closeness Constraint. I argued that the ACC is indeed a grammatical constraint and its adoption explains certain binding facts about exempt anaphora for which Pollard and Sag (1994) offered no analysis. Lastly, I discussed some problems which binding theory will eventually have to address.

In the next chapter, I will revise HPSG's control theory, which is now problematic in its old formulation, due to being defined on the level of argument structure and the changes that have been made to this level in recent work. The final role of the ACC – to ensure locality of control – will also become apparent in the next chapter.

Chapter 4

A Revised Control Theory

4.1 Introduction

In this chapter I will present my final revisions to the theory of control. First, I will discuss certain problems with control theory in HPSG. Some of these problems are residues of the original control theory presented in Pollard and Sag (1994); that is, there were certain problems with that theory that were acknowledged by the authors but never adequately resolved. Other problems arise from recent work in HPSG which follows Manning (1996) in allowing argument structure lists to be nested. The control theory that I present in section 4.5 provides solutions to the problems discussed in the following sections. But first I will briefly review the version of control theory that I am criticizing.

I presented the HPSG control theory in chapter 2. The third version, presented in section 2.5.1, was formulated to work on ARG-ST lists following arguments and suggestions by Manning (1996) and also assumed that ARG-ST is a head feature and thus passed from the head daughter to the mother via the Head Feature Principle. Here is that version of the HPSG control theory again, for convenience.

(4.1) **Control Theory** (third version)

If the CONTENT of an unsaturated phrase is the SOA-ARG in a psoa whose relation is a control relation, then the maximum a-subject of the phrase is
(i) reflexive; and
(ii) coindexed with the INFLUENCED, COMMITTOR, or EXPERIENCER value in that psoa, according as the control relation is of sort *influence*, *commitment*, or *orientation*, respectively.

In the next two sections I will discuss inadequacies of this control theory in dealing with Visser's generalization, which is a putative language universal. First I will show how this control theory inherits certain problems with respect to Visser's generalization that stem from the control theory in Pollard and Sag (1994); then I will show how recent revisions to the representation of argument structure lists create further problems.

4.2 Old Problems

The phenomenon commonly known as Visser's generalization was discussed extensively in Bresnan (1982: 401ff.) and is presented here:[1]

(4.2) **Visser's Generalization**
Subject control verbs cannot be passivized.

The contrast in (4.3) is an example of the predicted asymmetry between object and subject control passives.

(4.3) a. Gonzo was prompted to kneel (by Craig).
b. *Craig was promised to kneel (by Gonzo).

In Pollard and Sag (1994), Visser's generalization follows directly from the theories of binding and control. However, there were two problems that I will discuss shortly.

First, though, I will discuss how they derived Visser's generalization. They assumed that the passive is produced by a lexical rule that permutes SUBCAT lists such that the active subject is optionally appended to the end of the list in a prepositional *by*-phrase. This also has the result that the active object becomes the passive subject and that the *by*-phrase, if there is one, is the most oblique argument.[2] As the SUBCAT list is equivalent to the valence lists and ARG-ST lists are canonically the append of the valence lists, the ARG-ST for a passivization of *promise* would be like the following:

(4.4) *promise* (passive): ARG-ST ⟨NP, VP[ARG-ST ⟨NP:*refl*⟩], PP[*by*]⟩

Recall that Pollard and Sag (1994) assumed an extended definition of local o-command, which is equivalent to extended local a-command once binding is defined on ARG-ST instead

[1]According to Bresnan, Visser's generalization accounts for other related phenomenon, such as the ungrammaticality of (ii).

(i) Chantal struck Gonzo as dumb.

(ii) *Gonzo was struck by Chantal as dumb.

However, Pollard and Sag (1994: 307) attribute this to *strike* being a subject raising verb. The unpassivizability is then due to the fact that it fails to assign a semantic role to its subject. So, I will only talk about Visser's generalization with respect to subject control verbs. It is important to point out that this generalization is meant to predict a regular crosslinguistic phenomenon, because its application in control is quite limited in English, since there are very few common subject control verb with an object as well and only objects may be passivized in English. The main examples are *promise* and *threaten*.

[2]Following Manning and Sag (1999), I will refer to the NP in the *by*-phrase as either the agent argument or the logical subject (the latter term is attributed to Jespersen 1924). Since the PP containing the logical subject is headed by a case-marking preposition and therefore inherits the INDEX value of the logical subject, I will also sometimes refer to the PP as the agent or logical subject.

of SUBCAT.[3] Accordingly, the reflexive understood subject of the controlled VP is locally a-commanded by the NP that precedes the VP on the ARG-ST list and the reflexive must therefore be a-bound by this NP, due to Principle A. However, control theory requires the controlled subject to be coindexed with the logical subject, since it is still the COMMITTOR. The PP inherits the index of the logical subject and the resulting argument structure with coindexation indicated is:

(4.5) *promise* (passive): ARG-ST $\langle$NP$_i$, VP[ARG-ST $\langle$NP:*refl*$_i\rangle$], PP[*by*]$_i\rangle$

This coindexation makes the following predictions about grammaticality for these example sentences:

(4.6) a. *Kim$_i$ was promised to leave by Sandy$_i$/Kim$_i$

b. *John$_i$ was promised to leave by him$_i$

c. John$_i$ was promised to leave by himself$_i$.

(Pollard and Sag, 1994: 305, (78a–c))

Any *nominal-object* of type *npro* or *ppro* (i.e. a nonpronoun or a syntactically nonanaphoric pronoun) is disallowed in the *by*-phrase. Due to the coindexation that results, these types of nominal will always result in a Principle C or B violation, since NP$_i$ locally a-binds PP[*by*]$_i$. By contrast, a reflexive in the *by*-phrase is predicted to be grammatical, since it is locally a-commanded and locally a-bound, thus satisfying Principle A.

But example (4.6c) is clearly ungrammatical. The question is whether the ungrammaticality is specific to subject control verbs, in which case a good control theory should predict it, or whether the ungrammaticality is something general about passives, in which case control theory does not have to independently mark the ungrammaticality. Thus, control theory only has to have something to say about the grammaticality of subject control verb passives with reflexive *by*-phrases if they do not pattern like other passives with reflexive *by*-phrases.

It turns out these reflexivized subject control patterns are indeed different from other reflexivized passives. In particular, added information which "rescues" deviant reflexive passives still fails to rescue subject control passives. In general, it seems that reflexives in passive *by*-phrases are infelicitous unless there is extra pragmatic information in the sentence. For example, it seems that the topic/focus structure of the sentence is important to whether a reflexive may appear in PP[*by*]. Compare the differences in felicity in these sentences.

(4.7) a. Andrew hurt himself.

b. #Andrew was hurt by himself.

c. Only Andrew was hurt by himself.

[3] For the sake of argument, I am for the moment ignoring the problems with extended local a-command discussed in chapter 2.

Normally, a speaker wouldn't utter (4.7b) when all they mean to say is (4.7a). This seems to be a Gricean maxim violation of sorts, since the speaker would be making their statement needlessly marked in terms of focusing *Andrew*. However, when the overt focus element *only* is used, the passivized form becomes much more felicitous. But, even the *only*-focused form of a *promise* passive is ungrammatical.

(4.8) *Only Craig was promised to kneel by himself.

Therefore, it seems that passivized subject control verbs with reflexive logical subjects are ungrammatical independently of whatever makes reflexive logical subjects typically ungrammatical.

There is another reason for concluding that (4.6c) is truly syntactically ill-formed and not just pragmatically infelicitous. Namely, it is perfectly reasonable for somebody to promise themself something in the active voice:

(4.9) a. John promised himself to try harder next year.

b. I promised myself to never go there again.

These sentences are certainly felicitous. The fact that they are felicitous indicates that it is not pragmatically impossible to promise something to yourself. Again this shows that the reflexivized passive subject control verb is just as ungrammatical as other instances of passivized subject control verbs. We can thus conclude that control theory should rule out subject control passives with reflexive *by*-phrases, because they pattern differently from other *by* passives and are not ruled out for pragmatic reasons.

An even worse spurious prediction that the control theory of Pollard and Sag (1994) makes is that short passives (those that lack a *by*-phrase) of subject control verbs are possible, although with a specific interpretation. Here is an example of a short subject control passive with the ARG-ST list of the control verb.

(4.10) a. *Craig was promised to kneel.

b. *promise*: ARG-ST $\langle \text{NP}_i, \text{VP}[\text{ARG-ST} \ \langle \text{NP:}\textit{refl}_i \rangle] \rangle$

This sentence should be ungrammatical. However, binding theory and control theory, as presented in Pollard and Sag (1994), could both be satisfied by the ARG-ST in (4.10b). Principle A is satisfied by the understood subject being coindexed by its local a-commander, *Craig*. Control theory only requires the controlled subject to be coindexed with the COMMITTOR of the promise. Since *Craig* is coindexed with the COMMISSEE role of *promise*, this results in a situation where the COMMITTOR and COMMISSEE roles of *promise* are coindexed. This means that (4.10a) is predicted to mean that Craig promised himself to kneel. But it doesn't mean this. It doesn't mean anything, because it's ungrammatical and not up for interpretation.

In conclusion, the control theory of HPSG2, as presented in Pollard and Sag (1994), only gets the right result with respect to Visser's generalization when the passive subject control verb's argument structure contains an overt *by*-phrase containing either a nonpronoun or a syntactically nonanaphoric pronoun, such as *her*. The theory wrongly predicts that a reflexivized passive subject control verb is grammatical. In addition, the ungrammaticality cannot be attributed to noncontrol reasons, because other passive reflexives are possible and the act of promising oneself something is not pragmatically deviant. An even more serious wrong prediction is that short passives of subject control verbs yield a reflexive reading of the control relation. However, this is not the case and such sentences are clearly syntactically ill-formed.

In the following section I will explain the motivation for assuming a different argument structure for passives. This new argument structure for passive makes things even worse for HPSG2's control theory, because it now fails to get *any* of the Visser's generalization facts right, as I explain in section 4.4.2.

4.2.1 Passive Argument Structure

As mentioned in section 2.5.1 of chapter 2, recent work in HPSG assumes nested ARG-ST lists as results of operations that affect argument structure (e.g. see Manning 1996, 1997). Since passives affect argument structure, they are assigned a nested ARG-ST. But there are also independent reasons for this, which have to do with binding. In this section I review the motivation for the nested structure, and in section 4.3 I bring the passive more in line with argument sharing complex predicates.

Manning and Sag (1999) assume that the mapping between an active and its passive is performed by a derivational type (Meurers, 1995) that maps a feature structure of type *trans-v-lxm* (transitive verb lexeme) to type *pass-v-lxm* (passive verb lexeme). Indeed, the causative (Manning, 1996; Manning et al., 1999) and other valence changing predicate operations (Manning, 1996) are also defined on derivational types. The advantage of using derivational types instead of lexical rules is that the former allow derivations to be incorporated in a hierarchical lexicon, thus allowing the derivational types to inherit from the rest of the lexicon (Manning and Sag, 1999). This yields a more compact lexical encoding and uniformity of lexical information in types, rather than a split between lexical types and rules. The derivational type that Manning and Sag (1999: 6) give as the "universal characterization" of passive is this:[4]

[4]The symbol '$\oplus$' stands for list append, which is a function that adds the contents of one list onto the end of another list.

(4.11)
$$\begin{bmatrix} \textit{passive-drv} & \\ \text{RESULT} & \begin{bmatrix} \textit{pass-v-lxm} & \\ \text{ARG-ST} & \left\langle \boxed{2}_i, \left\langle \boxed{1}, \text{PRO}_i \right\rangle \oplus \boxed{3} \right\rangle \\ \text{CONT} & \boxed{4} \end{bmatrix} \\ \text{SOURCE} & \begin{bmatrix} \textit{trans-v-lxm} & \\ \text{ARG-ST} & \left\langle \boxed{1}, \boxed{2} \right\rangle \oplus \boxed{3} \\ \text{CONT} & \boxed{4} \end{bmatrix} \end{bmatrix}$$

I will not go into any more details about derivational types, or about where in the lexical hierarchy *passive-drv* should be placed. The ARG-ST of the resulting *pass-v-lxm* is the most important aspect of (4.11) for the present purposes. There are two differences with the passive ARG-ST reviewed in the previous section: first, there is a nested ARG-ST, and second, the prepositional *by*-phrase containing the logical subject will no longer be the least oblique item on its ARG-ST. The significance of these changes will be apparent shortly. However, I will eventually adopt a slightly different ARG-ST, which has no 'PRO' in ARG-ST (section 4.3). Before moving on to the discussion of PRO and why my theory does not allow it, I will review Manning and Sag's reasons for adopting the nested ARG-ST given above for passives and present an argument of my own for adopting this ordering for English.

As discussed briefly in the previous chapter, there are certain relations for which being a subject is crucial. For example, a control target must be a subject. However, the level at which the notion subject should be defined in binding and control is argument structure, as also discussed in the previous chapter. This led Manning (1996) to propose the notion of a-subject, which can be defined as follows:

(4.12) **Definition of A-subject**
The first member of an ARG-ST list is an a-subject.

A-subjecthood is relevant to binding theory as well as control, because there are various languages, such as Russian (Manning, 1997), Japanese (Manning et al., 1999), Inuit (Manning, 1996), and Danish (Vikner, 1985) that have anaphoric pronouns that must be bound by an a-subject. These languages would have an additional binding constraint that states that if an anaphor is a-bound, its a-binder must be an a-subject (see also section 3.2.1).

Given that Russian is a language where binders must be a-subjects, the following example indicates that the logical subject of the passive must be an a-subject.

(4.13) Èta kniga byla kuplena Borisom$_i$ dja sebja$_i$.
this book.NOM was bought Boris.INSTR$_i$ for self$_i$
This book was bought by Boris for himself.
(Manning, 1997; Manning and Sag, 1999)

Since *Borisom* can grammatically bind *sjeba* and it is an independent fact about Russian that binders must be a-subjects, it follows that the logical subjects of passives must be a-subjects. Due to the definition of a-subject given above, there is little choice but to adopt the nested ARG-ST in (4.11). This argument structure schema, when instantiated with the specific arguments in (4.13), yields this as the ARG-ST for the verb *kuplena*:

(4.14) *kuplena*: ARG-ST ⟨NP[*èta kniga*]$_j$, ⟨NP[*Borisom*]$_i$, PRO$_j$, PP[*dja sebja*]$_i$⟩⟩

This ARG-ST has *Borisom* as an a-subject as required, and also makes it less oblique than the PP containing the reflexive. This has the result that the reflexive is locally a-bound (since it is locally a-commanded) by an a-subject.

A note about obliqueness is in order here. Recall that the relevant notion of obliqueness is defined such that Y is less oblique than Z iff Y precedes Z on some ARG-ST list. This means that although the leftmost argument is less oblique than the whole nested ARG-ST, it is not less oblique than anything contained in the nested ARG-ST, since there is no ARG-ST list on which the leftmost argument precedes these embedded arguments. This also entails that there is no a-command relationship between the argument outside the nested list and those inside the nested list. This is essentially what motivates the use of placeholder PRO. In order to get binding facts right, the outside argument must be able to a-command certain things in the embedded list. The PRO allows it to do this by carrying its index.

Leaving the PRO issue aside for the moment, even in English, which does not have the a-subject requirement on binders, there is some evidence for the obliqueness ordering that places the logical subject before other oblique complements, rather than at the very end of the ARG-ST list. For the sentence in (4.15a) — ignoring irrelevant argument structure nesting for simplicity's sake — the two potential argument structure lists are as shown in (4.15b) and (4.15c). The argument structure in (4.15b) is the one assumed in Pollard and Sag (1994) and the one in (4.15c) is like the kind advocated for *pass-v-lxm* in (4.11).

(4.15) a. The puppy$_i$ was given to her$_j$ by Mary$_j$'s uncle.

b. *given*: ARG-ST ⟨NP$_i$, PP[*to*]$_j$, PP[*by Mary$_j$'s uncle$_k$*]$_k$⟩

c. *given*: ARG-ST ⟨NP$_i$, PP[*by Mary$_j$'s uncle$_k$*]$_k$, PP[*to*]$_j$⟩

According to either the definition of a-command given in Pollard and Sag (1994) and reviewed in the previous chapter, or the revised version of a-command presented in section 2.2 of this chapter, (4.15a) should be ungrammatical if it has the ARG-ST given in (4.15b). The reason is that the less oblique PP[*to*] a-commands the possessive NP *Mary*. Since this nonpronominal NP is a-commanded by PP[*to*] and coindexed with it, it is a-bound and this is a Principle C violation, because this principle requires that *nominal-objects* of type *nonpronominal* be a-free.

On the other hand, if the ARG-ST for (4.15a) is the one given in (4.15c), with the PP[*by*] containing the logical subject preceding the *to* PP, the sentence is predicted to be grammatical.

The reason is that since *Mary* is embedded in the NP argument of PP[*by*], it does not locally a-bind the more oblique PP[*to*]. This means that the pronoun is locally a-free as required. With respect to binding theory, then, the ARG-ST of the grammatical sentence (4.15a) must be the one given in (4.15c). Thus, this is evidence for the passive *by*-phrase being ordered after the passive subject and before other complements, rather than appearing last on the ARG-ST list.

Therefore, I assume that the obliqueness ordering for passives given by the passive derivational type in (4.11) is essentially correct, since it is supported by data from Russian and English. Of course, it may be that other languages contradict this requirement, but this would not necessarily weaken the claim that this is the correct ordering for English, since nothing in principle precludes languages from having parochial passive ARG-ST orderings. Furthermore, I also assume the nested argument structure for passives, since it is certainly motivated by data from various languages (Manning, 1997). Although it may not be strictly necessary, it is parsimonious to adopt it for English as well. Unless there is contradictary evidence, we can assume that lexical and grammatical rules are universal.

4.2.2 Visser's Generalization Revisited

The changes to passive argument structure just discussed yield the following ARG-ST for *promise* with a *by*-phrase agent.

(4.16) *promise* (passive): ARG-ST $\langle$NP$_i$, $\langle$PP[*by*], PRO$_i$, VP[ARG-ST $\langle$NP:*refl*$\rangle$]$\rangle\rangle$

The short passive argument structure would be the same, except there would be no *by*-phrase present.

The ordering in (4.16) spells trouble for the standard HPSG control theory in (4.1), which is essentially the theory proposed in Pollard and Sag (1994), with minor modifications to work on ARG-ST lists. This control theory will no longer capture Visser's generalization because it crucially depends on the PP being ordered last. If the PP precedes the VP, then its coindexation with the understood VP subject will simultaneously satisfy the extended Principle A and the control theory. Here are some examples which the control theory predicts to be grammatical.[5] They are all in fact ungrammatical.

(4.17) a. *Kim$_i$ was promised to leave by Kim$_i$.

b. *John$_i$ was promised to leave by him$_i$.

c. *Kim$_i$ was promised to leave by Sandy$_j$.

d. *Kim$_i$ was promised to leave by him$_j$.

e. *John$_i$ was promised to leave by himself$_i$.

f. *John was promised to leave.

[5]Some of these are from Pollard and Sag (1994) and were presented in (4.6). Others are variations on those examples.

Example (4.17a) is predicted to be grammatical, because the *by*-phrase locally a-binds the controlled subject of *to leave*, satisfying the extended Principle A, and the PP is coindexed with the COMMITTOR of *promise*, satisfying control theory. Furthermore, since PRO is just a dummy placeholder and not of type *npro*, Principle C cannot apply to it; thus, even the coindexation between the PP and PRO does not rule (4.17a) out. Sentence (4.17b) is also grammatical, since it satisfies the extended Principle A and control theory in the exact same manner as (4.17a). And again, since PRO does not have a type (and thus doesn't have the type *ppro*), the appropriate binding principle — in this case Principle B — does not bar coindexation between the PP and PRO. Examples (4.17c) and (4.17d) illustrate that sentences with noncoindexed names and pronouns are also predicted to be grammatical, since the extended Principle A and control theory are fulfilled in the same manner as for (4.17a) and there is no illicit binding of PRO by PP. Sentence (4.17e) shows that PP reflexives are again predicted to be grammatical, since PRO is not subject to binding and the reflexive in the *by*-phrase is exempt (it isn't a-commanded). If PRO were subject to Principle B or C, (4.17e) is predicted to be out for the same reason as (4.17a) would be: PRO is assumed to have the type *nom-obj* and thus be subject to Principle C, which is not satisfied due to local a-binding of PRO by PP. Finally, (4.17f) is again predicted to be grammatical and to mean that John promised himself to leave.

Thus, on the new passive argument structure, which is well-motivated by crosslinguistic evidence and is assumed to hold universally by Manning and Sag (1999), the control theory of Pollard and Sag (1994) fails to account for Visser's generalization at all. In section 4.5 I will offer a solution to this problem, but first I will demonstrate that there is no place for placeholder PRO in HPSG.

4.3 Against Placeholder PRO

In this section, I motivate and present my one change to the passive ARG-ST in (4.11), which is to get rid of PRO. Where there would be a PRO, I propose to have a *content* object that is structure shared with a member of the non-embedded ARG-ST. For example, my *passive-v-lxm* would look like this:

(4.18)
$$\begin{bmatrix} \textit{pass-v-lxm} & \\ \text{ARG-ST} & \left\langle \boxed{2}{:}\boxed{4}_i, \left\langle \boxed{1}, \boxed{4}_i \right\rangle \oplus \boxed{3} \right\rangle \\ \text{CONT} & \boxed{4} \end{bmatrix}$$

I use the standard HPSG convention of writing X:$\boxed{y}$ (where y is instantiated to an appropriate integer, like 4 in example 4.18) to indicate X[CONTENT $\boxed{y}$]. Notice that the coindexation is now redundant, since INDEX is on the path CONTENT. That is, the structure sharing of the CONTENT value entails the structure sharing of the INDEX value. I will retain the subscripted indices for clarity, though (these are just a notational convention, in any case).[6]

But before arguing for the removal of PRO, I will first explain a bit of its history and purpose. This object was first introduced in Manning et al. (1999) and is actually just a dummy placeholder. As indicated in (4.11), in the case of the passive the dummy element would be coindexed with the surface subject of the passive. In general, argument structure-modifying lexical derivations would leave this PRO in the nested argument list and the motivation for this object comes solely from binding theory. There is evidence from various languages, such as Japanese (Manning et al., 1999) and Russian (Manning and Sag, 1999) that the binding possiblities in a derived predicate are sensitive not only to the derived, nested argument structure configuration, but also to the original argument structure of the underived form. Here is an example from causativization in Japanese (Manning et al., 1999: 25–26, (64)).

(4.19) a. Taroo$_i$ wa Ziroo$_j$ ni kare$_{i/*j}$ o bengo s-ase-ta.
Taroo TOP Ziroo DAT he ACC defense do-CAUS-PAST
Taroo$_i$ made Ziroo$_j$ defend him$_{i/*j}$.

b. *bengo saseta*: ARG-ST ⟨NP[*Taroo*]$_i$, NP[*Ziroo*]$_j$, ⟨PRO$_j$, NP[*kare*]$_{i/*j}$⟩⟩

Thus, the coindexation between *Ziroo* and the pronoun *kare* is blocked due to the PRO locally a-binding *kare* and causing a Principle B violation. Crucially, *Taroo* does not a-command the pronoun and can therefore be coindexed with it. Since *Taroo* and the pronoun *kare* do not cooccur on any ARG-ST list, there is no a-command relation between them.[7]

However, there are three major problems with PRO. The first is that the use of PRO fails to make certain predictions about the Russian data that was actually presented to motivate its presence. Recall the Russian example (4.13) along with the ARG-ST of the passivized verb, *kuplena*:

(4.20) a. Èta kniga byla kuplena Borisom$_i$ dja sebja$_i$.
this book.NOM was bought Boris.INSTR$_i$ for self$_i$
This book was bought by Boris for himself.

b. *kuplena*: ARG-ST ⟨NP[*èta kniga*]$_i$, ⟨NP[*Borisom*], PRO$_i$, PP[*dja sebja*]⟩⟩

The reflexive in this ARG-ST can be a-bound by either a-subject, *èta kniga* or *Borisom*, although the former binder is filtered out by pragmatic considerations. However, the higher a-subject binding is only made possible by the PRO that indicates where the higher a-subject "came from". Thus, it is exactly as Manning and Sag (1999: 7) say: "These placeholder elements in ARG-ST lists are used to mark positions coindexed with an element in the ARG-ST, and are

[6] In fact, the repetition of synsems rather than CONTENT objects was used by Manning (1997). It is unclear to me what the precise motivation for the switch to the use of PRO is, but I suspect that it has to do with ensuing difficulties in defining the compression function, which I discuss further below. However, as I will show, the available evidence only necessitates replacing PRO with a *content* object, which avoids the compression difficulties.

[7] This account, while it gets the facts about pronouns right, also predicts that a second occurrence of the name *Taroo* as the object of *bengo* would be grammatical, since there would likewise be no Principle C violation.

needed for binding." Thus, having this placeholder PRO present is sufficient to get the right binding on the reflexive.

The problem occurs, though, in cases where the PRO itself must not be a-bound. For example, the following Russian sentences are both ungrammatical, just as their English translations are.

(4.21) a. *On$_i$ byl kuplena Borisom$_i$.
He.NOM$_i$ was bought Boris.INSTR$_i$.
**He$_i$ was bought by Boris$_i$*

b. *On$_i$ byl poranen Borisom$_i$.
He.NOM$_i$ was hurt Boris.INSTR$_i$.
**He$_i$ was hurt by Boris$_i$*

Sentence (4.21a) is a simple alternation on (4.20a); since it is pragmatically odd, I've included sentence (4.21b) which is the same construction with a more plausible verb. It is important to note that both of these sentences are only ungrammatical on the coreferential construal indicated. Indeed, it would be surprising, according to any linguistic theory, to find a language where such sentences are grammatical on this construal.

But it turns out that this is the exact prediction that the use of PRO makes. This will be clearer in reference to a specific ARG-ST list, so here is the one for (4.21b):

(4.22) *poranen*: ARG-ST $\langle$NP[*on*]$_i$, $\langle$NP[*Borisom*]$_i$, PRO$_i\rangle\rangle$

With the old notion of passive argument structure, this would have been a Principle C violation. This is no longer the case, since the NP *Borisom* is not a-bound. But, the sentences are still ungrammatical. The only other source of this ungrammaticality would be a Principle B violation. That is, (4.21b) should be ruled out because the pronoun *on* is locally a-bound. However, Principle B states that a *personal pronoun* must be a-free. This is short for the statement that a *nominal-object* of type *ppro* should not be coindexed with any nonexpletive that precedes it on a ARG-ST list. But PRO isn't a personal pronoun. In fact, it isn't anything, it's just a placeholder that is coindexed with something else. As such, it doesn't have *any* type, nevermind the type *ppro*. Thus, if we use PRO, even if it is coindexed, the binding theory would predict that sentences like those in (4.21) are perfectly fine. However, not only are they awful on the construal indicated, but it is also only binding theory that should rule them out, since it is only the coindexation of the pronoun and the name that results in ungrammaticality. In other words, the sentences are fine, except for the binding indicated.

To rule these sentences out, PRO must at the very least be replaced by the *content* of the required argument. This would yield an ARG-ST for *poranen* like this:

(4.23) *poranen*: ARG-ST $\langle$NP[*on*]:$\boxed{2}_i$, $\langle$NP[*Borisom*]$_i$, $\boxed{2}_i\rangle\rangle$

This means that the placeholder for NP[*on*] now has the right type, *ppro*, for Principle B to rule this sentence out. This in itself does not mean that PRO should be replaced with another occurrence of the relevant *synsem*, as done in Manning (1997), since it is sufficient to use a *content* object.

The second problem with the use of PRO again stems from the fact that it is an untyped dummy element. In HPSG, lists are typed relative to the kind of items that appear on them. Thus, the partition of *list* is as in (4.24a), with feature declaration for *nonempty-list* as in (4.24b) (Pollard and Sag, 1994: 396–397).

(4.24) a. *list*(σ)

nonempty-list(σ) *empty-list*(σ)

b. *nonempty-list*(σ): $\begin{bmatrix} \text{FIRST} & \sigma \\ \text{REST} & \textit{list}(\sigma) \end{bmatrix}$

The sigma (σ) indicates the type of each of the members of the list. For example, the old SUBCAT list and earlier, unnested versions of ARG-ST had the value *list(synsem)*, meaning that the value was a list, each member of which was an object of type *synsem*.

The new nested argument structure would have to be specified as *list(synsem* $\vee$ *list(synsem))*, which would yield a list, each member of which is either a *synsem* or a list of synsems or lists. The embedded lists could then contain more embedded lists, and so on recursively. But, since PRO has no type, it is not possible, given the machinery just described, to define a list that contains PROs. Minimally, this means that PRO must be given a type. Thus, giving PRO the type *content* also allows us to define an appropriate list of the form *list(synsem* $\vee$ *content* $\vee$ *list(synsem* $\vee$ *content))*. However, if PRO is given a type, then it is no longer a dummy element; it would now be a full-fledged linguistic object.

Therefore, replacing PRO with a structure shared instance of the appropriate *content*, as I advocated above, makes the correct empirical predictions and is more appropriate for HPSG representations. Furthermore, it is the most economical move. Although using appropriate repetitions of synsems[8] may seem to be more in line with treating arguments as bundles of syntactic and semantic information, this is not a necessary feature of HPSG. The only reason to stipulate that valence and argument structure lists contain synsems is to guarantee that heads can select for the categorical and perhaps semantic information of their arguments, while also guaranteeing that they cannot select for their arguments' phonology or internal structure (Pollard and Sag, 1994: 23–24). This just entails that whatever is on these lists must not contain information about its phonology or daughters. However, any given *instance* of argument selection will result in an argument with a determinate phonology and phrase structure surfacing. That is, even though the selection is restricted to synsems, the synsems are still part of sign objects and selecting the synsem will drag the rest of the sign along. Thus, although the arguments of lexical items are *schematically* just bundles of syntactic and semantic information,

[8]In other words, the same object would appear more than once on the ARG-ST list.

they will be instantiated to specific phrases. For example, we can say that the object argument of the verb *smooch* is a noun phrase, but we can also say that the object argument of *smooch* in *Gonzo smooched the picture of Natalie* is *the picture of Natalie*. Thus, *synsems* allow selection of only the appropriate information by heads, but it is erroneous to conclude that synsems are arguments; they're just part of arguments. In fact, one way of thinking of *synsem* objects with respect to argument structure is that they give a handle to an argument, without referring to its phonology or phrase structure.

In fact, a *content* "is" an argument just as much as a *synsem* "is" an argument. That is, *content* objects are also just part of arguments and can therefore serve as handles, but they are not themselves arguments. And, again like synsems, they do not refer to the inappropriate parts. Lastly, having a *content* that is coindexed with another argument on an ARG-ST amounts to the statement that this argument is shared between levels of argument structure, which is exactly what having PRO was supposed to accomplish. The crucial difference, as I will discuss shortly below, is that a *content* object amounts to the *same* argument serving double duty, whereas PRO is just a dummy item.

Furthermore, replacing PRO with *content* preserves the fact that while this element is relevant to argument structure, it is irrelevant to valency. As Manning et al. (1999) explain, the valence lists are the relevant portions of the ARG-ST list with the nested structure flattened out and with PROs removed. There is a function, compression, that accomplishes the flattening and removal (Manning et al., 1999; Manning and Sag, 1999). For example the type *acc-canon-lxm* (accusative canonical lexeme) in Manning and Sag (1999) states that its ARG-ST is $\boxed{1} \oplus \boxed{2}$ and that its COMPS is compression($\boxed{2}$), where compression is defined as follows ('$\leftarrow$' designates 'only if'):

(4.25) i. compression($\langle\ \rangle$) = $\langle\ \rangle$.

ii. compression($\langle$PRO|Y$\rangle$) = Z $\leftarrow$ compression(Y) = Z.

iii. compression($\langle$X|Y$\rangle$) = $\langle$X|Z$\rangle$. $\leftarrow$ X is a *synsem*, compression(Y) = Z.

iv. compression($\langle$X|Y$\rangle$) = Z $\leftarrow$ X is a *list*, compression(X) = X', compression(Y) = Y', append(X',Y') = Z.

It is a simple matter to redefine the compression function to work on *content* by replacing (4.25ii) with compression($\langle$X|Y$\rangle$) = Z $\leftarrow$ X is a *content*, compression(Y) = Z.

I mentioned above that Manning (1997) uses repeated occurrences of the same *synsem* object, which yields ARG-ST lists like $\langle\boxed{1}, \langle\boxed{2}, \boxed{1}, \boxed{3}\rangle\rangle$, and so on. The second occurrence of $\boxed{1}$ here, would be the *content* of the first occurrence, on my account. The problem with using multiple synsems, is that it then becomes difficult for the compression function to operate, since it must only remove subsequent occurrences of previously encountered synsems. Of course, the function is still definable, but it would not be very elegant. Furthermore, the empirical evidence only motivates the use of *content*; this is the most economical type necessitated. And, as

I argued above, a *content* object can serve as a handle on an argument just as well as a *synsem* object.

Finally, I turn to the last problem with PRO, which is quite a conceptual, HPSG-specific one. The problem is that PRO is fully equivalent to a trace in transformational theories, albeit a kind of lexical trace. It is there only to indicate the position of an item before a lexical rule applied to the construction. This effectively introduces a new stratum. Not only does this contradict the monostratal basis of the rest of HPSG, but it also devalues recent work to rid even the extraction account of traces (Bouma et al., 1998). Proponents of the use of PRO could well say that this case is different because the trace is in the lexicon and not in the syntax. But then the question becomes why traces should be allowed in the lexicon but not in the syntax. This argument does not mean that PRO is necessarily wrong, but it does indicate that it should only be a last resort, since it significantly changes the interpretation of HPSG as a monostratal, traceless theory which has been a fundamental insight of the theory and its precursors for so long (Gazdar et al., 1985; Pollard and Sag, 1994; Sag and Fodor, 1994; Bouma et al., 1998).

The same criticism cannot be levelled against the use of *content* that I have advocated. Since the *content* fully represents an argument, rather than just the position and index of an argument, my account is equivalent to sharing arguments. In other words, in my theory the same argument would be relevant to multiple levels (i.e. embeddings) of argument structure. This is similar to the structure sharing of grammatical subjects and so on, which is quite common in HPSG analyses (see for instance the analysis of various predicative complements and raising in Pollard and Sag 1994). The difference is that this structure sharing is at the level of argument structure, rather than at the level of grammatical relations. Thus, my theory states that the passive subject is simultaneously an argument structure subject and an argument structure object. But perhaps in passives this is not as transparent as in other valence changing predicates, like causatives. For example, my account treats the object argument of a Japanese causative, like in (4.19a), as being simultaneously in the argument structure of the causative verb and that of the caused predicate. This captures the intuition that the causee is the object argument of the causative predicate, but also the subject argument of the caused predicate.

4.4 Passive Argument Structure without PRO

The argument sharing account of passive that I've developed predicts that all instances of coindexation between the surface and logical (*by*-phrase) subjects of the passive are ungrammatical. This is due to the ARG-ST that results:

(4.26) *passive-v-lxm*: ARG-ST $\langle$NP:$\boxed{1}$, $\langle$PP[*by*], $\boxed{1}$, ...$\rangle\rangle$

Since the nested $\boxed{1}$ is the *content* of the surface subject, any coindexation between the PP[*by*] and the index of $\boxed{1}$ will result in a nonpronominal (*npro*) or syntactically nonanaphoric pronoun (*ppro*) being locally a-bound, which would be ruled out by Principles C and B, respectively.[9]

It is uncontroversial that coindexation between the subject and PP[*by*] results in ungrammaticality if the argument of *by* is an *npro* or *ppro*, as illustrated by these sentences.

(4.27) a. *Andrew$_i$ was interrupted by Andrew$_i$.

b. *Andrew$_i$ was interrupted by him$_i$.

But, my theory also predicts that the following sentence is ungrammatical:

(4.28) *Andrew$_i$ was interrupted by himself$_i$.

In fact, sentences like (4.28) have been used in the past to motivate thematic constraints on binding (Jackendoff, 1972). My theory does not necessitate resorting to thematic relations to bar this sentence, since its ungrammaticality just falls out of binding theory. This is important, since Pollard and Sag (1992, 1994) argue that stating conditions on reflexive binding on a thematic hierarchy leads to a paradox in role ordering.

However, Pollard and Sag (1992, 1994) also argue that a reflexive in the *by*-phrase is grammatical. Although *by*-reflexives may seem ungrammatical, according to Pollard and Sag they are not really, due to examples like the following:

(4.29) a. The only barber who was shaved by himself was Figaro.

b. The only pitcher who was ever hit by himself was Cy Young.

(Pollard and Sag, 1994: 276, (112a–b))

Indeed, I agree with them that these examples are perfectly fine, but I disagree that this entails that passive *by*-reflexives in general are grammatical.

In general, focus elements like *only* and *even* can license bindings which are normally ungrammatical. I will not attempt to give an analysis of focused NPs here, but even without such an analysis it is possible to show that Pollard and Sag's argument is fallacious. The hidden premise in their argument is that a syntactic structure X is grammatical if [only X] is grammatical. However, this premise is false, because it is possible to have a structure that is grammatical with *only*, but ungrammatical without it:

(4.30) a. *Andrew$_i$ nominated Andrew$_i$ for class president.

b. Only Andrew$_i$ nominated Andrew$_i$ for class president.

(4.31) a. *Andrew$_i$ thinks Andrew$_i$ is a genius.

b. Only Andrew thinks Andrew is a genius.

[9] If the surface subject were a reflexive, it would actually be required to be bound to the PP[*by*]. However, reflexive subjects must be independently blocked anyway, since sentences like **Himself danced* are ungrammatical. Pollard and Sag (1994: 262) attribute this to reflexives being marked for accusative case and thus not being allowed to appear in nominative positions. This would naturally account for why passive subjects cannot be reflexives, since this too is a nominative case position.

(4.32) a. *Everybody hates Bob$_i$. Bob$_i$ likes him$_i$.

b. Everybody hates Bob$_i$. Only Bob$_i$ likes him$_i$.

(4.33) a. *Everybody hates Bob$_i$. Bob$_i$ hates him$_i$.

b. Everybody hates Bob$_i$. Even Bob$_i$ hates him$_i$.

The mechanism by which focus elements like *only* and *even* can rescue illicit bindings is no doubt an interesting research issue, but I will not pursue it any more here. Of course, this entails that there is some kind of syntactic difference between the focused sentences and the unfocused ones, but I take it that this is uncontroversially true, since focused sentences have extra overt elements and a distinct semantics from their unfocused counterparts (Rooth, 1996; Horvath, 1985).

Thus, I conclude that my theory is right in blocking reflexive *by*-phrases in passives. The argument that Pollard and Sag present for concluding that reflexive passives are grammatical rests on a false premise. Furthermore, there is also evidence for concluding that short passives cannot have a reflexive reading. I turn now to a consideration of this construction.

4.4.1 Short Passives

A short passive is a passive that lacks a *by*-phrase. Semantically, a short passive entails an existentially quantified logical subject. For example, *Andrew was interrupted* $\vdash$ *Andrew was interrupted by some x*. The variable in the restriction of the existential quantifier is purposefully left vague, because there are a number of different things that can instantiate it. Andrew could have been interrupted by a person, thing, or event. However, it is clear that the entailment holds, because negating the entailment entails the negation of the short passive. For example *It is not the case that Andrew was interrupted by some x* $\vdash$ *It is not the case that Andrew was interrupted*. Furthermore, this is an entailment and not a presupposition, because it fails standard tests for presuppositions. For example, embedding the short passive in a conditional means that the entailment does not hold.

Now, if we are to understand the ARG-ST list as a mapping between semantics and syntax, this existentially quantified argument must be somewhere on the ARG-ST list of the passive verb, since I have just demonstrated that it is a semantic argument. Assuming, the passive argument structure motivated in the previous section, this means that the ARG-ST of a short passive will be one of the following two options:

(4.34) a. ARG-ST $\langle$NP:$\boxed{1}$, $\langle$Q, $\boxed{1}\rangle\rangle$

b. ARG-ST $\langle$NP:$\boxed{1}$, $\langle\boxed{1}$, Q$\rangle\rangle$

I use Q to stand for the understood existential quantifier, because it unclear what its categorial features are, or even whether it has any, other than being a nominal of some kind. Either one of these will result in binding violations if the Q is coindexed with the *content* of the surface subject, $\boxed{1}$. Option (a) will result in a Principle B or C violation, because the surface subject must be a *ppro* or *npro*. And option (b) will result in a Principle C violation, since quantified nominals are nonpronominals and thus of type *npro*. The binding theory therefore cannot decide between these two options.

I will select the first one, because this is more in keeping with the ARG-ST of long passives and the fact that the understood quantifier is the logical subject. I assume the following derivational type for short passive.[10]

(4.35)
$$
\begin{bmatrix}
\textit{short-passive-drv} & \\
\text{RESULT} & \begin{bmatrix} \textit{short-pass-v-lxm} & \\ \text{ARG-ST} & \left\langle \boxed{2}{:}\boxed{4}_j, \left\langle \text{Q}_i, \boxed{4}_j \right\rangle \oplus \boxed{3} \right\rangle \\ \text{CONT} & \begin{bmatrix} \textit{rel} & \\ \text{ACTOR} & i \\ \text{UNDERGOER} & j \end{bmatrix} \end{bmatrix} \\
\text{SOURCE} & \begin{bmatrix} \textit{trans-v-lxm} & \\ \text{ARG-ST} & \left\langle \boxed{1}_k, \boxed{2}_j \right\rangle \oplus \boxed{3} \\ \text{CONT} & \begin{bmatrix} \textit{rel} & \\ \text{ACTOR} & k \\ \text{UNDERGOER} & j \end{bmatrix} \end{bmatrix}
\end{bmatrix}
$$

Notice that this derivational type changes the index of the actor from that of the active subject to that of the understood quantifier, since they should not be stipulated as being identical.

It is important to realize, though, that the understood quantifier is only present at the level of argument structure. It is not linked to the level of grammatical relations, since it is not a syntactic argument of the passive that is subcategorized for. That is, the short passive is saturated syntactically, and thus the quantifier will not appear on the COMPS list. But, not being required syntactically is not sufficient to keep something off the ARG-ST list. This is a linking level, and thus all arguments must appear in the argument structure, whether they are syntactically motivated (e.g. expletive subjects) or semantically motivated (e.g. the pro in pro-drop languages, this understood quantifier).

[10] I have also used this opportunity to switch the notation for the CONTENT. Following Davis (1996), I assign relations the features ACTOR and UNDERGOER rather than roles that reflect the name of the relation.

4.4.2 Visser's Generalization Rerevisited

Replacing PRO with a *content* object still does not fully capture Visser's generalization. Once the change is carried out, the argument structure of passive *promise* will be:

(4.36) *promise* (passive): ARG-ST ⟨NP:$\boxed{1}_j$, ⟨PP[*by*], $\boxed{1}_j$, VP[ARG-ST ⟨NP:*refl*⟩]⟩⟩

This argument structure is what is motivated by the data that I have examined in previous sections. However it still erroneously predicts sentences like the following to be grammatical.

(4.37) a. *Kim$_i$ was promised to leave by Sandy$_j$.

b. *Kim$_i$ was promised to leave by him$_j$.

When I present my own analysis, it will be obvious that Principle A does not apply to the understood subject of the VP, but for the sake of argument I will assume that there is still an extended Principle A.[11] Principle A can be satisfied by coindexing *Sandy* or *him* with the controllee in the VP. Control theory can be satisfied with this coindexation as well, since *Sandy* is coindexed with the ACTOR value, as required by the control verb *promise*. Finally, because *Kim* and the element in the *by*-phrase are not coindexed, the embedded *content* of *Kim* will not be locally a-bound. Therefore, neither Principle B nor Principle C is violated. Thus, as the theory stands now, it will always predict that syntactically nonanaphoric pronouns and nonpronominals in the *by*-phrase will result in a grammatical subject control passive. This is clearly wrong, as all subject control passives are ungrammatical.

The basic trouble with my analysis and the analysis of Pollard and Sag (1994), is that Visser's generalization is left to the vagaries of the obliqueness ordering of arguments. Thus, the generalization is only (partially) captured if the PP is ordered after the controlled VP, which results in a mismatch between control and binding such that there is a three-way binding. This is a doomed venture since nothing guarantees that the *by*-phrase is ordered after the VP complement of a control verb. Furthermore, this ordering will result in subject control passives with *by*-reflexives being predicted to be grammatical when they are clearly ungrammatical. In any case, there is evidence from English for the *by*-phrase in passives being ordered before other oblique arguments. What is needed is a control theory that predicts, no matter what the obliqueness ordering, that subject control passivization is disallowed. In the next section I will outline such a theory, based on Bresnan (1982).

4.5 Conditions on Controllers

The obvious solution to these problems is to place restrictions on the controller. Indeed, this is what allows Bresnan's Lexical Functional Grammar (LFG) account to capture Visser's generalization. The control theory presented in Bresnan (1982: 376) basically states that the controller

[11] My analysis, which involves the Antecedent Closeness Constraint, would still get the wrong result for these examples, as things stand now.

must be a core grammatical role, where the core grammatical functions are subject, direct object and indirect object.[12] If the controller must be a core role, the passivization properties of control verbs are directly predicted. Object control verbs can be passivized, because the controller is a core role both in the active and in the passive. In the active the controller is the direct object and in the passive it is the subject. Subject control verbs cannot be passivized, though. In the active, the controller is the core subject role, but in the passive the controller is an oblique role, as indicated by its prepositional marking, and therefore cannot be a controller. This account would predict that no oblique argument could be a controller, and therefore all instances of control by a passive *by*-phrase would be blocked.

In fact, Manning (1996) and Manning and Sag (1999) already assume the existence of core roles. These are motivated in Manning (1996) due to various facts about binding, verbal agreement and word order. For example, a-subjects are core roles according to Manning. These roles are actually indicated in the lexical hierarchy. The type for transitive verbs marks the NP as type *core* (Manning and Sag, 1999).[13]

(4.38)
$$\begin{bmatrix} \textit{trans-v-lxm} & \\ \text{CAT} & \text{V} \\ \text{SPR} & \langle\ \rangle \\ \text{ARG-ST} & \left\langle \text{NP}\begin{bmatrix}\textit{core}\end{bmatrix}, \text{NP}\begin{bmatrix}\textit{core}\end{bmatrix}, \ldots \right\rangle \end{bmatrix}$$

This marking of NPs for *core* will not do for my purposes, though. The logical subject would still be marked as *core*, because the passive is derived from the type in (4.38). In addition, it does not really make sense for NPs to have a feature *core*, since something is a core role only relative to the argument structure of some head.

Therefore, I propose two new features for *head* which have lists as values, and serve to keep track of a head's core and oblique arguments.

(4.39) **Feature Declaration**

$$\textit{head}: \begin{bmatrix} \text{CORE} & \textit{list(synsem)} \\ \text{OBLIQUE} & \textit{list(synsem)} \end{bmatrix}$$

I assume that the other features for *head* remain the same. The features CORE and OBLIQUE are similar to the features CORE and OBL which Manning (1996) uses in his LFG representations. The fact that I have made them HEAD features means they will be passed from head daughters to their mothers via the Head Feature Principle.

[12] In using these terms, I am deliberately abstracting away from LFG formalism. At the time the article in question was written, these roles would have been assigned to the functional categories SUBJ, OBJ, and OBJ2. However, since LFG has now largely adopted Bresnan and Kanerva's Lexical Mapping Theory, what was OBJ2 and is now OBJ_θ is no longer a core role (Bresnan and Kanerva, 1989). The details of this are unimportant here.

[13] What I've presented here is actually an amalgamation of the information provided by *trans-v-lxm* and the two supertypes it inherits from, *verb-lxm* and *subj-v-lxm*.

I assume that the contents of these two lists are lexically specified as structure shared with elements on the ARG-ST list. Thus, the type declaration for *trans-v-lxm* would be:

(4.40) $\begin{bmatrix} \textit{trans-v-lxm} & \\ \text{CAT} & \text{V} \\ \text{SPR} & \langle\ \rangle \\ \text{ARG-ST} & \left\langle \boxed{1}\text{NP}, \boxed{2}\text{NP} \right\rangle \oplus \boxed{3} \\ \text{CORE} & \left\langle \boxed{1}, \boxed{2} \right\rangle \\ \text{OBLIQUE} & \boxed{3} \end{bmatrix}$

The type for intransitive verbs would be similar, except it would have only one item on ARG-ST (not counting any obliques) and CORE. It may seem redundant to specify this information on the lexical types, but there would be very few types that actually had to do this. Instantiating the information on the necessary types is the simplest assumption.[14]

Derivational types can alter the core roles, just as they can alter the ARG-ST list. For example, the passive derivational types will now be accordingly modified to take the information into account.

[14]It would also be possible to generalize over what the core role configuration is using a well-formedness constraint on lexical items.

(i) **Constraint on CORE values**
A *synsem* Y is a member of CORE if and only if there is an ARG-ST list Z such that:

a. Z is not a member of any list; and
b. Y is the first member of Z and Y is an actor; or
c. Y is the second member of Z and Y is an undergoer.

The first clause guarantees that the argument structure list in question is unembedded. The second and third clauses guarantee that only subjects and direct objects can be core roles.

(4.41)
$$\begin{bmatrix} \textit{passive-drv} & \\ \text{RESULT} & \begin{bmatrix} \textit{pass-v-lxm} & \\ \text{ARG-ST} & \left\langle \boxed{2}{:}\boxed{5}_i, \left\langle \boxed{1}, \boxed{5}_i \right\rangle \oplus \boxed{3} \right\rangle \\ \text{CORE} & \left\langle \boxed{2} \right\rangle \\ \text{OBLIQUE} & \left\langle \boxed{1} \right\rangle \oplus \boxed{3} \\ \text{CONT} & \boxed{4} \end{bmatrix} \\ \text{SOURCE} & \begin{bmatrix} \textit{trans-v-lxm} & \\ \text{ARG-ST} & \left\langle \boxed{1}, \boxed{2} \right\rangle \oplus \boxed{3} \\ \text{CORE} & \left\langle \boxed{1}, \boxed{2} \right\rangle \\ \text{OBLIQUE} & \boxed{3} \\ \text{CONT} & \boxed{4} \end{bmatrix} \end{bmatrix}$$

(4.42)
$$\begin{bmatrix} \textit{short-passive-drv} & \\ \text{RESULT} & \begin{bmatrix} \textit{short-pass-v-lxm} & \\ \text{ARG-ST} & \left\langle \boxed{2}{:}\boxed{4}_j, \left\langle \text{Q}_i, \boxed{4}_j \right\rangle \oplus \boxed{3} \right\rangle \\ \text{CORE} & \left\langle \boxed{2} \right\rangle \\ \text{OBLIQUE} & \boxed{3} \\ \text{CONT} & \begin{bmatrix} \textit{rel} & \\ \text{ACTOR} & i \\ \text{UNDERGOER} & j \end{bmatrix} \end{bmatrix} \\ \text{SOURCE} & \begin{bmatrix} \textit{trans-v-lxm} & \\ \text{ARG-ST} & \left\langle \boxed{1}_k, \boxed{2}_j \right\rangle \oplus \boxed{3} \\ \text{CORE} & \left\langle \boxed{1}, \boxed{2} \right\rangle \\ \text{OBLIQUE} & \boxed{3} \\ \text{CONT} & \begin{bmatrix} \textit{rel} & \\ \text{ACTOR} & k \\ \text{UNDERGOER} & j \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

This has the result that the only core role in a passive is the surface subject. Nothing else about the derivational type in (4.11) has been changed. In particular, the order and nesting on the ARG-ST list are still the same. The short passive derivational type is the one given (4.35), with the addition of core and oblique information.

The pieces are now in place for the revised control theory.

(4.43) **Control Theory** (final version)

If the CONTENT of an unsaturated phrase Y is the value of a semantic role in a control relation, then the first core role of Y is[15]

i. reflexive; and

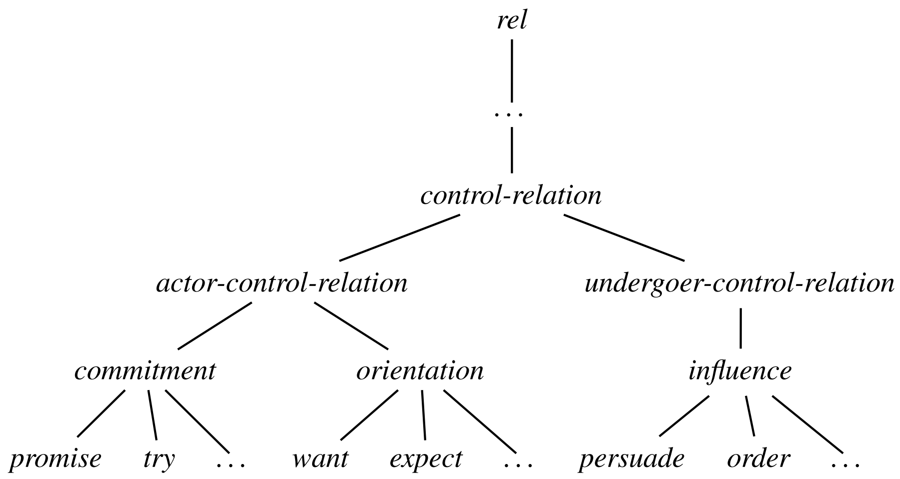
ii. coindexed with a core role not in Y[CORE $\langle \ldots \rangle$]; and

iii. coindexed with the ACTOR or UNDERGOER value in the control relation, according as the relation is of sort *actor-control-relation* or *undergoer-control-relation*, respectively

I take this control theory to be a constraint on lexical items whose content is a *relation* in the *control-relations* hierarchy, which was given in (2.41) of chapter 2. The fact that the control theory makes reference to the relevant argument of the unsaturated complement through the CORE list guarantees that the argument selected is the maximum a-subject, since the first member of the CORE list will always be coindexed with the first member of the ARG-ST list.

I will assume that the control relations are in a hierarchy that at some point inherits from the type *rel*. Following recent work in HPSG (Riehemann, 1993; Davis, 1996) I assume abstract semantic types that allow the control theory to affect the most general types possible. This entails modifying the *control-relations* hierarchy such that there is an abstract type for subject control and object control.

(4.44)



The control theory will now apply to the immediate subtypes of *control-relation*. An instance of a control relation, for example *try*, is still a control relation by virtue of the type of its relation, in this case *commitment*. However, in order to capture the two types of subject control relation,

[15]The added stipulation in the second clause that the core role is not in Y is needed to prevent vacuous satisfaction of the clause by coindexing the controllee with itself, which will always be possible.

commitment and *orientation*, with maximal generality, the abstract type *actor-control-relation* (*act-con-rel*) is needed. The type *undergoer-control-relation* is strictly speaking not necessary, since object control could be defined directly on the type *influence*, since this is the sole daughter of *undergoer-control-relation* (*und-con-rel*). However, the architecture of this hierarchy makes it is easy to add object control relations without having to adjust the definitions.

My control theory is now in place. This forms the last component of my revisions to binding and control. In the next section I show what the coverage of the theory developed here and illustrate how the streamlined binding theory, the Antecedent Closeness constraint, and the revised control theory account for various phenomena. In particular, I will show how the control theory now properly captures both Manzini's and Visser's generalizations and how the Antecedent Closeness Constraint predicts syntactic binding in extended domains.

4.6 Coverage of the Revised Control Theory

The control theory formulated in (4.43) gets the correct results for active subject and object control verbs. It does this by guaranteeing that any lexical entry that has a CONTENT value that is a subtype of *control-relation* must meet certain conditions or else be ill-formed. According to this control theory, the relevant parts of the entries for the subject control verb *promise* and the object control verb *encourage* would look like this:[16]

(4.45)
$$\begin{bmatrix} \textit{promise-verb} & \\ \text{ARG-ST} & \left\langle \text{NP}_i, \text{NP}_j, \text{VP}\begin{bmatrix}\text{CORE} \left\langle \text{NP}:\textit{refl}_i, \ldots \right\rangle\end{bmatrix}:\boxed{1} \right\rangle \\ \text{CORE} & \left\langle \text{NP}_i, \text{NP}_j \right\rangle \\ \text{CONT} & \begin{bmatrix} \textit{promise} & \\ \text{ACTOR} & i \\ \text{UND} & j \\ \text{X-ARG} & \boxed{1} \end{bmatrix} \end{bmatrix}$$

[16]I have assigned the third role the name X-ARG, which is meant to be reminiscent of the LFG assignment of XCOMP to controlled complements (Bresnan, 1982).

(4.46)
$$\begin{bmatrix} \textit{encourage-verb} & \\ \textsc{arg-st} & \left\langle \text{NP}_i,\ \text{NP}_j,\ \text{VP}\begin{bmatrix}\textsc{core}\ \left\langle \text{NP:}\textit{refl}_j,\ \ldots\right\rangle\end{bmatrix}\!:\boxed{1} \right\rangle \\ \textsc{core} & \left\langle \text{NP}_i,\ \text{NP}_j \right\rangle \\ \textsc{cont} & \begin{bmatrix} \textit{encourage} & \\ \textsc{actor} & i \\ \textsc{und} & j \\ \textsc{x-arg} & \boxed{1} \end{bmatrix} \end{bmatrix}$$

Notice that I am not saying that these are whole lexical entries. Rather, these are the parts of the lexical entries that are relevant to the control theory in (4.43). It is simple enough to check that the right information has been encoded. The triggering configuration for control obtains, since the VP is an unsaturated complement whose *content* is the value of a semantic role (X-ARG in this case) in a control relation. The *rel*s for *promise* and *encourage* are, respectively, subtypes of *commitment* and *orientation*. Clause (4.43i) is satisfied because the VP's maximum a-subject — the first core role — is a reflexive. Clause (4.43ii) is satisfied because the reflexive is coindexed with an item on the CORE list of promise and thus is coindexed with a controller. Finally, the third clause is satisfied by the coindexation between this reflexive and the appropriate semantic role of the control verb.

4.6.1 Manzini's Generalization

In the previous chapter, I explained that the second clause of the local a-command definition, (2.5ii), and the corresponding second case of local a-binding, (2.18b), were needed solely for HPSG's control theory. But, I also observed that (2.5ii) becomes problematic if we understand subcategorization in terms of the ARG-ST list, as we must for binding purposes. Therefore, in the Principle A I presented at the beginning of this chapter, I removed the problematic second clause of local a-command. This seemingly leaves us with no account of Manzini's generalization, which states that a control target must be controlled by an argument of the control verb. In this section I will show how the Antecedent Closeness Constraint accounts for this in my system.

Recall that Manzini's generalization basically states that a controlled complement in object position must be controlled by a coargument. The first clause of the control theory in (4.43) is responsible for capturing this generalization, along with the extended binding theory. For example, consider the following sentence.

(4.47) *Chrystale$_i$ said Gonzo encouraged Craig [NP:*refl*]$_i$ to behave herself$_i$.

The reflexive controllee is exempt from Principle A, but the first clause of control theory will result in an application of the Antecedent Closeness Constraint. The two close potential antecedents in this case are *Gonzo* and *Craig*. *Chrystale* is not a CPA, because there is an animate a-commander that is closer. Therefore, the ACC will coindex the understood subject with either *Gonzo* or *Craig*. But note that nothing technically prevents the second clause of control from coindexing the understood subject with *Chrystale*, since *Chrystale* is a core role and is not on the same CORE list as the understood subject. Finally, the third clause coindexes the understood subject with the UNDERGOER of *encouraged*, which is coindexed with *Craig*. The end result of all this will be the following coindexations.

(4.48) *Chrystale$_i$ said Gonzo encouraged Craig$_i$ [NP:*refl*]$_i$ to behave herself$_i$.

This structure is ruled out by two factors. First, there is unification failure between the index of *Craig* and *herself* due to conflicting specifications on GENDER. Similarly, there is unification failure between the indices of *Chrystale* and *Craig*. The second factor is that *Chrystale* a-binds *Craig* and this results in a Principle C violation.

It is possible to tease these two factors apart by making all three participants in (4.48) male.

(4.49) *Andrew$_i$ said Gonzo encouraged Craig$_i$ [NP:*refl*]$_i$ to behave himself$_i$.

The first factor — unification failure on indices — no longer applies, since the indices of the three coindexed overt NPs can unify. But, there is still a Principle C violation due to *Andrew* a-commanding and a-binding *Craig*.

These two cases should make it obvious that there could never be control from outside the control verb's clause. Even if there were an imaginary verb — like the verb *foobar* that we considered in section 2.5 — that had a controller outside the clause that contains the controlled complement, there would always be a Principle B or C violation due to the Antecedent Closeness Constraint coindexing the controlled subject with an argument of the control verb. Thus, the control theory captures Manzini's generalization. Furthermore, it captures it as a constraint on possible lexical items. The result of this control theory is that there could actually be no verb such as *foobar* in any language. Thus, the crosslinguistic prediction that Manzini's generalization represents is fully captured.

4.6.2 Inanimate Controllers

If the controller is inanimate it may at first blush seem that Manzini's generalization is not captured by the ACC and control theory. Consider a sentence like the following:

(4.50) Bob says Bill 101 promises to badly damage Anglo-French relations.

According to the definition, Y is a close potential antecedent of Z if there is no X such that a) Y nonlocally a-commands X, b) X a-commands Z, and c) X is animate. Both *Bob* and *Bill 101* satisfy these conditions.

Although, *Bob* is a CPA, Manzini's generalization is still captured. If *Bob* is picked up as the CPA, the following indexation results.

(4.51) Bob$_i$ says Bill 101$_i$ promises [NP:*refl*]$_i$ to badly damage Anglo-French relations.

The first clause of control leads to activation of the ACC, which is satisfied by coindexing *Bob* and the controllee. This coindexation also satisfies the second clause of control theory, since *Bob* is a core role. However, the third clause requires coindexation between *Bill 101*, the actor[17] of *promise*, and the understood subject of the controlled complement. This means that *Bob* and *Bill 101* are coindexed, which results in unification failure and a Principle C violation. First, the indices fail to unify due to differing values on the feature GENDER. Since English is a natural gender language, *Bob* will have the value *masculine* for this feature, while *Bill 101* will have *neuter*. However, even if this were a case of grammatical gender, in which case there would not necessarily be gender disagreement, there is still a Principle C violation, due to *Bob* a-binding *Bill 101*.

Thus, the theory developed here captures Manzini's generalization in all cases and makes the crosslinguistic prediction that there cannot be no lexical item that violates the generalization. Of course, whether this is true depends on crosslinguistic research, but this only indicates that the generalization itself is subject to disconfirmation. Indeed, a good hypothesis should be subject to being disconfirmed.

4.6.3 Visser's Generalization

In section 4.4.2, I demonstrated that the passive argument structure that I adopt suffices on its own to guarantee Visser's generalization in some cases. This argument structure predicts that any instance of passive where the surface subject is coindexed with the *by*-phrase is ungrammatical, even when the *by*-phrase has a reflexive index. These cases will always result in a Principle B or C violation, as the PP[*by*] precedes and locally a-binds the *content* of the surface subject if the PP and the *content* are coindexed. This automatically blocks cases like the following:

(4.52) a. *Gonzo$_i$ was promised to sing by Gonzo$_i$.
b. *Gonzo$_i$ was promised to sing by him$_i$.
c. *Gonzo$_i$ was promised to sing by himself$_i$.

These cases are blocked for the same reason that coreferential passives are in general.

The problem occurred with the following kinds of sentences, which should also be ungrammatical.

(4.53) a. *Gonzo$_i$ was promised to sing by Liza$_j$.
b. *Gonzo$_i$ was promised to sing by her$_j$.

[17] It may seem that ACTOR is a strange role to assign an inanimate subject, but feature names have no interpretation in HPSG. The feature could just as easily be called SUPERFLY or SPICY FETA, as far as the feature logic is concerned, but this would of course make the features less perspicuous.

These were erroneously predicted to be grammatical.

The control theory I presented in (4.43) correctly rules these sentences out. The passive ARG-ST for *promise* with an overt logical subject would be:

(4.54) *promise* (passive): ARG-ST ⟨NP:$\boxed{1}$, ⟨PP[by], $\boxed{1}$, VP[ARG-ST ⟨NP, ...⟩]⟩⟩

The first clause of control activates the ACC. There are two CPAs in this argument structure: PP[*by*] and $\boxed{1}$. The nonembedded NP is not a CPA because it does not a-command into the embedded list and therefore does not a-command the controlled subject.

However, this structure will be ruled out by the control theory independently of the ACC. No matter which CPA is selected, the structure will be ungrammatical. The third clause of control requires that the understood subject be coindexed with the ACTOR role, and this has the result that the understood subject is coindexed with the PP, since the PP is coindexed with the ACTOR role. However, the second clause of control requires the controllee to be coindexed with a core role. The only core role in this argument structure is the unembedded NP. This yields the following coindexation in the argument structure:

(4.55) *promise* (passive): ARG-ST ⟨NP:$\boxed{1}_j$, ⟨PP[by]$_j$, $\boxed{1}_j$, VP[ARG-ST ⟨NP$_j$, ...⟩]⟩⟩

This structure will be ruled out by one of two things. Either there will be unification failure between the NP and the PP, if they do not have the same agreement features, or there will be a Principle B or C violation, due to $\boxed{1}$ being locally a-bound. Thus, if the CPA is PP[*by*], the sentence will be ungrammatical according to the theory developed here.

The last case that has to be covered is that of short passive subject control verbs, like the following.

(4.56) *Gonzo was promised to sing.

I argued in section 4.4.1 that short passives have the following argument structure.

(4.57) *promise* (passive): ARG-ST ⟨NP:$\boxed{1}$, ⟨Q, $\boxed{1}$, VP[ARG-ST ⟨NP, ...⟩]⟩⟩

These are again ruled out by control theory independently of the ACC. The third clause coindexes the understood subject with the ACTOR which is in turn coindexed with the understood, quantified agent argument Q. This means that the understood subject is coindexed with Q. The second clause requires that the understood subject is coindexed with a core role. The only core role is the unembedded NP and coindexation with this argument entails coindexation with $\boxed{1}$. This means that Q and $\boxed{1}$ are coindexed and the sentence will be blocked by unification failure or Principle B or C.

4.7 Conclusion

The theory of control that I have developed in this chapter captures both generalizations about control relation. Visser's generalization is captured directly by the control theory, since controllers must be core roles, following Bresnan (1982). Core roles are an independently necessary part of the grammar, as argued by Manning (1996) and Manning and Sag (1999). Of course, why it should be that only core roles can serve as controllers is an extremely important question in its own right, but one that I cannot answer at this point.

Manzini's generalization, on the other hand, is a consequence of the extended binding theory. The Antecedent Closeness Constraint guarantees that the controller is always a coargument of the controlled clause, if there is one. Furthermore, it predicts that there can be control verbs that violate Manzini's generalization. Most imporantly, the problematic extended local a-command has been done away with. This clause was purely stipulative, since it was only used in control theory. The ACC covers the control cases, but in a nonstipulative manner, since this constraint also captures many binding facts to do with Super Equi-NP deletion, picture NPs, and reciprocals in specifier position.

Chapter 5

The Interpretation of Indices

5.1 Introduction

In the previous chapters, I have been developing an extended and revised version of binding and control. However, there is more to indices than just determining syntactic possibilities. Indices actually constrain semantic interpretation. In section 5.2, I propose a rule that interprets indices. Since HPSG lacks a model theory, I review the consequences of this rule in Discourse Representation Theory (Kamp and Reyle, 1993). The chapter ends with a restricted proposal for dealing with the phenomenon of logophoricity in English.

5.2 The Index Interpretation Rule

There has been a lot of work done on what coindexation and noncoindexation respectively entail. It is beyond the scope of this thesis to thoroughly review the various arguments[1], so I will only outline my own stance on this position and review some arguments for it.

The following rule encapsulates what I take to be the interpretation of indices:

(5.1) **Index Interpretation Rule** (IIR)
Coindexation of two NPs entails that the two NPs are covalued.

I will discuss the term "covalued" in more detail shortly, but for now it can be roughly glossed as (extensional) coreference. This rule borrows from the 'Linking Rule' of Fiengo and May (1994), but it is different in an important respect. Fiengo and May's linking rule is defined relative to a given sentence. They acknowledge that this is a problem given coindexation in discourse, and they redefine their rule relative to a sequence of sentences (Fiengo and May, 1994: 15). They give the following little two sentence text as an example that motivates the move to a sequence of sentences.

[1] Some crucial references on this topic, in chronological order, are: Lasnik (1976), Evans (1980), Chomsky (1981), Reinhart (1983), Higginbotham (1985), Chomsky (1986b), Fiengo and May (1994), Chomsky and Lasnik (1995).

(5.2) Superman$_i$ is faster than a speeding bullet. He$_i$ also leaps tall buildings in a single bound.
(Fiengo and May, 1994: 15, (16))

However, there is no reason to assume that the pronoun in the second sentence must be coindexed with *Superman*. This also entails that the coindexation mentioned in the IIR does not need to be relative to sentences or contexts, etc. This is an important facet of the IIR: it says only that if two NPs are coindexed then they are covalued. It does not have anything to say about cases in which two NPs are not coindexed. Most importantly, the IIR *does not* say that noncoindexation entails noncovaluation.

Higginbotham (1985: 569–570) presents a compelling argument for the IIR being stated as it is here and Fiengo and May (1994: 3) adopt it, too, in formulating their Linking Rule. Suppose Gonzo and Craig are watching someone leave a party and Gonzo asks Craig who the person is. It is reasonable for Craig to reply "I'm not sure, but she put Chrystale's coat on.", meaning to imply that the person is Chrystale. According to Principle C, the embedded sentence in Craig's statement can have the indexation in (5.3a), but not the one in (5.3b).[2]

(5.3) a. She$_i$ put Chrystale$_j$'s coat on.
b. She$_i$ put Chrystale$_i$'s coat on.

This example shows that coindexation does not determine covaluation. That is, being noncoindexed does not entail being noncovalued.

Similar arguments were presented in Evans (1980). He gave the example of an exasperated logic teacher saying this to an inept pupil.

(5.4) Look, fathead. If everyone loves Oscar's mother then certainly Oscar must love Oscar's mother.

The second sentence must have the following indices to be sanctioned by Principle C, which states that a nonpronominal cannot be bound in any domain.

(5.5) If everyone loves Oscar$_i$'s mother then certainly Oscar$_j$ must love Oscar$_k$'s mother.

However, it is clear that the logic teacher means all instances of *Oscar* to denote the same individual. This again shows that noncoindexation does not entail noncovaluation. However, it does not show that coindexation does not entail covaluation. The arguments due to Evans and Higginbotham show that a rule about the interpretation of indices can be an entailment between coindexation and covaluation, but cannot be a biconditional between the two.

[2] Of course, in assigning nonidentical indices to NPs, which values are used is unimportant, as long as they are nonidentical. In fact, the form of the indices is immaterial as long as they have an easily defined identity relationship.

Given this, I think that Fiengo and May (1994) have made a mistake in assigning the same indices to discourse anaphoric pronouns and their antecedents in order to determine covaluation. It is not a necessary move, since even when they are not coindexed they may still be covalued. But perhaps this is due to the way they conceive of indices as being generated to begin with. I take it that coindexations are determined by the grammar of HPSG that I have developed, and are not assigned randomly and then evaluated as in some GB approaches (Chomsky, 1981; Chomsky and Lasnik, 1995). For example, Principle A and the ACC act as feature structures that add information to another feature structure. If the second structure meets the triggering requirements of these constraints, they add the coindexation information. Likewise, Principles B and C disallow coindexations under certain conditions. Therefore, the syntax will determine what things are definitely coindexed or definitely not coindexed. However, there is nothing in the grammar that coindexes two NPs other than binding and control theory. Therefore, we can assume that any two NPs in the grammar are not coindexed *unless some constraint adds this information*. This entails that in the grammar developed here the indices on (5.2) would be like this.

(5.6) Superman$_i$ is faster than a speeding bullet. He$_j$ also leaps tall buildings in a single bound.
(Fiengo and May, 1994: 15, (16))

As just discussed, this representation does not mean that *he* is not anaphoric on *Superman*. Rather, it means that the syntax does not determine covaluation in this case.

But what exactly does it mean for two NPs to be 'covalued'? The interpretation of this term depends on the type of NPs that are coindexed and the semantic theory it is understood relative to. For example, consider the case where NP1 is a quantified noun phrase and NP2 is a reflexive and a treatment like Montague's PTQ is being assumed (Montague, 1974). In such a treatment, covaluation means that the reflexive ranges over the individual concepts in the set of individual concepts that the restrictor of the generalized quantifier picks out. Thus, the reflexive acts as a bound variable. If NP1 is a name and NP2 is a reflexive then they both denote the set of properties of the individual concept named. The interpretation of reciprocals is not as straightforward, as they cannot reasonably be construed as picking out the same things in the model universe as their antecedents, since they perform some kind of distribution over their antecedents. I will discuss reciprocals further in the next chapter.

In the next section I will offer an interpretation of indices, alternatively an implementation of the IIR, in the Discourse Representation Theory (DRT) of Kamp and Reyle (1993).

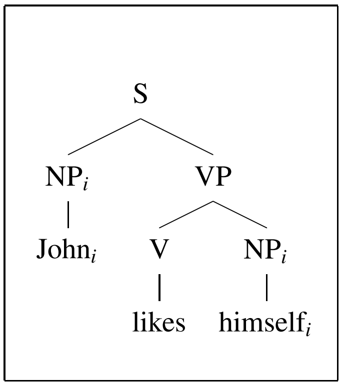
5.3 Coindexation in Discourse Representation Theory

The comments I will make about DRT essentially presume the version presented in Kamp and Reyle (1993), but without the syntactic component. There are two principal reasons for selecting this strategy. First, I do not wish to presume the GPSG[3] syntactic engine that they adopt. In fact, the comments in this section could be incorporated in a theory of DRT no matter what syntax it presupposes. Second, the ideas presented here could be easily extended to modifications of DRT, such as Underspecified Discourse Representation Theory (UDRT; Reyle 1993). Since I am assuming the standard version of DRT presented in the major work in the theory (Kamp and Reyle, 1993), I will not be presenting the model theory or the well-formedness criteria for Discourse Representation Structures (DRSs), etc. For these details the reader is invited to consult Kamp and Reyle (1993). Furthermore, since I wish to present a general thesis about the interpretation of indices, I will not be providing construction rules that map any particular syntactic theory, including the one developed here, into DRSs.

If coindexation entails coreference, and is determined syntactically, then it is pointless for DRT to recapitulate syntactic binding conditions, as it does in the version of Kamp and Reyle (1993: 233–239). Therefore, I will be assuming one crucial change to DRS construction that can be grafted into whatever syntax-DRS mapping is being assumed. Namely, I assume that the syntactic structures that are used for constructing DRSs bear the indices that are used by binding theory. These indices are also present on the discourse conditions introduced by certain nominals. However, the index has no model theoretic interpretation, meaning that the the model theory of DRT does not have to be adjusted. This means that an unresolved DRS would have the following form.

(5.7) a. John$_i$ likes himself$_i$.

b.



I've used a simple phrase structure grammar to give a neutral representation of the syntax. The point is that the coindexation information is included in the syntactic structure.

I assume the following constraint on coindexation.

[3] 'Generalized Phrase Structure Grammar' (Gazdar et al., 1985)

(5.8)

Coindexation Constraint
If *index*(α_i) = *index*(β_j), then add to the condition set of the highest accessible DRS *referent*(α_i) = *referent*(β_j). **Definitions:** *index*(Φ_i) yields i, the index of Φ *referent*(Φ_i) yields the discourse referent that Φ introduces

This constraint basically adds a condition of the form **x = y** to the information in the highest DRS that is accessible to both **x** and **y**, where **x** is the discourse referent of α_i and **y** is the discourse referent of β_j.

I've left the exact algorithm that calculates the values in the Coindexation Constraint purposefully unspecified, since it depends on details of implementation and on the syntactic theory that is being assumed. In an actual implementation of DRT, this could be achieved via a variable binding operation, such that the two discourse referents are bound to the same variable and will thus get instantiated to the same value. By examining cases I will show that this constraint gets the right results.

The first case is where NP1 is a name and NP2 is a coargument anaphor.

(5.9) a. Simon$_i$ admires himself$_i$.

b.

x y
Simon$_i$(x) x admires y x = y

=

x
Simon$_i$(x) x admires x

Once the condition x = y in the first DRS is resolved, the second DRS is the end result. It has the usual model theoretic interpretation such that the second DRS is true in a model if and only if it is verified in that model by some embedding function. In this case, what this amounts to is that (5.9b) is true if and only if there is a model in which the individual in the universe that *Simon* is mapped to forms a pair with itself in the set of pairs denoted by *admires*. For the rest of the cases, I will not discuss (even this informally) the model theoretic interpretation, since I am not assuming anything different from Kamp and Reyle (1993), to which the reader can refer if they wish to check that the DRSs give the correct interpretations for the sentences they translate.

Next I turn to a case where NP1 is a quantifier and NP2 is a reflexive acting as a bound variable.

(5.10) a. Every cat_i cleans itself_i.

b.

$$\boxed{\boxed{\begin{array}{c} \text{x} \\ \\ \text{cat}_i(\text{x}) \end{array}} \Rightarrow \boxed{\begin{array}{c} \text{y} \\ \\ \text{x cleans y} \\ \text{x = y} \end{array}}}$$

$$= \boxed{\boxed{\begin{array}{c} \text{x} \\ \\ \text{cat}_i(\text{x}) \end{array}} \Rightarrow \boxed{\text{x cleans x}}}$$

Again, this DRS has the usual DRT interpretation. The results would still be similar assuming the DRT definition of generalized quantifiers (Kamp and Reyle, 1993).

The final set of cases to be considered are cases of exempt anaphors (leaving reciprocals aside, for the moment) that the ACC has coindexed with something else. The basic cases are those of picture NPs, Super Equi and control.[4]

(5.11) a. Gonzo_i does not like the picture of himself_i.

b.

$$\boxed{\begin{array}{c} \text{x} \\ \\ \text{Gonzo(x)} \\ \neg \boxed{\begin{array}{c} \text{y z} \\ \\ \text{the picture(y)} \\ \text{y of z} \\ \text{x like y} \\ \text{z = x} \end{array}} \end{array}}$$

[4] In (5.11b) I am glossing over the presupposition attached to the definite description, which would project it into the main DRS.

<table><tr><td>=</td><td><table border="1"><tr><td colspan="2">x

Gonzo(x)</td></tr><tr><td>¬</td><td><table border="1"><tr><td>y

the picture(y)
y of x
x like y</td></tr></table></td></tr></table></td></tr></table>

(5.12) a. Craig$_i$ says P$_i$ tickling himself$_i$ is fun.

b.

<table border="1"><tr><td colspan="2">x e′

Craig(x)
x says p</td></tr><tr><td>p:</td><td><table border="1"><tr><td colspan="2">y z</td></tr><tr><td>e′:</td><td><table border="1"><tr><td>y tickling z</td></tr></table></td></tr><tr><td colspan="2">x = y
y = z
fun(e′)</td></tr></table></td></tr></table>

<table><tr><td>=</td><td><table border="1"><tr><td colspan="2">x e′

Craig(x)
x says p</td></tr><tr><td>p:</td><td><table border="1"><tr><td>e′:</td><td><table border="1"><tr><td>x tickling x</td></tr></table></td></tr><tr><td colspan="2">fun(e′)</td></tr></table></td></tr></table></td></tr></table>

(5.13) a. Andrew persuaded Gonzo$_i$ P$_i$ to dance.

b.

$$\begin{array}{|c|}\hline x\ y\ z \\ \\ \text{Andrew}(x) \\ \text{Gonzo}(y) \\ x \text{ persuaded } y\ p \\ p: \begin{array}{|c|}\hline z \\ \\ z \text{ dance} \\ z = y \\ \hline\end{array} \\ \\ \hline\end{array}$$

$$= \begin{array}{|c|}\hline x\ y \\ \\ \text{Andrew}(x) \\ \text{Gonzo}(y) \\ x \text{ persuaded } y\ p \\ p: \begin{array}{|c|}\hline y \text{ dance} \\ \hline\end{array} \\ \\ \hline\end{array}$$

The details of these DRSs other than the discourse referents are largely irrelevant and are most likely partially incorrect. The point is that syntactic coindexation, no matter what the source, leads to sharing of discourse referents. This is how the IIR is cashed out in DRT.

Although I've not demonstrated the technical details of its application, it should be clear that the IIR is a promising rule for semantic interpretation and that it is sufficiently general to be incorporated into most semantic theories. In fact, once the IIR is assumed, then a semantic theory is free to treat noncoindexed items as covalued or noncovalued, according to the dictates of the theory. The last case to consider, specifically with respect to anaphors, is that of noncoindexed anaphors. I will refer to these cases as logophoric anaphors.

5.4 Logophoric Anaphors

The term 'logophoric pronoun' was introduced by Hagège (1974). He observed that many African languages have particular forms of pronouns that are used to refer to an antecedent whose speech, emotions, or thought are being reported (Hagège, 1974; Sells, 1987). These pronouns have distinct morphological paradigms and different restrictions on their distribution (Hagège, 1974). However, various authors have discussed cases of nondistinct forms being used in a logophoric fashion. For example, this has been proposed for the following reflexives: Japanese *zibun* (Sells, 1987; Kuno, 1987), Icelandic *sig* (Maling, 1984; Sigurthsson, 1986), and English *-self* anaphors (Zribi-Hertz, 1989; Reinhart and Reuland, 1991, 1993), among others.

In the extended binding theory presented in this thesis, Principle A and the ACC will coindex most reflexives with an a-commander. The most significant place in which these syntactic conditions do not apply is across a sentence boundary. Therefore, the only truly logophoric use of reflexives is when an *exempt* anaphor is contained in a constituent that is in subject position.

(5.14) John$_i$ was going to get even with Mary. That picture of himself$_j$ in the paper would really annoy her, as would the other stunts he had planned.
(Pollard and Sag, 1994: 270, (94))

In the original example, *himself* was assigned the index *i* (Pollard and Sag, 1994). However, there is no reason to assume that the reflexive has this index. Coindexation is added information and must be added by some mechanism. If no mechanism adds coindexation, it does not occur. And since Principle A and the ACC do not apply across sentence boundaries, there is no syntactic coindexation between *John* and *himself*.

This means that according to the IIR, *John* and *himself* may or may not be covalued. Thus, it may seem that the usual discourse processes are free to operate in finding an antecedent for *himself*. In DRT, for example, this might mean treating the resolution of *himself* similarly to other pronouns, such that *himself* can take any appropriate antecedent, so long as the antecedent is accessible from the reflexive's DRS. However, there is reason to believe that the interpretation of noncoindexed reflexives is not as free as this. As Pollard and Sag (1994: 266ff.) note, these reflexives are solely used in stating the point of view of a participant in the narrative. This is witnessed by the ungrammaticality of another version of example (5.14).

(5.15) *Mary was quite taken aback by the publicity that John$_i$ was receiving. That picture of himself$_j$ in the paper had really annoyed her, and there was not much she could do about it.
(Pollard and Sag, 1994: 270, (95))

In (5.15), *John* is accessible to the reflexive, since the discourse condition introduced by the name is added to the main DRS. Therefore, there is no discourse representation theoretic reason that this sentence should be out. But, it is clear that (5.15) no longer expresses John's point of view, since it is Mary's feelings that are being described. In fact, the second sentence is fine if *herself* is used instead of *himself*.

(5.16) Mary$_i$ was quite taken aback by the publicity that John was receiving. That picture of herself$_j$ in the paper had really annoyed her, and there was not much she could do about it.

Now, the discourse is fine, although it sounds a little strange since it has not been explained why pictures of Mary should give John publicity. But, suppose Mary is a TV evangelist and John is her estranged lover who has gone to the media with compromising photographs of Mary, hoping to ruin her reputation. This background information improves the felicity of (5.16) and it is clear that the reflexive is in fact licensed.

Similarly, a passing knowledge of current events during the summer of 1998 should provide the necessary background knowledge to interpret this slightly altered version of (5.16).

(5.17) Bill$_i$ was quite taken aback by the publicity that Monica was receiving. That story about himself$_j$ in the paper had really annoyed him, and there was not much he could do about it.

I take it that I don't have to invite the reader to suppose that Bill is an American president and Monica is his estranged lover or what the compromising evidence is in this case.

As mentioned above, logophors are used to refer to a discourse participant whose speech, thoughts, or emotions are being reported. Point of view is then essentially the same sort of notion. Therefore, I present the following condition to capture the behaviour of noncoindexed anaphors.

(5.18) **Condition on Logophoric Reflexives** (first version)
A reflexive functions logophorically if it is not coindexed with another element.

Notice that this condition applies to reflexives and not reciprocals. It is uncertain whether the latter function logophorically; at least, there is no mention of logophoric uses of reciprocals in the literature. In addition, a reciprocal in similar discourses to the ones here is ungrammatical.

(5.19) a. *John and Mary were nervous, but ecstatic. Those pictures of each other had made the final round of the model selection competition.

b. *The boys slinked in morosely. Those stories about each other could cause a lot of trouble at home.

In each case, the use of a pronominal *them* or *themselves* makes the discourse much better. However, it is clear that the two discourses here are still told from the point of view of *John and Mary* and *the boys*, respectively. If the reciprocal has a logophoric use, it then remains mysterious why these sentences are out, when the counterparts with reflexives are not. This must be studied in more detail, but for now I will restrict my attention to logophorically functioning reflexives.

The condition in (5.18) must be made more precise by defining what it means for a reflexive to function logophorically. Sells (1987) proposes that the notion of logophoricity must be broken down into the following three components:

(5.20) SOURCE: one who is the intentional agent of the communication.
SELF: one whose mental state or attitude the content of the proposition describes.

PIVOT: one with respect to whose (space-time) location the content of the proposition is evaluated.
(Sells, 1987: 457)

These are discourse roles that can be specified as taking a discourse-internal referent or the external speaker (the one who utters or writes the discourse; not to be confused with SOURCE). The roles are meant to define distinct discourse environments, depending on whether they take external or internal referents.

Sells (1987: 457) proceeds to augment DRT with these roles, as follows. First he adds notationally distinct discourse conditions to represent the three discourse roles, and a notationally distinct discourse referent to represent the external speaker.

(5.21) σ represents SOURCE
φ represents SELF
$\heartsuit$ represents PIVOT
S represents the external speaker

This allows him to provide the following lexical entry for the verb *say*.[5]

(5.22)

$$\begin{array}{|c|}\hline \mathrm{S\ u\ p} \\ \mathrm{u\ say\ p} \\ \mathrm{p:}\ \begin{array}{|c|}\hline \sigma(\mathrm{u}) \\ \varphi(\mathrm{u}) \\ \heartsuit(\mathrm{u}) \\ \vdots \\ \hline \end{array} \\ \hline \end{array}$$

The idea is that a pure logophoric pronoun will have to have as an antecedent the referent that one of these roles is a condition on. Sells (1987: 459) envisages that even nonlogophoric pronouns can optionally do this. An example, due to Sells (1987: 459, (40)), will show best how this works in practice.

(5.23) a. Max said that Louise loved him.

[5] In this case, the external speaker referent, S, is not doing anything, but it gets picked up by the logophoric discourse conditions in certain other cases.

b.

S u p

Max(u)
u say p

p:

v w

σ(u)
φ(u)
$\heartsuit$(u)

Louise(v)
v loved w
w = $\heartsuit$

The link w = $\heartsuit$ is meant to indicate that w takes as its antecedent whatever the PIVOT role is predicated of[6] (Sells, 1987: 459), which is *u* in this case. As Sells mentions, the direct equality w = u is also possible.[7]

The distinction with logophors is that they obligatorily take discourse roles as antecedents. For example, Sells provides evidence that Japanese *zibun* always binds to the discourse marker predicated of PIVOT. This allows the term 'functions logophorically' to be cashed out as 'must have a particular discourse role as its antecedent'. The final requirement, then, is to determine what discourse role these noncoindexed reflexives require. The role in Sells' system that basically represents point of view is SELF. Therefore, I will replace the previous condition on noncoindexed reflexives, with the following one:

(5.24) **Condition on Logophoric Reflexives** (final version)
A reflexive must have a SELF discourse antecedent if it is not coindexed with another element.

In the brief discourses in (5.14) and (5.16) above, in each case the discourse referent that was the SELF was also the antecedent of the reflexive and the discourse was felicitous. But, in the

[6]Of course, the pronoun can actually take any discourse referent that is accessible; but this case is meant to illustrate a logophoric usage.

[7]However, he makes a small mistake in his interpretation of DRT here. He writes "Intuitively, the first case represents the situation where the speaker reports what Max actually said ('Lousise loves me'), whereas in the second case the speaker reports the simple fact of the matter ('Louise loves Max')". In fact, this presupposes that the logic that DRT provides is intensional, when it is actually extensional. In other words, after resolution of w = $\heartsuit$, the result will be the condition w = u. DRT in no way distinguishes *how* this condition was arrived at. In effect, both w = $\heartsuit$ and w = u are the same and the two distinctions that Sells mentions are lost by the time the DRS is interpreted.

infelicitous (5.15), the antecedent of the reflexive was not the referent of the SELF role, and the reflexive was therefore not licensed.

Of course, this is all highly informal. Sells does not provide a model theoretic interpretation for his roles, and to do so here is beyond the scope of this thesis. Furthermore, there must be some mechanism for updating which discourse referent is the SELF, SOURCE or PIVOT at any point in a discourse. Until these gaps are filled in, this is essentially just more syntax. On the other hand, pursuing this system and its predictions could be a direction for future work. At least it offers the hope of providing an account of logophoricity, since this phenomenon is very sensitive to discourse structure.

5.5 Conclusion

In this chapter I have provided arguments for interpreting indices as not completely determining covaluation. In particular, I proposed the IIR, which states that coindexation entails covaluation, but does not mention the opposing entailment. Given the arguments reviewed, this seems to be the correct result. In the second section, I illustrated the effect that the IIR should have in Discourse Representation Theory and proposed some small modifications and the Coindexation Constraint. However, more work has to be done to determine the exact formalization of this constraint. Similarly, in the last section, I discussed the notion of logophorically functioning anaphors and gave an informal rule for interpreting them. By developing the system presented in Sells (1987), it should be possible to give an explicit account of logophoric reflexives, but I leave this for future work.

Chapter 6

Reciprocals and Quantification

6.1 Introduction

It is tempting to treat the English reciprocal expression *each other*[1] as a kind of quantifier, given its overt form and its meaning. Indeed, two recent treatments of reciprocal expressions, Heim et al. (1991) and Dalrymple et al. (1998), have done just this, although in different ways. However, there is no consensus opinion on the quantificational status of reciprocals. In her treatment of reciprocals, Moltmann (1992) argues that reciprocals are not quantifiers. It is therefore necessary to systematically examine reciprocal expressions for evidence that they're quantifiers. This is not only of relevance to the semantics of reciprocals and their status as syntactic anaphors (i.e. their status with respect to binding theory). It also affects our conception of just which expressions can function as quantifiers, since the reciprocal shows certain morphological, syntactic and semantic asymmetries to other quantificational expressions; not just in English, but also crosslinguistically.

In this chapter, I will perform a class of tests on the English reciprocal expression. The tests broadly fall under the heading of quantifier scope tests. This refers to the fact that in all natural languages there is a well documented interaction between quantifiers and various other types of expressions. Under certain syntactic restrictions, quantifiers can either take scope outside or inside these other operators. That is, the quantifier can be applied to a sentence either before or after certain other operators are applied to the sentence. Most importantly, this difference is truth conditional and thus is a proper part of the semantic and logical study of sentence meaning. Therefore, quantifier scope interactions are often referred to as "scope ambiguities",

[1]English also has another reciprocal, *one another*. However, I have yet to see any data that really distinguishes the two. Quirk et al. (1985: p. 364) note that "[a]lthough in prescriptive tradition, *each other* is sometimes preferred for reference to two and *one another* to more than two, this distinction seems to have little foundation in usage." In fact, as they go on to note, *one another* is considered more formal and hence stylistically marked. This is corroborated by the fact that in large corpora, such as the British National Corpus, *each other* occurs far more often than *one another*. I acknowledge the fact that it is in many respects dangerous to make assumptions of synonymy and equivalent syntactic behaviour regarding two items, but at this preliminary stage especially, I think that any potential differences are minor and should not be the focus of analysis.

since they lead to an ambiguity in the truth conditions of a sentence, depending on which scope assignment is made. Thus, if *each other* is a quantifier, it should exhibit the same ambiguities in interpretation as other quantifiers. If it does not, then one must either reject the hypothesis that it is a quantifier or independently account for the lack of ambiguity in each aberrant case.

6.2 Arguments for Reciprocals as Quantifiers

First, let us look at the evidence that has previously been put forward for reciprocals being quantifiers. There are four main pieces of evidence: meaning representation, superficial similarity to the quantifier *each*, distribution, and scope interaction with propositional attitude verbs. Let us examine each in turn.

Meaning representation refers to the fact that it seems straightforward to give the semantics of the reciprocal using quantified predicate calculus. For example, if we were to take the antecedent of the reciprocal as the restriction of a universal quantifier, we could interpret (6.1a) as in (6.1b).

(6.1) a. The girls like each other.

b. $\forall x \forall y (x \neq y \rightarrow likes(x, y))$[2]

The antecedent of the reciprocal, *the girls*, is providing the restriction for the universal quantifiers. Thus, we know that x and y are ranging over the set of girls in question. In other words, the argument is that since the meaning of (6.1a) can be represented using quantifiers, as in (6.1b), we have reason to believe that the reciprocal is a quantifier.

However, as evidence for the quantification status of reciprocals (or anything else for that matter), meaning representation is circumstantial at best and nowhere in the literature is it cited as a reason for considering reciprocals to be quantifiers. On the other hand, all of the major treatments of reciprocals cited in this chapter use quantified predicate calculus to represent the semantics of reciprocals. Therefore, it would be tempting to argue that since reciprocals are readily translated using quantifiers, perhaps they are just complex quantifiers in their own right.

The second argument is in the same vein and has been proposed, in Fiengo and Lasnik (1973) and Heim et al. (1991). This argument is that it is superficially obvious that the expression *each other* contains the word *each*, which is arguably a quantifier. Now, we could then attempt to compositionally derive the syntax and semantics of *each other* from the syntax and semantics of *each* and *other*. Then *each other* would be at least partly a quantifier, since it is partly derived from a quantifier, *each*.

Similarly, it has been argued in these two papers that *each other* can be seen as a case of *each . . . the other* constructions such as:

(6.2) Each of the girls likes the other.

[2] In (6.1a), I'm assuming, for simplicity's sake, a domain of discourse restricted to girls.

Indeed, it certainly seems that this equivalence holds for simple cases like (6.1a) and (6.2).

This leads us directly to the third argument for reciprocals being quantifiers: distributivity. Given a noun phrase whose specifier is a universal quantifier, such as *each* or *every*, the quantifier distributes the predicate in its nuclear scope over the elements in its restriction.

(6.3) a. Each boy found a penny.

b. Every boy found a penny.

Of course, these sentences are scopally ambiguous (with the possible exception of (6.3a)), but the important point is that they both have a distributive reading. Let us say that there are five boys we are talking about in (6.3a–b). Then, the situations these sentences describe each involve five pennies.

A similar effect of distributivity is observed for sentences containing *each other*. However, in this case it is the antecedent of the reciprocal which is distributed in relation to the predicate taking the reciprocal as an argument. For instance, in the situation described by sentence (6.1a), each girl must like the other ones. Thus, the predicate of liking the other girls is distributed over the set of girls in question. Since the reciprocal distributes in a similar manner to universal quantifiers, this suggests that reciprocals are a kind of universal quantifier themselves. This is orthogonal to whether they actually *contain* the quantifier *each* (Heim et al., 1991) or just behave similarly without this being the case (Dalrymple et al., 1991, 1998)

The fourth piece of evidence is the most compelling; it has to do with the behaviour of reciprocals embedded under propositional attitude verbs. Higginbotham (1980) was the first to observe the ambiguity in sentences such as (6.4a), which has the two readings in (6.4b) and (6.4c).[3]

(6.4) a. Chrystale and Craig believe they appeal to each other.

b. Chrystale and Craig believe Chrystale and Craig appeal to each other.

c. Chrystale believes she appeals to Craig and Craig believes he appeals to Chrystale.

Heim et al. (1991), following Higginbotham (1980), Lebeaux (1983), and Chomsky (1986b), note that this can be viewed as a scope ambiguity so long as the reciprocal is treated as a scope-bearing element. The reading in (6.4b) results when the reciprocal takes narrow scope with respect to the propositional attitude verb *believe*, whereas the second reading occurs if the reciprocal takes wide scope. The two readings seem similar on first inspection, but they are actually truth conditionally different. The narrow scope reciprocal reading, (6.4b), involves each person having a belief about him- or herself *and* a belief about the other person. However, the second reading, (6.4c) involves each person having beliefs *only* about him- or herself.

[3] I will return to a discussion of the plural pronoun shortly.

Now, if this is indeed a matter of a scope interaction between the propositional attitude verb *believe* and the reciprocal, then this is evidence that the reciprocal is a quantifier. The reason for this is that a quantifier is the kind of thing that scopally interacts with a propositional attitude verb. A simplified example serves to illustrate:

(6.5) a. Chrystale believes she appeals to everyone.

b. Chrystale believes that every person x is such that she appeals to x.

c. Every person x is such that Chrystale believes she appeals to x.

In the narrow quantifier scope reading, (6.5a), Chrystale has one belief, but in the wide quantifier scope reading, she has as many beliefs as there are people (in the contextually restricted sense). Thus, this is a truth conditional difference, albeit a subtle one.

The most striking examples of this type of interaction between the reciprocal and propositional attitude verbs are those which involve the reciprocal as an argument of an asymmetric predicate which is then embedded in a propositional attitude context. Consider (6.6) and (6.7):[4]

(6.6) #They are taller than each other.

(6.7) They$_i$ think they$_i$ are taller than each other.

(Heim et al., 1991: p. 85, (68–69))

As Heim et al. (1991) observe, (6.6) is simply a contradiction, since the comparative is a asymmetric predicate that can't simultaneously be true of all of the antecedent set. However, once we embed (6.6) in a propositional attitude context, as in (6.7), there is a noncontradictory reading; namely, if we were to treat the reciprocal as a scope-bearing element, the reading in which it takes wide scope over the verb *think*. Thus, the noncontradictory reading is one in which each of them thinks s/he is taller than the others.

However, a name or pronoun does not exhibit this same kind of behaviour, as we can observe by performing an appropriate substitition for the quantifier in (6.5a)[5]

(6.8) a. Chrystale believes she appeals to Craig/him.

b. Chrystale believes that Craig/he is such that she appeals to him.

c. Craig/he is such that Chrystale believes she appeals to him.

Truth conditionally, (6.8a) is equivalent to (6.8b), since each entails the other. As long as we perform no substitution with coreferential names, this equivalence holds.

[4]In this chapter, I'm using the hash sign to indicate semantic anomaly in a sentence that is syntactically well-formed. I'll use the question mark to indicate a sentence whose syntactic grammaticality is under question, but which is not obviously ungrammatical either. Finally, I'll use the exclamation mark to indicate a sentence that is anomalous principally due to world knowledge.

[5]I'm assuming here that the name is indeed referential. The complications that arise from mythical or fictional names like *Atlantis* or *Narnia* are not important to the central point here.

To sum up, when embedded under a propositional attitude verb, the reciprocal behaves like a quantifier and unlike a name or pronoun. Therefore, we could make the assumption that the reciprocal is not a pronoun, but is in fact a quantifier, with the scope-bearing properties this entails.

In this section, I have shown that there are four arguments, of varying strengths, for the reciprocal *each other* being a quantifier. The first argument is about meaning representation: since the meaning of the reciprocal is readily represented using quantifiers, then we could conclude that it is a sort of complex quantifier. The second argument is from the similarity between the reciprocal and the less controversially quantificational *each*. The third argument is that the reciprocal, like universal quantifiers, leads to a distributive reading of a predicate. The last argument, is that like quantifiers, the reciprocal exhibits a scope interaction with propositional attitude verbs such as *believe*.

6.3 Counterarguments

Although the arguments presented in section 6.2 are somewhat compelling — particularly the arguments regarding distributivity and propositional attitude contexts and scope — there is counterevidence available. In fact, I will argue that the effects observed in the previous section can be explained without treating the reciprocal as a quantifier.

The argument regarding meaning representation is straightforwardly dismissable. All that this argument claims is that since it is straightforward, in simple cases, to represent the reciprocal as an iteration of quantifiers, then perhaps it literally is a quantifier. Thus, the only strong claim is that *each other can* be represented using quantifiers, not that this must be done. Indeed, this argument is essentially abductive and is based on the premise that if the reciprocal is a quantifier then it is representable using quantifiers. What we know is that the reciprocal is representable using quantifiers. We also know that quantifiers can be represented using quantifiers. Therefore, until we have evidence to the contrary, we can tentatively conclude that the reciprocal is a quantifier. In summary, the argument from meaning representation is weak because of its form as an abductive argument. Indeed, even if the reciprocal is *not* a quantifier, this argument is not falsified. As a result, it cannot be the decisive argument on this point.

The second argument had to do with the superficial similarity between *each other* and the universal quantifier *each*. As mentioned above, this argument is particularly exploited in Fiengo and Lasnik (1973) and Heim et al. (1991). There are two counterarguments in this case. The first is that superficial, synchronic similarity does not guarantee likeness of behaviour. Although the similarity between these two forms is probably not coincendental, this provides no guarantee that, at this point in time, there is parity of syntax or semantics. It is quite likely that there is some diachronic relation between the forms, but this does not form an argument for synchronic similarity.

However, Fiengo and Lasnik and Heim et al. do not simply claim syntactic and semantic similarity based on surface form. These papers essentially make the claim that the behaviour of *each other* can in an interesting and principled way be derived by making the assumption that it literally is composed from the quantifier *each* and the adjective *other* and that the reciprocal is, as a result, a quantifier in its own right, inheriting this property from *each*. Heim et al. (1991) argue for an analysis in which this is achieved by launching *each* (via movement) and leaving a phrase containing the trace of the *each*-movement and *other* (i.e. [*e other*]). They further argue that, for the purposes of binding theory, the trace of *each* is an anaphor and therefore subject to Principle A of the GB binding theory (Chomsky, 1981), whereas [*e other*] is an referring expression and therefore subject to Principle C. They use this distinction to explain certain facts about the "long-distance" scope-taking abilities of *each other*, as discussed with regards to propositional attitude verbs above. Heim et al. use the nomenclature "distributor" to refer to this moved *each* and "reciprocator" to refer to the [*e other*] complex.

The second objection to the similarity argument stems from empirical data. In a 1994 *Linguistic Inquiry* paper, Dalrymple, Mchombo, and Peters reply to Heim et al.'s analysis. Their basic complaint is that the analysis Heim et al. give fails to generalize to languages other than English. The semantics of reciprocals seems to be uniform across languages, although many languages encode the reciprocal in morphosyntactic ways which are very distinct from English. Since the Heim et al. account postulates a semantic analysis of reciprocals that is fuelled by their morphosyntactic properties (e.g. separating *each* and *other*, movement of these constituents, and various coindexation possibilities), it fails to predict the cross-linguistics semantics of reciprocal expressions. The Dalrymple et al. examples come from Chichewâ, which is a Bantu language. Chichewâ encodes the reciprocal using an intransitivizing verbal affix, *-an-*:[6]

(6.9) Mbidzi zi-ku-mény-an-a.
10zebras 10SM-PRES-hit-RECIP-FV
'The zebras are hitting each other.'

The result is that having separate things encoding the distributor and reciprocator is not an available option in this case. Furthermore, as (6.10) illustrates, this is also a problem for Heim et al.'s analysis with respect to Danish, which is historically closely related to English and has a similar syntax.[7]

(6.10) Zebraerne slår hinanden.
zebra..PLU.DEF hit.PRES each.other
'The zebras are hitting each other.'

[6] The prefixed numbers in the gloss refer to noun classes; SM = subject marker; PRES = present tense; RECIP = reciprocal affix; FV = final vowel (Dalrymple et al., 1994: p. 146, fn. 1).

[7] PLU = plural; DEF = definite.

This is different from the Chicheŵa case, because *hinanden* is not a verbal affix. However, it is also different from the English reciprocal in that the reciprocal is encoded morphologically as one word. Movement/long-distance dependency phenomena canonically apply to whole words, not to word bits. In fact, Heim et al. use this argument to handle some Italian clitic phenomena in their own analysis. Furthermore, unlike English *each*, the Danish morpheme *hin* is (no longer) a free morpheme and thus never occurs on its own. Short of postulating empty operators and so forth, it is hard to see how a strict reading of Heim et al.'s proposal would let us deal with such facts.

Although these counterarguments to the similarity argument do not in themselves show the reciprocal not to be a quantifier, they do cast doubt on that argument for the reciprocal's quantificational status. As such, with respect to this argument, it is once again up for grabs whether the reciprocal is a quantifier.

There are likewise counterarguments against the argument from distributivity. The first counterargument is that these distribution effects can be observed in cases without quantified noun phrases[8], such as

(6.11) The girls asked a boy to the dance.

This sentence, perhaps due to world knowledge, prefers a reading in which there is a boy for every girl, as opposed to one in which all of the girls asked the same boy. Perhaps it is controversial whether *the girls* in this example is quantificational or not. But, the same effect can be seen for bare plurals:

(6.12) Vans carrying emergency aid arrive at this village every three days.

Although in (6.12) the distribution is over times, the point stays essentially the same. This sentence clearly has a reading in which a different van comes every three days, as well as the other reading, in which a fleet of vans, for example, arrives every three days. Thus, the first counterargument here is essentially that there are expressions other than quantifiers which allow distributive readings. Therefore, it is not sufficient to conclude that the reciprocal is a quantifier based on its distributive behaviour, since there are expressions other than quantifiers which are also distributive. Indeed, given the evidence seen here, it could well be that the reciprocal inherits its distributive properties from its antecedent. Then, it would be possible to say that this distributivity is due to the antecedent necessarily being plural.

The second counterargument to distributivity is that there are cases in which the reciprocal fails to distribute fully. That is, it is not always possible for the reciprocal to distribute a singular object over the denotation of its antecedent, as is possible for various forms of the universal quantifier, as seen in (6.3a)–(6.3b) above. Williams (1991: 163, (12a–b)) used the following sentence to illustrate this point:[9]

[8] Assuming a Kamp-Heim approach to definites.

[9] Williams gives *a new nose* an asterisk in this sentence. I've changed this to a hash, since this is what I'm using to indicate semantic anomaly, while reserving the asterisk for syntactic ungrammaticality.

(6.13) They gave each other new noses/ #a new nose.

The crucial contrast occurs when we replace the reciprocal in sentence (6.13) with a universal quantifier. Then we can observe that the preference for plurality on *new nose* is reversed.

(6.14) They gave every patient !new noses/ a new nose.

However, even if the nonanomalous construal — that each patient received one nose — is possible with the plural *new noses*, the singular usage is less marked. This might be because there is then no risk of confusion with the pragmatically anomalous situation, in which each patient receives several noses. Furthermore, (6.14) becomes markedly worse if we use the fully distributive universal quantifier *each* with the plural.

(6.15) They gave each patient #new noses/ a new nose.

This indicates that the reciprocal can, in certain cases, behave in the opposite way to quantifiers, *especially* to the quantifier *each*, from which Fiengo and Lasnik (1973) and Heim et al. (1991) have tried to derive the reciprocal.

Indeed, the reciprocal behaves much more like a plural noun phrase in such cases:

(6.16) They gave the patients new noses/ #a new nose.

Thus, in both counterarguments to distributivity, we have seen that the reciprocal behaves more like a plural noun phrase than like a quantified noun phrase. In this second counterargument, we have seen the reciprocal actually pattern oppositely to quantifiers. In fact its behaviour is closer to that of plurals. At this point I will not say anything further regarding this, except that this does not necessarily mean that the reciprocal is itself a plural, since it could be inheriting the relevant plural properties from its antecedent.

In conclusion, these two counterarguments have shown that distributivity is not a sufficient condition for concluding that the reciprocal is a quantifier, since plurals also distribute. The second counterargument further showed that reciprocals actually behave more like plurals than like quantifiers with regards to distribution. Thus, with regards to distribution, it is just as feasible to conclude that the reciprocal is a plural as it is to conclude that it is a quantifier.

The final argument for the reciprocal being a quantifier was that it interacts scopally with propositional attitude verbs. The particularly remarkable effect occurred when otherwise contradictory reciprocal statements were embedded to yield noncontradictory readings, as observed in (6.6) and (6.7). But is it then necessary to conclude that the reciprocal is a quantifier?

Before turning to this case, I'd like to discuss the simpler case of (6.4a)–(6.4c), repeated here as (6.17a)–(6.17c).

(6.17) a. Chrystale and Craig believe they appeal to each other.

b. Chrystale and Craig believe Chrystale and Craig appeal to each other.

c. Chrystale believes she appeals to Craig and Craig believes he appeals to Chrystale.

This in itself was part of the argument from propositional attitude verbs, since this is explainable as a case of scopal ambiguity between a narrow and wide scope reading of the putatively quantificational *each other*.

However, again this effect is due to the reciprocal's plural antecedent and not to the reciprocal itself. Crucially, if we replace the reciprocal with an uncontroversially nonquantificational proper name, we get the very same effect.

(6.18) a. Chrystale and Craig believe they appeal to Weird Tony.

b. Chrystale and Craig believe Chrystale and Craig appeal to Weird Tony.

c. Chrystale believes she appeals to Weird Tony and Craig believes he appeals to Weird Tony.

Assuming compositionality in our semantics, since we only replaced the reciprocal, and the readings persisted, then the readings cannot be due to the reciprocal. Thus, the actual explanation for the putative scope of the reciprocal is that the plural pronoun can be either indexed with the plural *Chrystale and Craig* or with its atoms, *Chrystale* and *Craig*. The details of this mechanism (for reciprocals) remain to be worked out, and the binding of plurals is a largely unresolved isssue in binding theory, but the point is that the apparantly scope-taking behaviour of the reciprocal is actually due to its plural antecedent.

Now let's turn to the more interesting case of embedding an otherwise contradictory reciprocal statement to yield a noncontradictory reading. This was observed in (6.6) and (6.7) above, which are here repeated for convenience as (6.19) and (6.20).

(6.19) #They are taller than each other.

(6.20) They$_i$ think they$_i$ are taller than each other.

The question is whether the explanation regarding plurality and the reciprocal's antecedent extends to such cases. For perspicuity and ease of talking about the participants, let's use names instead of the first *they*.

(6.21) #Chrystale and Craig are taller than each other.

(6.22) Chrystale and Craig think they are taller than each other.

(6.23) #Chrystale and Craig think Chrystale and Craig are taller than each other.

(6.24) Chrystale thinks she is taller than Craig and Craig thinks he is taller than Chrystale.

This makes it more obvious that the noncontradictory reading is the one where the reciprocal putatively takes wide scope over the propositional attitude verb, *think*.

However, there is another way of thinking about this which ties in to the discussion about (6.18a)–(6.18c). Again there are two construals for the plural antecedent of the reciprocal, the pronoun *they*. The group construal leads directly to semantic anomaly, since what Chrystale and Craig think is precisely the contradictory, nonembedded statement, as in (6.19). But, the reading where *they* is bound in turn to the atoms of the plural *Chrystale and Craig*, rather than directly to the entire plural, again yields the desired, noncontradictory reading.

Thus, as in the case with the counterargument to distributivity, we again see that the properties of the reciprocal's antecedent, as a plural, can give an explanation of the reciprocal's behaviour without assuming that the reciprocal is a quantifier. Indeed, since these properties are posssessed by the antecedent whether the reciprocal is present or not, it is more economical to explain this data with these properties than it is to postulate additional properties for the reciprocal. In other words, using the plural behaviour of the antecedent is preferable, since this theory postulates one less property; namely, that the reciprocal is a quantifier.

6.4 Scope Tests

In this section, I will go about testing the scope properties of *each other*. I will test it in five environments in which uncontroversial quantifiers exhibit scope ambiguities: in the presence of other coargument quantifiers, in negated sentences, in modal sentences, in sentences containing a dependency between a WH question word and a coargument of the quantifier, and in sentences containing an ellipsis that contains the quantifier.

The general logic of the section is that if the reciprocal is a quantifier, then it should behave like one with respect to scope ambiguities. In particular, the general strategy will be to make one scope reading unavailable, and to see whether the reciprocal can take the other scope option. If the reciprocal can take the other scope option, then these restricted (i.e. scopally biased) sentences should be felicitous. If such a sentence is not felicitous, then the reciprocal cannot participate in the given scope relation. This is convoluted logic, so I will turn directly to an application, which will hopefully help matters.

6.4.1 Quantifiers

Possibly the best known and most intuitively obvious case of scope ambiguity is that which occurs between two quantifiers. Thus, sentence (6.25a) has two readings:

(6.25) a. Every Islamic Studies student read one book last term.

b. There's one book that every Islamic Studies student read last term.

c. For every Islamic Studies student, there is one book that he or she read last term.

The strong reading, (6.25b), is true if and only if there is one book that all of the students read (e.g. the Koran). On the other hand, the weak reading in (6.25c) can be true even if every student read a different book, as long as they each read at least one.

These kinds of straightforward quantifier scope ambiguities unfortunately do not arise in reciprocal constructions. The fact that the quantifier in subject position is the antecedent of the reciprocal obscures the issue. For example, look at sentence (6.26):

(6.26) Three boys like each other.

Suppose we were to give a generalized quantifier interpretation for the determiner *three*:

(6.27) $\mathbf{[3]}$(A)(B) = 1 iff $|A \cap B| \geq 3$

Then, using Dalrymple et al.'s RECIP quantifier[10], we could represent sentence (6.26) as follows (with *three boys* having wide scope):

(6.28) $\mathbf{3}(boy, \lambda X.\textsc{recip}(X, \lambda xy.\ like(x, y)))$

This gets us appropriate truth conditions for (6.26), but in a strange way. The representation in (6.28) combined with the truth conditions for the generalized quantifier denotation of *three* in (6.27) mean that (6.26) is true just in case the intersection of the set of boys with the set of things that like each other is greater than or equal to three. But, sentence (6.26) is not making any claims about "the things that like each other". Rather, it is making the claim that there exists three boys who like each other. In this respect, the quantifier is acting like a description (Ewan Klein, p.c.). To put it another way, we would like the X that is the first (set) argument of RECIP to be the same set as the quantifier **3** and its restriction yield. That is, we would like the same three boys to be the first argument of the reciprocal. However, substituting the set of boys for the set argument of RECIP does not achieve this effect. First of all, we get a type mismatch for the second argument of **3**. The count quantifier requires a set as its second argument, but the RECIP phrase yields a truth value. Second, even if the type mismatch were somehow resolved, the reading of the reciprocal would now be that all boys like each other, and this is far too strong: we only require three boys to like each other. Thus, it is not straightforward how one would ensure that the reciprocal is indeed operating on the same three boys that satisfy its antecedent.

Letting the reciprocal operator take wide scope by reversing the quantifiers yields even more incomprehensibility. It is hard to conceive how one could even compose an appropriate representation. It would have to look something like (6.29), though.

(6.29) $\textsc{recip}(boy, \lambda xy.\ \mathbf{3}(boy, like(x, y)))$

[10]This is defined as follows:

(i) **Definition of RECIP:**
A formula RECIP(A, λxy.ϕ) is true iff the relation RECIP holds between the set A and the binary relation of which λxy.ϕ is the characteristic function.
(Dalrymple et al., 1998)

The logical representation in (6.29) indicates that the set of boys is such that its members like each other and that, furthermore, the intersection of the set of boys and the set of things that like other things is greater than or equal to three. These are not the truth conditions that (6.26) requires.

Therefore, neither (6.28) nor (6.29) give appropriate truth conditions for sentence (6.26). It seems, then, that a reciprocal does not enter into a scope relationship with a quantified antecedent. This is not really surprising, but it does force the conclusion that either the reciprocal is not a quantifier, or it is unique in not entering into scope relations with a coargument quantifier.

But, it is possibly the case that the antecedent of the reciprocal is just a privileged exception in this respect. It would be prudent to examine the potential scope interactions of reciprocals with coargument quantifiers that are not antecedents. To do this, we obviously need to examine a predicate with more then two arguments. Double object predicates and their corresponding dative alternations provide such a test case.

First, a note is in order about a difference in scopal ambiguity in double object and dative constructions. Aoun and Li (1993: 29–38) observe that when we have quantifiers in the direct object and dative object position of a ditransitive verb there is scope ambiguity. But, they claim that in the double object sentence there is no parallel scope ambiguity. The following sentences illustrate this phenomenon.

(6.30) John assigned one problem to every student.

(6.31) John assigned one student every problem.
(Aoun and Li, 1993: 35, (63–64))[11]

They thus claim that (6.30) is ambiguous between a reading where *one problem* gets wide scope (meaning "There is one problem that John assigned to every student") and a reading where *every student* gets wide scope (meaning "For every student, there is one problem that John assigned to that student"). The ambiguity can be readily shown in this case by the availability of either of these continuations to (6.30):

(6.32) a. The problem was difficult.
b. The problems were difficult.

On the other hand, (6.31) is unambiguous, giving only the *one student* with wide scope reading, and permitting only a singular continuation sentence to be felicitous (e.g. "The student felt persecuted."). It should follow, in the double object construction, that a direct object quantifier should always outscope an indirect object one.

But, it must be mentioned that the methodology here is a little questionable. Sentence (6.31) is not the double object alternate of (6.30). The proper double object alternate would be:

[11] They give Larson (1990: 604) as the original source for these examples.

(6.33) John assigned every student one problem.

This sentence is less clearly unambiguous than (6.31), as witnessed by the fact that both (6.32a) and (6.32b) are possible continuations of (6.33). Thus, it is unclear whether what we have here is true lack of scope ambiguity. It may be the case that in (6.31), the universal quantifier in indirect object position is failing to take scope over the direct object, analogous to the case we will observe in (6.46) of section 6.4.2, where the universal quantifier resists taking scope over negation.

But let us follow Aoun and Li for a little bit longer. This leads to a surprising conclusion about reciprocals, on the assumption that they are quantifiers. There is some disagreement in the literature, about whether a putatively quantificational reciprocal direct object can outscope a quantifier in indirect object position. Moltmann (1992) writes that sentences like (6.34a) are unambiguous, having only a reading as in (6.34b), where *some present* takes wide scope, and thus only permitting singular continuation sentences like (6.35a). Dalrymple et al. (1998: 23), on the other hand, claim that the reading with *each other* taking wide scope, as in (6.34c), is "readily available". They should then find plural continuations like (6.35b) felicitous.

(6.34) a. John and Mary gave each other some present.
(Dalrymple et al., 1998: 23, (83))
b. There is some present that John gave Mary and Mary gave John.
c. John gave Mary some present and Mary gave John some present.

(6.35) a. The present was cheap and undesirable.
b. The presents were cheap and undesirable.

However, even if the reading that assigns *each other* wide scope is available, my own intuition (and that of others I have asked) is that a preferred way of making the claim that this scope assignment embodies is to use the plural:

(6.36) John and Mary gave each other presents.

This example illustrates that (6.34a) is a marked way of communicating the meaning in (6.34c).

However, this is exactly the opposite conclusion from the one we would expect if, following Aoun and Li, the double object construction is treated unambiguously, with the direct object outscoping the indirect object. That is, since the reciprocal in sentence (6.34a) is in direct object position, we would expect the unmarked reading to be the one were the reciprocal outscopes the existential quantifier. Contrary to expectation, the preferred reading is the one which assigns the existential scope over the reciprocal. Therefore, if the reciprocal is indeed a quantifier, it is behaving unlike other quantifiers by not preferentially taking scope over its indirect object coargument.

One possible rebuttal to this position is that there is a kind of pragmatic effect happening here. Namely, one could claim that since using the plural as in (6.36) is an alternative way to to make get across the reading where John and Mary give each other different presents, the use of the singular is preferentially interpreted as giving the existential quantifier wide scope. Thus a hearer will conceive a speaker as having used the singular "on purpose", as the other meaning is better communicated by using the plural. This argument is bolstered by examples such as (6.37), where world knowledge provides additional pragmatic information that defeats the inference of the existential indirect object taking wide scope.

(6.37) At the stroke of midnight, John and Mary gave each other a diamond ring[12].

(6.38) At the stroke of midnight, John and Mary gave each other diamond rings.

Such an argument would then claim that (6.37) and its plural counterpart, (6.38), have the same preferred interpretation, and this does seem to be the case.

But, the general strategy in this chapter has been to attempt to force situations were one reading is ruled out and to see whether the second reading is still available. So far, none of the double object sentences that we have examined accomplish this, since in none of them is there any additional knowledge which makes it *impossible* for there to be more than one of the items that the existential indirect object quantifies over. The following sentence controls for this.

(6.39) #Just over an hour ago, Bill Gates and the Sultan of Brunei mailed each other an original Van Gogh painting called *The Sunflowers*.

In this sentence, due to real world knowledge about the speed of mail delivery and the stipulation that it is a specific, *original* Van Gogh, we know that different paintings must have been mailed. That is, it is impossible for Bill Gates and the Sultan of Brunei to mail each other the *same* painting, because one or the other has to receive it before mailing it back, and this can't have been the case, since we know the mailing took place only an hour ago. It could be the case, though, that the existential quantification is over types. That is, there is one particular Van Gogh painting, such that Bill Gates sends the Sultan an instance of it and vice versa. However, the fact that we are talking about an original Van Gogh means that we are talking about the same token painting, since there can only be one authentic token of any given Van Gogh. Therefore, there can be no quantification over types.

My own intuition is that sentence (6.39) is infelicitous. That is, I cannot assign *each other* wide scope and am therefore left with the contradictory state of affairs in which either the two men somehow mail each other the same painting in the span of an hour or that they mail each other two different tokens of the same type of painting, and yet both tokens are stipulated to be originals. However, others who I have asked have been split as to the interpretation. That is,

[12] This example is due to Ewan Klein. The temporal adjunct is used to block readings that have John and Mary giving each other a ring or rings on different occasions.

some can assign *each other* wide scope and felicitously assign this meaning to (6.39), whereby the two men send each other different Van Goghs, both of them originals. Another group of people reported that the sentence is infelicitous due to similar reasons to my own. Clearly, more systematic study of this construction is in order. Until this can be carried out, it is unclear whether (6.39) shows the lack of wide scope for the reciprocal.

Next I turn to the dative alternation of double object constructions. Recall that this is the construction for which, following Aoun and Li (1993), we observed a robust ambiguity, as exemplified by sentence (6.30). Therefore, if the reciprocal is a quantifier, we should observe a clearer scope ambiguity in such cases. Here is sentence (6.34a), now renumbered as (6.40a), and its dative alternate.

(6.40) a. John and Mary gave each other some present.

b. John and Mary gave some present to each other.

Again, the reciprocal patterns in a suprising manner. On the usual assumption that the reciprocal is a quantifier, sentence (6.40b) should be more clearly ambiguous than (6.40a). However, if anything, I find that (6.40b) more clearly indicates that there is one particular present in question. It could be claimed that this is due to a specificity effect yielded by using the determiner *some*. But, the effect does not vanish, even if we use the perhaps less specific indefinite article:

(6.41) John and Mary gave a present to each other.

Similarly, I find the previously felicitous diamond ring sentence now marked in its dative version.

(6.42) #At the stroke of midnight, John and Mary gave a diamond ring to each other.

The interpretation I get for this sentence is that there's a diamond ring such that John and Mary simultaneously (at the stroke of midnight) give it to each other. However, this requirement of simultaneity conflicts with the notion of transfer of possession implicit in the meaning of the verb *gave*. That is, one of them must have had the ring first to give it to the other one, who then must have given it back. That this conflict leads to infelicity is illustrated by the following sentence, which uses a verb with different lexical semantics. This dative verb, *show*, can be predicated of two people simultaneously.

(6.43) At the stroke of midnight, John and Mary showed a diamond ring to each other.

The "original Van Gogh" sentence doesn't fare any better. That is, I still find it contradictory in its dative alternate.

(6.44) #Just over an hour ago, Bill Gates and the Sultan of Brunei mailed an original Van Gogh painting called *The Sunflowers* to each other.

If the reciprocal is a quantifier, then it should behave like other quantified dative objects. That is, it should show scope ambiguity relative to a quantified direct object. Since it does not readily show scope ambiguity in such configurations, it is not a quantifier according to this test.

In this section we have observed that simple sentences whose verb is ditransitive in its dative guise are scopally ambiguous if the two internal arguments of the dative verb are quantifiers. We also observed that the corresponding double object construction for the same ditransitive verb is less clearly scopally ambiguous. This provided two arguments against treating the reciprocal as a quantifier. First, it was observed that, in a double object construction, the direct object quantifier (i.e. the first argument after the verb) at the very least preferentially takes wide scope over the indirect object. However, the reciprocal in direct object position preferentially takes *narrow* scope under a quantified indirect object. The argument is that quantifiers in such constructions display a given scope preference. If the reciprocal is a quantifier, it should behave like other quantifiers in this respect. It does not, and therefore we should conclude that it is not a quantifier, according to the double object test.

The second argument against treating reciprocals as quantifiers came from the dative alternates of the same ditransitive verbs. It was observed above that the dative alternate of a ditransitive verb is scopally ambiguous if both of the verb's internal arguments are quantificational. The reciprocal on the other hand, prefers even more strongly to take narrow scope when it's a dative object. Since it does display this asymmetry in patterning, we can conclude, relative to this test, that the reciprocal is not a quantifier.

6.4.2 Negation

Normally, quantifiers can take narrow or wide scope relative to negation. Thus, we get the usual ambiguity in (6.45), with the two readings in (6.45a) and (6.45b):

(6.45) John didn't flunk three classes.

a. There are three classes that John didn't flunk.

b. It's not the case that John flunked three classes.

Chierchia and McConnell-Ginet (1990: 232) note that the choice of quantifier does matter to some degree. In particular, universal quantification in object position has difficulty taking scope over negation. Thus, the (a) reading of (6.46) is somewhat strained.

(6.46) John didn't flunk every class.

a. Every class is such that John didn't flunk it.

b. It's not the case that John flunked every class.

However, given strong emphasis on *didn't flunk* or an appropriate context (6.46a) is a possible reading. This indicates that the difference between (6.45) and (6.46) should not be treated truth conditionally. Furthermore, universally quantified noun phrases in subject position do interact with negation. A sentence like *Everybody didn't flunk algebra* exhibits the ambiguity more readily than (6.46). Thus, the difficulty in object position is not due to the universal quantifier per se.

The question is then whether the reciprocal expression *each other* exhibits this interaction with negation. Consider the following sentence:

(6.47) John loves Mary, but John and Mary don't love each other.

My intuition is that this sentence is grammatical. Indeed, it seems to have an ironic tone, since it implies that Mary doesn't love John without coming out and saying it. However, this sentence is only grammatical if the reciprocal takes narrow scope under negation. Then the sentence would mean that it's not the case that John and Mary love each other.

This is perhaps even more obvious if we formalize (6.47) in a simple predicate calculus representation.

(6.48) a. $\bot love(j,m) \wedge \neg love(j,m) \wedge \neg love(m,j)$

b. *1.* $love(j,m) \wedge \neg(love(j,m) \wedge love(m,j))$
2. $love(j,m) \wedge \neg love(j,m) \vee \neg love(m,j)$ (De Morgan, 1)
3. $\neg love(m,j)$ (Disjunctive Syllogism, 2)

If we let the reciprocal take wide scope, as in (6.48a) then we derive a contradiction, which I've here indicated using the falsum, $\bot$. This happens because letting the reciprocal take wide scope means that John does not love Mary and Mary does not love John; however, the first clause of sentence (6.47) explicitly denies the first conjunct. Therefore, one side of the second conjunction will always be false and this yields a contradiction. On the other hand, by applying a couple of simple logical equivalences to the representation of the reciprocal taking narrow scope, we get the desired conclusion that Mary does not love John. If the reciprocal can only take wide scope over negation, then (6.47) would be a contradiction. Since it is not a contradiction, we can conclude that the reciprocal can take narrow scope under negation.

Similarly, the reciprocal cannot take wide scope over negation, although this may seem possible at first. We can show this by picking a predicate which results in a contradictory reading if negation takes scope over the reciprocal and seeing whether the resulting sentence is felicitous. The predicate *related to* is an appropriate one:

(6.49) a. John and Mary are not related to each other.

b. *1.* $\neg(related(j,m) \wedge related(m,j))$
2. $\neg related(j,m) \vee \neg related(m,j)$ (De Morgan, 1)

c. *3.* $\neg related(j,m) \wedge \neg related(m,j)$

Letting the negation take wide scope over the reciprocal in interpreting (6.49a) leads to the representation in (6.49b). However, due to the meaning of the predicate *related to*, if John is not related to Mary, then Mary is not related to John. Thus, it may at first blush seem that the truth conditions of (6.49b) are too weak for this case. The right truth conditions are seemingly given by (6.49c), which is the reading we get if we let the reciprocal take wide scope.

However, there are reasons for rejecting this conclusion. First, (6.49b), on an inclusive reading, gets the right truth conditions, so it is certainly sufficient.[13] In fact, the fact that x being related to y entails y being related to x means that (6.49b) guarantees the right truth conditions. On the other hand, (6.49c) is strange. If the sentence is equivalent to this reading, this would mean that it asserts that John is not related to Mary and Mary is not related to John. But this is too much information; it should yield conversational infelicity. The fact that it does not, indicates that (6.49c) is not the correct reading for (6.49a). Thus, we can conclude that the reciprocal always takes narrow scope under negation.

6.4.3 WH words

Another scope ambiguity of quantifiers which has been much studied in the literature[14] is their interaction with WH words in certain positions. May (1985) observes of the following sentences that the first is ambiguous, whereas the second is not.

(6.50) What did everyone buy for Max?

(6.51) Who bought everything for Max?

With the quantifier taking narrow scope, sentence (6.50) means "What thing x is such that everyone bought x for Max?". In other words, everyone chipped in and bought something for Max and the speaker is questioning what that thing is. The other possible interpretation for (6.50), with the quantifier taking wide scope, is "For every person x, what did x buy for Max?". This is also called the pair-list reading, as the answer is a list of pairs of people and what they bought for Max. The following sentences respectively illustrate possible answers to the quantifier with narrow scope reading of (6.50) and the quantifier with wide scope reading.

(6.52) a. That rare and expensive copy of *The Cat in the Hat*.

b. Mary bought him a book, John bought him a record, and Weird Tony bought him a bra.

By contrast, (6.51) only has the quantifier with narrow scope reading and it thus cannot receive a pair-list answer. The differences between sentences (6.50) and (6.51) are likely traceable to the general asymmetry between questioning a subject and questioning an object (Pesetsky, 1982).

[13] Barbara Partee (p.c.) also points out that it is unclear whether there is an exlusive 'or' in English.

[14] My principal source is May (1985), but also see Aoun and Li (1993: chap. 2) and the references cited therein.

However, this distinction need not concern us too much. The reason is that reciprocals cannot occur in the position of the quantifier in (6.50) anyway:

(6.53) *What did each other buy for Max?

Therefore, a digression is in order to examine the possible scope interactions between WH words and quantifiers that are internal arguments of verbs. A straightforward example of such a case is a ditransitive verb like *give*.

Aoun and Li (1993: 70–71) argue that in a double object construction of the form [$V\ NP_1\ NP_2$], the following possible interactions hold.

(6.54) a. [V NP_1(QP) NP_2(WH)] (ambiguous)

b. [V NP_1(WH) NP_2(QP)] (unambiguous)

Thus, a sentence like (6.55a) has two possible readings.

(6.55) a. What did you assign everybody?
(Aoun and Li, 1993: 70, (66a))

b. Exercise 2 from chapter 3.

c. Mary, I assigned exercise 2; John, I assigned exercise 3; Weird Tony, I assigned all of the exercises in chapter 3, because he needs the extra work.

Answer (6.55b) is possible if *everybody* is assigned narrow scope under the WH operator. The other answer, (6.55c), is only possible if the quantifier takes wide scope over the WH operator. This illustrates that quantifiers can take either narrow or wide scope with respect to a WH operator.

We can apply this same methodology to reciprocals. Again, the strategy is to eliminate one scope reading from contention and to see whether the other scope reading is available. Let's use the WH version of the Bill Gates/Sultan of Brunei example:

(6.56) a. What did Bill Gates and the Sultan of Brunei mail each other just over an hour ago?

b. #An original Van Gogh painting called *The Sunflowers*.

c. Bill mailed the Sultan a patch for Microsoft Windows 95 and the Sultan mailed Bill an interesting objêt d'art.

Here we've ruled out the fact that Bill and the Sultan could have mailed each other the same thing. This means that the only possible interpretation of (6.56a) is one which assigns the reciprocal wide scope and this is indeed a possible reading, as (6.56c) attests. Thus, the reciprocal seemingly can take wide scope over a WH operator.

However, this seeming wide scope behaviour may again be due to distributivity rather than scope. The following sentence illustrates that replacing the reciprocal with a plural reflexive (which is nonquantificational), results in the putative wide scope reading being available.

(6.57) a. What did Bill Gates and the Sultan of Brunei mail themselves just over an hour ago?

b. Bill mailed himself a patch for Microsoft Windows 95 and the Sultan mailed himself an interesting objêt d'art.

Thus, it would be premature to conclude that the reciprocal can take wide scope over a WH operator, because this effect could simply be due to the reciprocal's distributive behaviour as a plural.

The other scope assignment, with the reciprocal taking narrow scope under the WH word, may be available, as the answer to the following question demonstrates.

(6.58) a. What did John and Mary show each other at the same time?

b. That dead squirrel under the porch.

c. #John showed Mary the dead squirrel and Mary pointed out the huge wad of gum to John at the same time.

Here, the WH operator is outscoping the reciprocal, as indicated by the singular noun phrase response. Furthermore, the answer with the reciprocal taking wide scope is infelicitous.

Thus, we have seen that with respect to the WH scope test, the reciprocal again behaves unlike a quantifier. Although it may seem that the reciprocal can take wide scope, this may be just due to distributivity. Lastly, example (6.58) shows that the reciprocal can take narrow scope under a WH operator.

6.4.4 Modals

Modal contexts are another type of construction in which quantifiers exhibit scope ambiguity. By a modal context, I mean a context which expresses either necessity or possibility. Using a model with possible worlds, we can informally define a proposition as necessary if it is true in all possible worlds and as possible if it is true in at least one possible world. Following Chierchia and McConnell-Ginet (1990: 234), some examples of English expressions that create modal contexts are:

- Modal auxiliaries: *can*, *must*, *may*, *shall*, *should*, *will*, *would*, *might*, *could*
- Dispositional adjectives: e.g. *solvable*, *soluble*, *conceivable* [15]
- Sentential adverbs: e.g. *possibly*, *necessarily*, *probably*

[15] The modality in these adjectives is perhaps emphasized by the fact that sentences containing them can be paraphrased using the modal auxiliary *can*, as illustrated by (i) and (ii).

(i) This problem is solvable.

(ii) This problem can be solved.

I will not be concerned with all of these cases here. Rather, the strategy will be to pick a given modal construction, show that quantifiers exhibit scope ambiguity relative to the modal, and then replace the quantifier with a reciprocal and check whether the reciprocal exhibits the same scope possibilities as the quantifier.

The modal construction that I will use for these tests is the epistemic use of the auxiliary *might*, as exemplified by the following sentence.

(6.59) There might be life on other planets.

Someone who utters (6.59) is basically stating that it is consistent with her knowledge that there is life on other planets. Equivalently, the speaker is saying that it is *possible*, given other things that she knows, that there is life on other planets. Thus, the proper treatment of epistemic *might* in modal logic is through the use of the possibility operator, $\Diamond$.

Next we need to see how normal quantifiers exhibit scope ambiguity relative to the modal *might*. There is a slight complication in dealing with modals though. Because their logical interpretation is captured in terms of possible worlds, the truth conditional differences between modal wide scope and modal narrow scope are subtle. Therefore, it is a bit more difficult to pick one given sentence and show that it is ambiguous, since the two scope readings are not as intuitively different as they are in some other cases (negation, for example). However, it is possible to pick different sentences that strongly suggest one modal scope rather than the other. In this manner it can be shown that either the modal or the quantifier can in principle take wide scope.

I have chosen to use the quantifier *every* for a few reasons. First, the universal quantifier places a strong requirement on satisfaction. It is reasonably clear when a universally quantified proposition is true or false. Second, in cases of strong reciprocity, or in cases where the cardinality of the reciprocal's antecedent is two, the reciprocal can be defined solely in terms of the universal quantifier. Thus, any differences between the scope behaviour of a universal quantifier and the reciprocal cannot be attributed to simple differences in choice of quantifier. Third, although the quantifier *all* has been argued to be less marked crosslinguistically than *every*, it has undesirable generic readings when used in the form [*all Xs*] and has similar side effects in its partitive use [*all of the Xs*]. In any case, the data still essentially works with *all*, as the reader is welcome to check.

The first case is one where the quantifier preferentially takes narrow scope relative to the modal.

(6.60) Professor Plum might flunk every student. In that case the university administration will have to intervene.

The first sentence of (6.60), given the second sentence, must mean that it might be the case that Professor Plum flunks every one of his students. That is, given our knowledge of university administrations, we know that they would not intervene if for every student Professor Plum might flunk that student. After all, every student enters a class with a chance of flunking. Thus, (6.60) shows that the modal can take scope over a quantifier.

Similarly, a quantifier can take scope over the modal. As observed above (section 6.4.2), *every* in object position tends to take narrow scope. However, it is possible to construct instances where the narrow scope reading is strongly biased against. Here is one such instance:

(6.61) The thing that makes Gunnar Håbløs' ski jumping so exciting is that he might die on every attempt. [16]

In this example, the speaker is morbidly and ironically commenting on Gunnar's incompetence. What is being said is that for each one of Gunnar's attempts, he stands a chance of dying on that attempt. The other reading, which means that it might be the case that Gunnar dies on every attempt, doesn't make a whole lot of sense. Once he dies he's dead, and his ski jumping career is sadly over.

Examples (6.60) and (6.61) thus show that a quantifier can take wide or narrow scope relative to the modal *might*. The next step is to check whether the reciprocal can take narrow and wide scope. Again, we must look at constructions that somehow rule out one or the other scope reading as impossible.

The following sentence, as I will explain below, shows that the reciprocal cannot take scope over a modal.

(6.62) #John and Mary might beat each other to the finish line.

This sentence is semantically anomalous, as it is a contradiction for John to beat Mary to the finish line and vice versa. However, if the reciprocal could take wide scope over *might*, (6.62) would not be a contradiction. This scenario would be equivalent to saying that John might beat Mary to the finish line and Mary might beat John to the finish line. This is a perfectly reasonable statement, since it is not necessary for both conjuncts to be confirmed in the *same* possible world. On the other hand, there is no possible world in which it can be the case that each of the two beats the other. Thus, the fact that sentence (6.62) is anomalous (i.e. is a contradiction) shows that the reciprocal cannot take scope over *might*.

It is also possible to construct a nonanomalous sentence that describes a scenario in which the modal must take scope over the reciprocal.

(6.63) John and Mary might be married to each other.

The predicate *marry* is inherently reciprocal, in the sense that $marry(x, y)$ entails $marry(y, x)$. So, if John is married to Mary, then it must be the case that Mary is married to John. Therefore, the reading where the reciprocal takes scope over the modal, which is equivalent to saying John might be married to Mary and Mary might be married to John, is too weak. This reading makes

[16] This example is due to Jesse Tseng.

the entire proposition true so long as each conjunct is evaluated as true in some possible world, however it is necessary that both conjuncts be evaluated as true in the *same* possible worlds. On the other hand, the modal can take scope over the reciprocal. This yields a case which is equivalent to John and Mary being married to each other in at least one possible world and this is clearly what (6.63) means.

We then have a disparity between reciprocals and quantifiers on the modal test of scope: quantifiers can take narrow or wide scope relative to modals, whereas reciprocals can only take narrow scope. Furthermore, as remarked earlier, this is a true difference, since the reciprocal in such cases is definable solely in terms of the universal quantifier, which was precisely the one we showed to optionally take wide or narrow scope relative to the epistemic modal *might*.

6.4.5 Ellipsis

Sag (1976) and Williams (1977) were the first to (independently) notice that sentences like (6.64a) are ambiguous between the "group" versus "individual" readings indicated in (6.64b) and (6.64c), respectively.

(6.64) a. Sandy greeted everyone when Betsy did.
(Sag, 1976: 62, (1.3.12))

b. Sandy greeted everyone as a group when Betsy greeted the same group of people.

c. Sandy greeted each person when Betsy greeted that person.

This difference is attributed to a difference in quantifier scope. Either the quantifier takes separate scope over the unellided and ellided segments, yielding the individual reading, or it takes scope over the whole sentence at once, yielding the group reading. This is perhaps made clearer, if we look at the respective logical interpretations that Dalrymple et al. (1991: 26–27) give for (6.64b) and (6.64c):

(6.65) a. *every(x, person(x), greet(sandy, x)) when every(x, person(x), greet(betsy, x))* = (6.64b)

b. *every(x, person(x), greet(sandy, x) when greet(betsy, x))* = (6.64c)

How exactly the ellipsis is resolved in such constructions is the topic of much current debate (see Lappin (1996b) for an overview).

However, the exact method that is used for resolving the ellipsis is not our concern. We are only interested in observing whether replacing the quantifier in a sentence such as (6.64a) still yields an ambiguity. Again, the strategy is to make one scope reading completely unavailable and to see whether the sentence is still interpretable. If it is uninterpretable, this signals the lack of scope ambiguity.

Unfortunately, of the cases we have looked at so far, the judgements for quantifier/ellipsis interaction are especially fragile. Therefore, we have to make sure we control for all other variables and also set the scene in a plausible and convincing manner. First, it has been noted several times in the past[17] that there is an ambiguity when pronouns are reconstructed as part of the ellipsis. This is exemplified by (6.64a) and its two different readings that follow.

(6.66) a. John loves his secret decoder ring and Bill does, too.

b. John loves John's secret decoder ring and Bill loves John's secret decoder ring.

c. John loves John's secret decoder ring and Bill loves Bill's secret decoder ring.

The reading in (6.66b) is referred to as the strict identity reading, as the identity of the pronoun is fixed and then reiterated in ellipsis. The other reading, (6.66c) is referred to as the sloppy identity reading, since the identity of the pronoun is not fixed, but rather resolved locally in each conjunct.

At the moment, it is an unresolved issue whether reciprocals and reflexives (i.e. syntactic anaphors) can exhibit this ambiguity or whether one can only get the sloppy reading with these expressions (Ivan Sag, p.c.). Sag (1976: 139–142) notes that there is variation among speakers regarding whether sentences such as the following have strict readings (all speakers can get the sloppy reading).

(6.67) John liked himself before Bill did.

Sag (1976: 139, (2.2.53b))

The issue, then, is whether such sentences can mean that John liked John before Bill liked John. Sag (1976: 140) attributes the variation in judgements between speakers to dialectal (presumably idiolectal) differences.

In studying the interaction of *each other* with ellipsis, it is crucial to control for the strict/sloppy ambiguity as it may be a confounding factor in assessing the scope issue, which is of primary concern. This essentially means that the subject of the ellipsis clause should not be an appropriate antecedent for the reciprocal in the ellipsis, as sentence (6.68) exemplifies.

(6.68) John and Mary saw each other where Bill did.

Presumably, the same speaker who only assign sloppy readings to sentences like (6.67) will find (6.68) ungrammatical. However, the question becomes whether even the strict reading is possible here. Well, if we take the strict reading to fix the interpretation of the reciprocal before the ellipsis is resolved, then the strict reading should be possible. Then sentence (6.68) should mean something like John and Mary saw each other in the same place as Bill saw them. Native speakers who I have interviewed regarding sentences like (6.68) have varied on

[17] For example, see Sag (1976), Reinhart (1983), Dalrymple et al. (1991), or Lappin (1996b).

their judgements. Some have found it ungrammatical, presumably due to the reconstruction problem, while others have considered it perfectly well-formed.

However, the fact that certain speakers do find these reciprocal/ellipsis sentences well-formed allows us to then ask whether the reciprocal exhibits any scope ambiguities in such cases.

First, I will show that the reciprocal cannot take wide scope. This involves setting up a situation of which a sentence of the appropriate kind can only be true if the reciprocal has wide scope and then showing that the sentence is not true.

Imagine a group of three children, Johnny, Billy and Molly, playing a copying game similar to "Simon Says". Except imagine that it involves the leader doing something and the others copying his or her actions. Maybe we could call it "Dougald Does". Johnny goes first and smacks Molly upside the head. So then Billy smacks her upside the head. Lastly, poor Molly has to smack herself upside the head. Now we can predict the sinister dynamics of "Dougald Does": do onto others as you would have them do onto you. Next it's Molly's turn, and she certainly knows the dynamics and seeks revenge. So, Molly smacks Johnny upside the head. Billy gleefully follows suit, and then Johnny has to deservedly do it to himself as well. Given the time line of these events, as shown in (6.69) (where S(x,y) indicates that x smacked y), if the reciprocal can take wide scope, a speaker should be able to truthfully and felicitously utter (6.70).

(6.69) $S(j, m) \longrightarrow S(b, m) \longrightarrow S(m, m) \longrightarrow S(m, j) \longrightarrow S(b, j) \longrightarrow S(j, j)$

(6.70) Johnny and Molly smacked each other (upside the head) before Billy did.

However, this sentence is not true in this situation. For example, one could not utter it in response to the question, "What happened when Johnny, Billy, and Molly played 'Dougald Does'?". Similarly, consider the yes/no question counterpart of (6.70):

(6.71) Did Johnny and Molly smack each other (upside the head) before Billy did?

The answer to this question is unambiguously "No". There is no presupposition failure and no possibility of saying something like "Sort of" in answering.

Since sentence (6.70) can only be true if the reciprocal takes wide scope and it is *not* true, we can conclude that the reciprocal cannot take wide scope over the ellipsis. This means that the individual reading is not available for reciprocals the way it is for attested quantifiers. Thus, this test indicates that the reciprocal is not a quantifier. Note that the reciprocal can take narrow scope under the ellipsis, yielding a group reading. This is proven by the fact that if Johnny smacked Molly upside the head and then she smacked him upside the head and then Billy smacked each of them upside the head in turn, then the answer to question (6.71) is unambiguously "Yes".

The test of scope interaction with ellipsis indicates that the reciprocal is not a quantifier. If it were, we would see the same kinds of scope interactions as occur with quantifiers in ellipsis. However, we do not observe these same interactions. Therefore, relative to this test, the reciprocal does not behave like a quantifier.

6.4.6 Summary of the scope results

In this section, I have been testing the quantificational status of the English reciprocal by subjecting it to a variety of scope tests. This is based on the argument that if a reciprocal is a quantifier, then it should behave like a quantifier. One well-known aspect of the quantifier interpretation is that sentences containing quantifiers and certain other expressions or constructions lead to an ambiguity. This ambiguity stems from whether the quantifier takes narrow or wide scope relative to the other operator in the sentence. Thus if the reciprocal is a quantifier, it should show scope ambiguities like other quantifiers.

I tested the reciprocal with respect to five different operators/constructions: coargument quantifiers, negation, WH words, modals, and ellipsis. The following table summarizes the results. It should be read with the top category relative to the side category. Thus, the second cell under "Reciprocals" states that a reciprocal can take narrow scope relative to a quantifier in indirect position. Similarly, in the double object and dative cases, the quantifier or reciprocal is the argument that is not specified for the other quantifiers. Thus, in the row that says "Dative object Quantifier", the other quantifier is the direct object. The configuration that has an "—" under the reciprocal header was not tested.[18]

(6.72)

Scope properties of quantifiers and reciprocals		
Operator	Quantifiers	Reciprocals
Direct object quantifier (double object alternate)	ns	—
Indirect object quantifier (double object alternate)	ws	ns
Direct object quantifier (dative alternate)	ws, ns	ns
Dative object quantifier (dative alternate)	ws, ns	ns
Negation	ws, ns	ns
WH word	ws, ns	?ws, ns
Modal	ws, ns	ns
Ellipsis	ws, ns	ns

This table shows that, according to these tests, the reciprocal is most likely not a quantifier. In every case where a quantifier exhibits scope ambiguity, the reciprocal takes narrow scope. The one exception to this, WH word environments, is uncertain due to the distributivity facts discussed in section 6.4.3. It may be argued that the reciprocal is actually a quantifier, but one

[18]This is because a reciprocal is marginal in this position. For example:

(i) ?John and Mary showed some people each other.

with a very strong narrow scope preference. This might be true, except for another striking fact observable in this table. Namely, when a reciprocal is in the direct object position of a double object construction, it shows exactly the opposite scope tendency to what would be similar quantifiers.

6.5 Conclusion

In this chapter, my main goal has been to determine whether the reciprocal *each other* behaves like a quantifier or not. I started by reviewing various arguments for the stance that it is a quantifier, in section 6.2. Then, in section 6.3, I presented various counterarguments to this position. I concluded that it is more economical to derive the behaviour of the reciprocal from its antecedent's properties as a plural. In the following sections, I explored the scope properties of the reciprocal as it interacts with 1) other quantifiers, 2) the negation operator, 3) WH operators, 4) modals, and 5) ellipsis. The idea was to test the hypothesis that the reciprocal is a quantifier empirically. The result of this empirical study was that the reciprocal, with respect to scope, behaves differently from quantifiers on various tests. Crucially, on certain tests it behaved exactly in the opposite manner to quantifiers. Therefore, the empirical data casts doubt on the reciprocal's status as a quantifier. Indeed, taking this data and the observations regarding plurality from section 6.3, it seems safe to conclude that the reciprocal is not a quantifier. If anything, the onus is now on advocates of the quantificational approach to refute the empirical data and also come up with new data that shows the plural approach is not sufficient.

Chapter 7

Summary and Final Remarks

The overarching goal of this thesis was to examine aspects of the syntax and semantics of reflexives and reciprocals. The main theoretical framework adopted was Head-driven Phrase Structure Grammar (Pollard and Sag, 1987, 1994). Within this framework, reflexives play a crucial role in control theory. Therefore, the treatments of binding and control are intimately tied together. Crucially, there have been recent changes to HPSG such that a new level of argument structure, which links lexical semantics and syntax, is now considered the proper representation on which to state constraints on binding and control (Manning, 1996). Thus, this thesis has not only been about reflexives, reciprocals, binding and control, but also necessarily about the level of argument structure as represented by the ARG-ST list.

There were four main goals in this thesis. The first was to extend and revise the theories of binding and control; these theories had become problematic due to the recent revisions in HPSG with respect to argument structure. In chapter 2, I presented the binding theory in more or less its original formulation. The principle of particular interest to the study of syntactic anaphora — Principle A — was then formalized as a (necessarily) disjunctive feature structure constraint. I then discussed various problems to do with exempt anaphors and long distance binding. In particular, I argued that exempt anaphora are not solely subject to discourse constraints — there are definable syntactic constraints on these items as well. However, one strength of the HPSG binding theory is precisely that it allows separation of canonical, coargument anaphora and exempt anaphora. This later allowed me to formulate constraints that interact differently with each kind of anaphor. In section 2.4 I reviewed the major cases of exempt anaphora, one of which in my system turns out to be the understood subject of controlled complements. This lead naturally to a discussion of control theory, and in particular Manzini's generalization, which has to do with locality of control and in HPSG is captured via Principle A. In section 2.5.1, I explained how this locality is no longer properly captured once the binding is construed to apply at the level of argument structure.

This led to an extended theory of binding being defined in chapter 3. I simplified the core Principle A so that it is no longer disjunctive, which avoids the problems discussed in 2.5.1.

In addition, I adopted Principle Z — following (Xue et al., 1994) — and showed how this principle and Principle B together constrain the distribution of Danish *sig*. A new type was posited for this lexical item (and by extension cognate lexical items with the same behaviour, such as Dutch *zich*) such that it inherits from both the type *nonlocal-anaphor* and the type *personal-pronominal*. The advantage of this approach is that it allows certain long distance anaphors, such as Chinese *ziji* to be locally bound, while also capturing the fact that the Germanic long distance anaphors must be locally free.

The major extension to the binding theory was the addition of the Antecedent Closeness Constraint. This constraint applies to all anaphors; most importantly it places constraints on the distribution and binding of exempt anaphors. It correctly predicts binding possibilities for anaphors in Super Equi-NP deletions, picture NPs, and specifier positions. In some cases, the predictions are quite subtle. The ACC is construed to be a grammatical constraint, on a par with the other binding constraints. The extended binding theory that results with the addition of this constraint basically means that all and only coargument anaphors are subject to Principle A. Exempt anaphors, including the subjects of controlled complements are subject only to the ACC.

In chapter 4, I discussed several major problems to do with passive argument structure, control theory and in particular Visser's generalization. I argued that the new, nested argument structure proposed in recent work by Manning and his colleagues (Manning, 1996, 1997; Manning et al., 1999; Manning and Sag, 1999), which is well-motivated on cross-linguistic grounds, results in severe problems for the control theory of Pollard and Sag (1994).In section 4.5, I recast the control theory to be further constrained by the notion of core roles, following Bresnan (1982). I then proceeded to show how the new control theory captures the facts about subject control verbs properly. Furthermore, Manzini's generalization was shown to be captured by the Antecedent Closeness Constraint.

The second goal of the thesis, which was to examine the implications that the revised binding and control theories have for the level of argument structure, was essentially carried out in tandem to these extensions and revisions. In chapter 2, I argued that the feature ARG-ST can only sensibly be construed as a head feature, such that phrases have argument structure, too. Then, in chapter 4, I made additional modifications to the level of argument structure; this yielded a level of representation where valence changing operations always result in the sharing of arguments. The first occurrence of an argument on a ARG-ST list is a synsem, but subsequent nested occurrences are repetitions of the relevant argument's CONTENT value.

The third goal was to provide a program for interpreting indices and coindexation. In chapter 5, I proposed the Index Interpretation Rule, which states that coindexation implies covaluation. Crucially, noncoindexation does not entail noncovaluation. In section 5.3 I outlined what the term covaluation and IIR mean in Discourse Representation Theory. I ended the chapter with some remarks about the logophoric use of English reflexives. Following Sells (1987), I sketched a possible account of these reflexives in DRT. I concluded that English logophoric reflexives are resolved to the SELF pivot in Sells' system.

The fourth and final topic treated was the quantificational status of reciprocals. In chapter 6, I discussed the merits and drawbacks of treating reciprocals as plurals on the one hand, or as quantifiers on the other. Assuming that parity of behaviour indicates category membership, I then subjected the reciprocal to five different scope tests. In each case, the reciprocal behaved differently to argument quantifiers. Therefore, I concluded that the reciprocal is best treated as a plural.

There are various avenues for future work suggested by the findings in this thesis. However, one theme emerged on a couple of occasions. Both in discussing the residual problems to do with binding (section 3.5) and in surveying the facts about reciprocals just mentioned, the concept of plurality surfaced as an important and problematic challenge in determining the distribution and interpretation of certain cases of anaphora. Therefore, an interesting avenue for future work would be a more indepth examination of plurality and syntactic anaphora.

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