Syntax and Discourse in the Acquisition of Adjunct Control

by

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ABSTRACT

This dissertation is a study of null subjects in adjunct clauses in English. The goal is twofold: to establish a comprehensive theory of control in adjuncts, and to utilize this theory to understand the adjunct control interpretations of children aged 3-6. The theoretical basis of this work is Landau (2000, 2001), who characterizes the complement control mechanism as a syntactic **Agree** relation (Chomsky 1995, et seq.). I argue that the same mechanism governs control into low-attaching adjuncts (like *before, after, while* and *without*) as well. High-attaching adjuncts and gerund subjects, on the other hand, are subject to discourse-governed control rather than the syntactic Agree relation. I argue that the topic of the sentence is the controller in these cases.

This theory makes certain predictions for acquisition. We expect control in verb complements and low-attaching adjuncts to develop at the same age, given that they are governed by the same mechanism. Discourse-governed control, on the other hand, is predicted to develop much later in childhood. However, many researchers have observed that control in some low-attaching adjuncts may be delayed until age 5, beyond the age at which children master complement control. I suggest that the control principles are intact, and that a separate aspect of grammar is responsible for these non-adult interpretations. I argue that adjunct attachment height, which is crucial to determining what type of control will obtain in the adult grammar, must be learned from the input and exhibits gradual development. If the child has failed to embed an adjunct clause at a sufficiently low level (e.g., within the VP), the null subject will fall into the domain of discourse control rather than syntactic control.

If these claims are correct, we expect children to show adult-like control in adjuncts, albeit contingent upon the adjunct type. Three experiments were conducted to test these predictions. We find correlations between non-adult control and non-adult pronoun interpretation, both argued to be due to the misattachment of the adjunct clause. Children's interpretations of PRO in misattached adjuncts are also similar to those in true discourse control contexts, as expected.

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Chapter 1: Introduction

1.1 Innate and Learned Factors in Language Acquisition

The study of language acquisition within the generative framework has demonstrated repeatedly that even young children have very sophisticated knowledge of the language they are acquiring. Despite the impoverished nature of the linguistic input, cross-cultural variation in child-directed speech and the lack of evidence regarding ungrammatical forms, all typically-developing children come to master the language of their environment along a similar time course. Chomsky (1975, 1981, 1986) has argued for the existence of Universal Grammar (UG) as a solution to this seemingly intractable problem. UG consists of innately specified (and most likely, genetically-encoded) knowledge about the possible structures in human language, and serves to delimit the range of hypotheses that children form about the language input they hear. Naturally, when children are found to differ from adults in their use or interpretation of linguistic structures, it is of interest to psycholinguists to investigate the source of the difference and the process by which children are able to converge on the adult grammar.

Beyond that which is specified in UG, clearly some aspects of language must be learned through exposure to the input, since not all languages are identical. Children must acquire the words of their language, for instance, a task which involves learning not just the sound-meaning pairs but also the argument structure and syntax associated with each lexical item. This process is crucial to correctly implementing the constraints which are specified in UG. Furthermore, there is mounting evidence that aspects of discourse structure and pragmatic information about language use are learned relatively late in

childhood (Chien and Wexler 1990; Chierchia et. al 2001; Musolino and Lidz 2002; Papafragou and Musolino 2003). In order to understand and make sense of the ways in which children diverge from the adult grammar, it is vital to identify and distinguish between properties of the language which are governed by universal grammatical principles and those which are subject to gradual learning.

These assumptions serve as the backdrop for the theoretical and experimental work presented in this dissertation. The goal is to understand how innate and learned aspects of grammar come together in the acquisition of a specific linguistic phenomenon known as **control** – the relation between a null subject and its antecedent. Clearly, in order to accomplish this we need a theory of control in the adult grammar. As such, I will argue for a particular theory under which the principles of control are the same in verb complements and some adjuncts; these structures are subject to universal, syntactically-based constraints. On the other hand, we find structures in which control depends on features of the discourse and shows variation cross-linguistically. With this distinction, we can better understand children's interpretations of null subjects in adjunct clauses, and why they may differ from those of adults'. I will investigate how the aspects of adjunct structure which must be learned from the language input could lead to the observed non-adult patterns in control even on structures which are subject to universal control principles.

Section 1.2 of this introduction provides an overview of the control theory I will present in Chapter 2. Section 1.3 gives some background on the study of control in child grammar and briefly outlines my account for the child data, both of which are covered in Chapter 3. This chapter also includes the experimental predictions of my account with

respect to children's interpretation of null subjects in adjunct structures. Finally, section 1.4 offers a sketch of Chapter 4, which details the three experiments I conducted in an investigation of these issues.

1.2 Control Theory (Chapter 2)

Within the Chomskyan tradition of **control theory** (Chomsky 1981), the "understood subject" of nonfinite clauses is a null element represented as **PRO**. This classic view takes PRO to be an empty category which is both pronominal and anaphoric in nature. Typically, it must be controlled by (i.e., anaphorically linked to) some other noun phrase in the sentence in order to be interpreted (although in some structures in which there is no potential controller, PRO can receive a generic or arbitrary interpretation). The sentences in (1) provide some examples of this relationship in verbal complements:

(1) a. John_i wants/tries PRO_i to open the presents.

b. John_i tells Mary_k $\text{PRO}_{k/*i}$ to cut the cake.

c. John_i promises Mary_k $\text{PRO}_{i/*k}$ to help with the dishes.

For some years now, linguists have been exploring alternative ways to categorize PRO and implement the control relation. As I will discuss in chapter 2, Chomsky's original characterization of PRO (as a caseless, null, pronominal anaphor) is not able to capture the full range of cross-linguistic control patterns. I will focus instead on the account of Landau (2000, 2001). He argues that PRO picks up its reference through the syntactic operation of Agree, which links PRO and the Tense-Agreement node of the infinitive to the T-Agr node and subject of the main clause. The Agree relation is sensitive to c-command and phase boundaries; as such, this mechanism can only apply when the

structural conditions are met: this is the domain of **obligatory control**. This account of control is able to capture a range of data within the domain of complement control that has largely not been recognized until now. Based on this breadth of empirical coverage, I will draw on it as the basis of the theory of control I follow.

In addition to infinitives within verbal complements, it is possible for PRO to occur as the null subject of a nonfinite adjunct clause:

(2) a. Sue_i talked to John_k without $\text{PRO}_{i/*k}$ mentioning the party.

b. John_i hugged Mary_k before/after/while $\text{PRO}_{i/*k}$ cutting the cake.

In these two examples, the subject of the main clause is taken to be the referent of PRO; adults do not allow an interpretation in which the object or some sentence-external character is the controller. I will maintain that the Agree mechanism which applies in (1) is responsible for these cases of control as well. This means that control in verbal complements and some adjunct clauses is regulated by the same mechanism. More specifically, I argue that adjuncts which attach low in the structure (e.g., within the VP) and are therefore c-commanded by the main clause subject fall under the domain of structural (obligatory) control. As I will discuss in the next section, this has important implications for the study of adjunct control in child language.

PRO can also appear in **non-obligatory control** contexts; i.e., those in which the syntactic control mechanism cannot apply. Several linguists have argued that control in these cases is based on features of the discourse (Bresnan 1982; Kawasaki 1993; Landau 2000; Williams 1992). Under the control-as-Agree account, the attachment height of an adjunct is crucial in determining whether it is subject to structural or discourse control. Temporal adjuncts and *without* adjuncts, I argue, meet the structural requirements. Other

adjuncts do not, because the controller is too remote from the null subject: there is no c-command relationship between PRO and the main clause T-Agr node, and they fall into different syntactic phases. For instance, this is true of absolutive adjuncts and PRO in gerundive subjects:

(3) a. PRO_i Being new in town, the grand old hotel impressed $John_i$.

b. PRO_i Giving money to charity was generous of $Mary_i$.

In sentences like these, PRO cannot be interpreted via the syntactic Agree relation; as such they fall under the domain of non-obligatory control. This is why they tolerate a 'looser' structural relationship between PRO and controller.

The control relation in these contexts is still subject to certain restrictions, although they are not syntactic in nature. In Chapter 2 I will discuss two theories of this type of control: that of Williams (1992) and Kawasaki (1993). Williams (like Landau) suggests that the examples in (3) are sensitive to logophoricity, a discourse feature concerning the source or target of a mental or communicative report; essentially, the logophoric center is the person whose point of view or feelings are being reported. Kawasaki focuses on control by the agent in passive constructions. She argues that a different discourse feature governs these cases: topicality. Extending this account to sentences like (3) and (4) explains why they are sensitive to manipulations of definiteness (a), structural position and "aboutness" (b), all properties relevant to topicality:

(4) a. PRO_i Contradicting himself will demonstrate that the $lawyer_i$ is a liar.

a'. *PRO_i Contradicting himself will demonstrate that a $lawyer_i$ is a liar.

b. PRO_i Being new in town, the grand old hotel impressed $John_i$.

b'. *PRO_i Being new in town, the grand old hotel collapsed on $John_i$.

Example (4a/a') shows that an indefinite NP is not grammatical as the controller for discourse PRO – rather, the controller must be established already in the discourse, as the use of a definite NP indicates. Example (4b/b') shows that the controller must be the person or thing which the sentence is about; it is not sufficient for the controller to simply appear in the sentence as in (4b'). This pair of examples also shows that the structural position of the controller is relevant (direct vs. indirect object).

In chapter 2 of this dissertation, I will take a closer look at the accounts of Williams and Kawasaki and argue that topicality is in fact the crucial discourse characteristic which determines control patterns in the non-structural cases. Drawing on the work of Reinhart (1983), the prototypical properties of sentence topics will be discussed, and a formal metric for topic selection will be presented.

With this analysis of control in the adult grammar, we can turn to the topic of acquisition. The goal is to determine how and why children could differ from adults in their control judgments.

1.3 Issues in Acquisition: Control and Adjunct Structure (Chapter 3)

1.3.1 Previous Research

The choice of referent for PRO has received a great deal of attention in the acquisition literature (Cairns et. al. 1994; C. Chomsky 1969; Cohen Sherman and Lust 1993; Broihier and Wexler 1995; Goodluck 1987, 2001; Goodluck and Behne 1992; Lust et. al. 1986; McDaniel et. al. 1991; Tavakolian 1977; Wexler 1992). The data from these studies bring to light an asymmetry in children's interpretation of PRO. Specifically, some children under 6 appear to be overly permissive in choosing a controller for PRO in

adjuncts even once they know the control properties of verbal complements. Control into purpose clauses like (5b) below has been found to be delayed even as late as age 8 or 9 (Hsu et al. 1985). Several studies have noted that children allow PRO in these structures to refer to any sufficiently salient referent from the discourse context (Broihier and Wexler 1995; Lust et. al 1986; Wexler 1992). For example, a sentence like (5a) below (repeated from (2)) may be accepted by children in a situation where Mary or some other participant was the one who cut the cake:

(5) a. John hugged Mary before PRO cutting the cake.

b. Daisy jumps over Pluto (in order) PRO to climb the ladder.

In Chapter 3, I will discuss the existing data on complement and adjunct control in more detail. I will then focus on two previous accounts for the findings: the nominalization hypothesis of Wexler (1992) and the adjunct misattachment account of Cairns et al. (1994), Hsu et. al. (1985) and McDaniel et al. (1991). Both accounts maintain that the principles of control are essentially the same in child and adult grammar; they identify other issues with the syntactic structure of adjunct clauses which leads to non-adult control.

Wexler (1992) argues that temporal adjuncts and purpose clauses are problematic for children because they contain an empty operator, as shown below:

(6) a. John hugged Mary [$_{PP}$ before/after [$_{IP}$ Op_i PRO cutting the cake t_i]]

b. Daisy jumped over Pluto [Op_i PRO to climb the ladder t_i].

He suggests that empty operators are subject to maturational constraints, such that children will not be able to represent or manipulate them until relatively late in childhood. Because the root of the problem is not actually control, children are expected

to show adult-like control in adjuncts which do not contain an empty operator. The linguistic theory of Larson (1988) and Johnson (1988) tells us that adjuncts headed by *while* and *without* never have this operator, although *before* and *after* adjuncts sometimes do. Based on this, Wexler's account predicts adult-like judgments on the former two, and non-adult judgment of the latter two.

We have yet to see how the presence of an operator influences children's choice of controller. In the case of temporal adjuncts like (6a), Wexler argues that children have an 'escape hatch' which allows them to represent the structure without an operator: they can substitute a nominal gerund for the non-finite clause under *before*; this is a very similar structure which does not contain an operator:

(7) John hugged Mary [before [$_{DP}$ the cutting of the cake]]

The change from (6a) to (7) results in an interpretive difference: namely, the agent of the cutting action is left unspecified in (7), whereas it is obligatorily the subject of the main clause in (6a). This is how Wexler accounts for the apparent 'free' interpretation of the missing subject.

In chapter 3, I identify some theoretical and empirical problems with this account. For instance, a closer look at the theory of temporal operators suggests that only *finite* temporal clauses contain an operator. This means that a sentence like (6a) given above does not contain an operator and is therefore not predicted to be problematic for children. Below I summarize the issues I will bring up in connection with this explanation of non-adult control:

(8) a. Although linguistic theory argues that finite temporal clauses contain an empty operator, non-finite temporal clauses like the one in (6a) do not. Thus, there is no reason for children to substitute a new structure with a different interpretation.

b. Research on purpose clauses suggests that children aged 3 to 5 *are* able to represent the operator in this type of adjunct (Vainikka and Roeper 1993).

c. Experiment 1 of this dissertation shows that children are non-adult on control in all three temporal adjuncts (*before, after, while*), contrary to the expectation of adult-like performance on *while* adjuncts.

Each of these concerns is motivated and discussed in detail in chapter 3. In essence, the evidence suggests that the presence of an empty operator does not correlate with non-adult interpretations of PRO.

Next I turn to the adjunct misattachment account of Cairns et al. (1994), Hsu et. al. (1985) and McDaniel et al. (1991). They maintain that an innate principle requires PRO to be controlled by a c-commanding NP in both complements and adjuncts. The child errors on these structures come from children making mistakes in the way that complements and adjuncts are represented syntactically. These authors argue for a series of developmental stages in which children slowly learn to embed these clauses, beginning with complements. Children persist in the misattachment of adjunct clauses; the result is that they might require object control, if the adjunct attaches within the c-command domain of the object, or allow external control if the adjunct attaches outside the c-command domain of both the subject and object. In this case, they suggest that children default to an 'arbitrary' PRO interpretation, which obtains in the adult grammar when

there is no specified controller (as in a sentence like *PRO Giving to charity is a noble deed*).

This account contains some problematic claims – for instance, the idea that children are defaulting to an arbitrary interpretation of PRO. The adult arbitrary interpretation actually amounts to a generic interpretation (e.g., *for anyone to give to charity is a noble deed*). However, in experimental settings children assign PRO a specific interpretation, not a generic one – i.e., they pick an individual who has been mentioned and established in the discourse. So, this is not an accurate description of the child grammar. In addition, a number of the proposed stages in this account involve structures that do not occur in any language; for instance, the authors claim that children might initially fail to embed verb complements, and later they may attach complements and adjuncts at the same level. Despite the concerns mentioned here (and explored in more detail in Chapter 3), I believe that these authors were on the right track in thinking that the attachment height of an adjunct is relevant to the interpretation of PRO. One piece of this analysis which will be adapted and maintained under my account is the idea that children might mistakenly attach a temporal adjunct very high in the structure, much like the way a coordinate clause is attached. As I will show, this has straightforward consequences for control judgments. In addition, there is evidence that children who allow overly liberal control in these structures treat actual coordinate structures and temporal adjuncts in a similar way (Cairns et al. 1994). This is discussed in more detail in chapter 3.

1.3.2 My Account: the Relevance of Adjunct Attachment Height

Like the two accounts reviewed here (Wexler's nominalization hypothesis and Cairns McDaniel, Hsu et al.'s misattachment account), the theory that I argue for assumes that the principles of structural control are specified in UG and therefore need not be learned from the input. However, I believe it is important to recognize that in the adult grammar, control will vary depending on the attachment height of the adjunct: low-attaching adjuncts exhibit structural control whereas high-attaching adjuncts exhibit discourse control. Independently from control, adjunct attachment height can vary from structure to structure and language to language (Ko 2003; Rapp and von Stechow 1999; Tomioka 2006). Given this, it seems reasonable to think that the attachment properties of adjunct clauses can and must be learned from the input.

Unlike the previous adjunct misattachment account, I assume that the existence of recursive embedding, and more specifically the c-command relations between a verb and its complement, is not something which must be learned. However, the syntactic properties of individual lexical items must be acquired before a child can correctly implement control in adjuncts – i.e., children must learn the right attachment height for various adjuncts. Part of this process involves learning which prepositions are used to subordinate clauses, and which are used to coordinate them. I suggest that the subcategorization properties of lexical items are utilized by the child as information regarding their structural properties.[1] In the case of the temporal terms *before, after* and

[1] This is similar to the claims made by Tavakolian (1977) in her conjoined clause analysis of relative clauses. However, the attachment of adjuncts but not complements is subject to variation within and across languages; as such I do not wish to maintain that the embedding of any type of complement clause is something which must be learned.

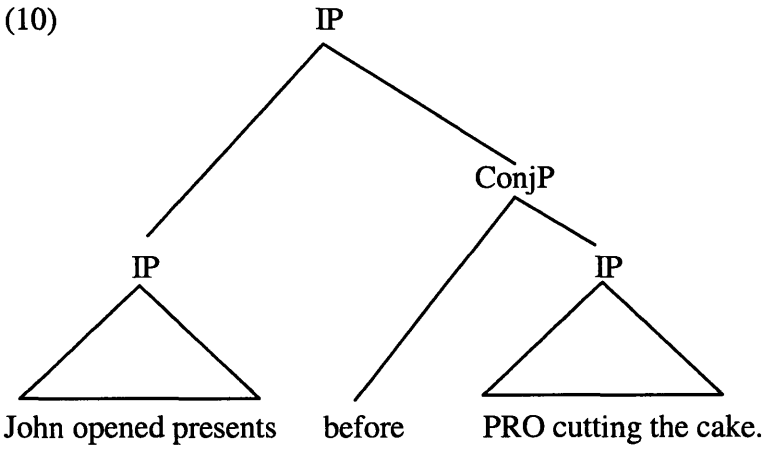
while, however, this information is not definitive, since they are similar to a true conjunction like *and* in being able to take a full sentence as a complement:

(9) a. John opened his presents [before [he cut the cake]].

b. John opened his presents [and [he cut the cake]].

I hypothesize that this and other similarities between temporal adjuncts and coordinate clauses (detailed in Chapter 3) lead children to wrongly analyze the temporal terms as lexical items which conjoin two clauses at a high level. The result is a structure like (10):

(10)



A structure like this does not meet the requirements for structural control, since the null subject is neither c-commanded by the main clause T-Agr, nor does it fall within the same phase as the main clause. For an adult, it would instead be subject to discourse control. If these considerations are correct, we expect to find similarities between the way that children interpret PRO in misattached adjuncts and the way they interpret it in actual discourse (i.e., non-obligatory) control contexts.

Recall that adults find a referent for non-obligatory control PRO by looking to the topic of the sentence, a role which is determined through properties of the discourse. So, in addition to determining the correct attachment height of adjuncts, children must also learn what discourse features are relevant to control in non-structural cases. I assume that

this aspect of control is not specified innately; indeed it seems that the exact discourse properties licensing PRO in non-obligatory contexts can vary across different constructions;[2] However, it has been discovered independently that children are relatively slow to master features of grammar that rely on discourse information. For instance, Avrutin and Cunningham (1997) and Sigurjónsdottir and Hyams (1992) have found that children were delayed on the acquisition of long-distance (logophoric) anaphora. These studies demonstrated that children's non-adult treatment of reflexives was limited to those cases governed by discourse properties rather than syntactic principles.

Based on the considerations discussed here, we can see that adjunct control will not necessarily be a uniform phenomenon in child language; rather, it will depend on the way that various adjuncts are represented. Consider, for instance, adjuncts headed by *without*. This lexical item cannot take a full sentence as a complement; it is limited to taking nominal complements:

(11) a. Mary cut the cake without [$_{DP}$ the knife].

b. Mary cut the cake without [$_{DP}$ PRO using the knife].[3]

c. *Mary cut the cake without [$_{IP}$ she used the knife].

Based on these distributional patterns, a child has motivation for assigning a conjoined clause analysis to the temporal adjuncts but not *without*. This adjunct should therefore be properly embedded within the VP presumably as soon as the word is acquired. This

[2] For instance, topicality seems to be crucial to controller choice in adjuncts and gerundive structures. Landau (2000), however, identifies logophoricity as the relevant feature in sentences with extraposition. This accounts for the contrast between (i) and (ii):

(i) John said to Mary that it would be easy PRO to prepare herself for the exam

(ii) *John said about Mary that it would be easy PRO to prepare herself for the exam.

In (i) *Mary* is the target of a communicative report; in (ii) she is merely mentioned in the sentence. Topicality cannot explain this contrast, since *Mary* fits the conditions for topic-worthiness in (ii), and yet the sentence is not acceptable.

[3] As I discuss in Chapter 2, gerunds like the form in (11b) are argued to be DPs rather than IPs (Abney 1987).

means that all the pieces of the puzzle are in place: the adjunct is properly attached, and the UG-given principles of structural control are, of course, available. As such, we expect that from a young age children will show adult-like control in *without* adjuncts: they will reliably reject readings in which PRO refers to some person in the discourse rather than to the main clause subject.

To summarize, the adjunct misanalysis account I propose predicts that the temporal adjuncts, but not *without* adjuncts, will exhibit overly liberal control. It is hypothesized that liberal control obtains when children mistakenly treat the structural control adjuncts as discourse control contexts. So, we expect to find parallels between the interpretation of PRO in misanalyzed temporal adjuncts and in true discourse control structures. In addition, the misattachment of an adjunct clause will clearly have consequences in domains other than control. Binding relations between pronouns and full noun phrases, for instance, are sensitive to c-command between the main clause and the adjunct. As such, they will be used as a diagnostic of adjunct misattachment. This will be explained in more detail in the next section, which describe the experiments I present in Chapter 4 of this dissertation.

1.4 Overview of Experimental Studies (Chapter 4)

Three experimental studies will be presented in Chapter 4. All of the experiments were conducted using a Truth Value Judgment task (Crain and McKee 1985). The first experiment seeks to expand the types of adjuncts which have been studied to include ones headed by *without*. Prior to this investigation, it was unknown whether children as a group ever demonstrated successful adjunct control younger than age 5. The theoretical

considerations I outlined above lead us to hypothesize that children will be able to implement the control relation in structural control adjuncts. Under this account, the non-adult performance observed so far is thought to be due to a separate factor regarding adjunct attachment. Therefore, if there is some adjunct clause which children are able to appropriately embed at a young age, we expect them to show adult-like control in this case. The adjunct misanalysis account predicts that adjuncts headed by *without* will be just such a structure. In fact, the majority of children were adult-like on control into *without* adjuncts even in the youngest age group tested (age 3-4).

The second experiment seeks to find positive evidence of adjunct misattachment based on the effect it will have on pronoun interpretation. More specifically, the misattachment account predicts that children who have misanalyzed the adjunct as a conjoined structure may allow interpretations which are ruled out by Principle C for an adult. Principle C of the Binding Theory is given below:

(12) Principle C: All r-expressions must be free (i.e., not bound)

A binds B if A and B are coindexed and A c-commands B

This constraint rules out coreference in sentences like the following:

(13) a. $He_{*i/k}$ ate a snack after the $clown_i$ went for a boat ride.

b. $He_{*i/k}$ found the pig while the $farmer_i$ was up in the tree.

For adults, the adjuncts are subordinate to the main clause and there is a c-command relation between the pronouns and the full DPs. By Principle C, the r-expressions must be free and so it is not possible to get a reading in which they and the pronouns are bound. Instead, adults interpret the pronoun deictically – it must refer to some other person in the discourse context. However, if the adjunct is misattached such that it is outside the c-

command domain of the main clause subject, we expect that coreference is possible. In fact, the results of this experiment indicate a correlation between non-adult control and non-adult Principle C violations in temporal adjuncts, as expected if the root of both is the misattachment of the adjunct clause.

Early research on binding in child language found evidence that children exhibit a general dispreference for backward anaphora, even when it is grammatical in the adult grammar (Tavakolian 1977; Lust, Loveland and Kornet 1980). So, we want to be sure that children who appear adult-like and rule out coreference in sentences like (13) are doing so because of Principle C and not because of a dispreference for having the pronoun precede its referent. For this reason, sentences with grammatical backward anaphora as in (14) were included in my study:

(14) a. While $she_{i/j}$ was riding in the boat, the $princess_i$ found a turtle.

b. After $he_{i/j}$ went for a ride, the $king_i$ bought the magic carpet.

If children accept coreference in (14) but not (13), we can conclude that the pattern is due to Principle C rather than a linear constraint on backward binding. So, these structures are included in the experiment as well. The data from this part of the experiment confirm the hypothesis that Principle C is active in the children's grammars: although they sometimes allowed backward binding where the adult grammar would not, they did distinguish between the sentences in (13) and (14) in this respect. Children allowed backward binding significantly more often when it was not ruled out by Principle C.

Finally, the third experiment examines true discourse control structures. The adjunct misanalysis account predicts that a misattached temporal clause will show similar

control properties to actual discourse control structures. Thus, the same 30 children who participated in experiment 2 were also tested on sentences like the following:

(15) a. PRO Racing the unicorn made Shrek nervous.

b. PRO Lifting the table, Care Bear found the cat.

Adults will require that the controller for PRO in these sentences be the character who is mentioned in the sentence – the object in (a) and the subject of the main clause in (b). However, as I show in Chapter 2, in these cases it is actually a topic selection metric which identifies the controller, and not the structural Agree relation. In temporal adjuncts, children have been shown to allow even a sentence-external character to control PRO; the goal here is to determine whether the same pattern holds in true discourse control structures like the ones in (15). To foreshadow, we find that children's interpretation of PRO in discourse control contexts is parallel to their overly liberal interpretations in temporal adjuncts. Interestingly, the delays in actual discourse structures remain even in the oldest age group tested (age 5-6), whereas the children showed at least 90% adult-like behavior on structural control by age 5. These results will be discussed in detail in Chapter 4.

Chapter 2: Control Theory

2.1 Introduction

This chapter deals with our theoretical understanding of null subjects in nonfinite clauses. The discussion focuses on treatments within the generative framework, beginning with Chomsky (1981) and moving on to alternative characterizations. Based on empirical coverage and theoretical parsimony, I offer support for one particular control theory, which takes the nonfinite Agr to be the seat of anaphoric features (Borer 1989; Landau 2000). This account of control in verb complements is presented in detail in section 2.2 and then compared with alternative accounts in section 2.3. The ultimate goal is to merge these elements into a comprehensive theory of control in adjuncts, which I address in section 2.4. Final remarks are presented in section 2.5. Armed with an understanding of control in the adult grammar, I will turn to the question of acquisition in chapters 3 and 4.

2.1.1 The History of PRO

In English, the subject of a finite clause must be overtly realized; hence the ungrammaticality of (1b), where *e* stands for an empty element:[4]

(1) a. John impressed Bill.

b. **e* impressed Bill.

[4] Some languages allow the option in (1b); these are typically ones with a rich inflectional system, i.e., those in which the phi-features of the intended subject are recoverable from the verbal inflection.

Similarly, it is not possible for an empty element to appear as the object of a transitive verb, regardless of whether it is intended to be coreferential with another noun phrase in the sentence:

(2) a. *John$_i$ impressed $e_{i/j}$.

However, an empty element can appear in the subject position of a nonfinite clause:

(3) a. John hopes [*e* to impress Bill]

b. John decided [*e* to leave early]

Chomsky (1981) assumes that in sentences like these, there must be some element which serves to satisfy the selectional requirements of the embedded verb; put another way, normally these verbs require a subject (which would appear in the position marked *e* in (3)) in order to be used grammatically. Chomsky argues that the subject *John* in (3) cannot fulfill this role since it already functions as the argument of the main clause verb. Instead, he represents the missing argument as PRO.

Chomsky (1981, 1986) used the features [±anaphor] and [±pronominal] to characterize types of noun phrases. The goal of this was to establish a uniform system for classifying both overt and covert noun phrases. There are four logically possible ways for these features to combine:

(4) a. [+anaphor, –pronominal]

b. [–anaphor, +pronominal]

c. [–anaphor, –pronominal]

d. [+anaphor, +pronominal]

Discussing the nature of these features, Chomsky (1995) states that "an expression that is [+anaphor] functions referentially only in interaction with its antecedent; the reference of

an expression that is [+pronominal] may be determined by an antecedent (but it does refer)" (p.41). R-expressions are assumed to be [–anaphor, –pronominal], since they are referentially independent. Based on these considerations, we can see that certain nominal elements easily fit into one or another category:

(5) a. [+anaphor, –pronominal] → reflexives (*himself*), reciprocals (*each other*)

b. [–anaphor, +pronominal] → pronouns (*he, she*)

c. [–anaphor, –pronominal] → R-expressions (*John, the cake*)

d. [+anaphor, +pronominal]

The early principles of Binding Theory (Chomsky (1981); Reinhart (1983)) were intended to capture the distribution of noun phrases according to their division into the four feature specifications given above:

(6) Binding Theory principles

A. An anaphor must be bound in its governing category

B. A pronoun must be free in its governing category

C. An R-expression must be free

...where *governing category of α* is (roughly) defined as the minimal clause containing α and a governor of α.

Where does PRO fit in this system? In some environments it is similar in its interpretation to a reflexive anaphor (consider example 3a, whose meaning is equivalent to something like *John hopes that he himself will impress Bill*), although the distribution of PRO and anaphors is complementary rather than overlapping. Additionally, PRO functions like a pronoun in that it must be free within a certain local domain. In order to capture this, Chomsky (1981) suggests that PRO falls into the last category of [+anaphor,

+pronominal]. He accounts for the complementary distribution between PRO and anaphors by appealing to case and government: anaphors must be governed and assigned case by a predicate, whereas PRO is barred from precisely those positions which are governed and receive case. PRO is grammatical as the subject of a nonfinite clause because the nonfinite Infl is assumed not to govern or assign case.[5] Under the binding principles, PRO must be simultaneously both bound and free because it is taken to be both [+anaphor] and [+pronominal]. It would seem that the only way for PRO to satisfy the Binding Theory is to not have a governing category, otherwise it would be unable to satisfy both principles A and B. If PRO does not have a governing category, then principles A and B are vacuously satisfied. Although this achieves the right result at a mechanical level, it suggests that the distribution of PRO should be determined independently of the binding principles. Control Theory, a module of grammar separate from binding, was developed to account for the distribution and interpretation of PRO. We now take a closer look at the development of this theory.

2.1.2 The Development of Control Theory

Descriptively, most theories of control have drawn a distinction between obligatory control (OC) and non-obligatory control (NOC), coined as such by Williams (1980). These two types differ along certain criteria, mostly regarding the range of interpretations that PRO tolerates. The need for c-command between PRO and its controller has often been treated as a fundamental feature of OC. The possibility of an "arbitrary" reading of PRO (in which PRO is interpreted much like *(any)one*) is typically a diagnostic of NOC. However, the exact criteria and the proper classification of various constructions differs

[5] Chomsky and Lasnik (1995) later revised this idea to say that nonfinite Infl licenses null case on PRO.

somewhat across different accounts. Control in verb complements is a prototypical example of obligatory control: it does not permit arbitrary control, but instead exhibits rigid, lexically-specified control patterns. In contrast, PRO in gerundive subjects permits arbitrary control and does not have a c-commanding controller. PRO in intraposition can have a long-distance controller; this is also considered an NOC structure.

Several approaches to control have followed in the binding theory tradition and distinguished between OC and NOC by saying that PRO is anaphoric in the former and pronominal in the latter (Bouchard 1984; Hornstein 1999). However, this characterization is problematic: the reference of NOC PRO is actually more restrictive than would be expected if PRO were simply interpreted using the principles of pronominal coreference (this will be explored in section 2.2.5). Many others have at least assumed that Condition A of the binding theory handles cases of OC (Manzini 1983, 1986; Lebeaux 1984, 1985; Kawasaki 1993). However, as Lasnik (1992) points out, there are non-trivial differences between PRO and anaphors which argue against a reduction of control to binding. As we have mentioned, their distribution is complementary. The choice of controller for PRO is sensitive in some ways to the lexical semantics of the verbs which take a nonfinite complement (i.e., each OC verb specifies whether it is a subject or object control verb), whereas the use of reflexives does not depend on lexical factors (Lasnik 1992). Landau (2000) also mentions that several languages (Polish, Icelandic, Japanese, Korean) have anaphors which are strictly subject-oriented, and yet PRO in these languages is not similarly restricted. If the nature of PRO is fundamentally the same as the nature of overt anaphors, none of these differences would be expected.

There are also a number of cases cross-linguistically in which possible controllers are not possible binders. For instance, Rizzi (1986) showed that in Italian an implicit dative argument can control PRO but not bind an anaphor:

(7) a. Lo psichiatra (gli) ha detto [di PRO parlare di se stessi].

'The psychiatrist said (to them) to speak about themselves.'

b. Lo psichiatra *(gli) ha restituito se stessi.

'The psychiatrist gave *(them) back themselves.'

It seems that in general, implicit arguments can control PRO but not bind anaphors. Another difference of this sort is found in German: case interferes in some way with binding, such that dative arguments cannot bind anaphors, and yet they can control PRO:

(8) a. weil der Hans der Maria $sich_{h/*m}$ auf dem Photo zeigte

since John-NOM Mary-DAT self in the picture showed

'Since John showed Mary himself/*herself in the picture...'

b. Ich_1 habe ihm_2 vorgeschlagen PRO_2 mich zu erschiessen.

I have him-DAT proposed PRO me to shoot

'I proposed to him to shoot me.' (Landau 2000: 117, cf. Wurmbrand 1998).

There are interpretive differences between PRO and anaphors as well. Landau (2000) and Petter (1998) showed that PRO can exhibit 'partial' control, an option not possible for other anaphora (this will be explored more in the next section). Additionally, only a sloppy interpretation of PRO is possible under ellipsis, whereas elided anaphors can receive either a strict or sloppy reading:

(9) a. John believes himself to be intelligent, but no one else [does].

a'. ...believes John to be intelligent.

a''. ...believes him/herself to be intelligent.

b. John claims PRO to be intelligent, but no one else [does].

b'. ...*claims that John is intelligent.

b''. ...claims that s/he is intelligent. (Landau 2000: 118)

The strict reading of the elided VP is paraphrased in the (a'/b') sentences; it is grammatical for (a) but not (b). The sloppy reading, paraphrased in (a''/b''), is grammatical in both cases.

The control-as-binding approach faces the non-trivial task of explaining why each of these discrepancies exist, if the mechanism responsible for interpreting PRO and reflexives is the same. These data seem to substantially weaken the motivation for conflating the two phenomena. A characterization of control which is independent from binding does not face the challenge of reconciling these differences. We now turn to such an account.

2.2 Landau's Account of Control

2.2.1 On the Interpretation of PRO in OC and NOC

Landau (2000, 2001) presents an comprehensive account of control within a minimalist framework (Chomsky 1998, et seq.). He begins by reformulating the OC/NOC distinction; not all of the properties enumerated previously are taken to be crucial under his account. For instance, he rejects the claim that alternation with a lexical subject is a diagnostic of NOC. He notes that this feature does not systematically correlate with the

other characteristics of NOC constructions. Furthermore, it appears that control patterns are not limited to covert elements. In languages which allow a pronoun as subject of a nonfinite clause (Chinese, Japanese, Korean), these overt elements demonstrate the same range of interpretations as PRO (Yang 1985; Borer 1989). Landau retains the idea that arbitrary control is a diagnostic of non-obligatory control. He notes that certain other interpretive options pattern with the PRO_{arb} interpretation. He suggests that this should form the descriptive basis for the distinction between obligatory and non-obligatory control:

(10) Table 2.1: Dovetailing properties of control constructions

Does the construction allow:	(OC)	(NOC)
Arbitrary control?	N	Y
Long-distance control?	N	Y
Strict reading under ellipsis?	N	Y
De re reading under attitude verb?	N	Y

Structures which have traditionally been considered OC all disallow these interpretive options, whereas they are all possible in prototypical NOC contexts. As we will see shortly, Landau's mechanism of control is able to explain why various structures fall into one interpretive category or the other. This is an important advantage of his account.

Let us look at some examples which demonstrate the interpretive patterns listed above.[6] Arbitrary control, in which the controller does not correspond to any argument in the sentence and is most readily understood as generic, is illicit in verb complements (11a,b) and allowed in gerundive subjects (11c):

[6] These examples are taken from Landau (2000); where relevant, I note his original sources.

(11) a. *John tried PRO_{arb} to be quiet

c. PRO_{arb} making a large profit requires PRO_{arb} exploiting the tenants.

Lebeaux (1984)

Long-distance control, i.e., control by an NP outside the IP containing PRO, is possible only with NOC constructions (here, intraposition):

(12) a. *$Mary_i$ knew that John hated PRO_i to perjure herself.

b. $Mary_i$ knew that [PRO_i perjuring him/herself] damaged John.

When control interacts with ellipsis, we find that OC constructions only permit a sloppy reading of PRO, whereas NOC can support a strict reading:

(13) a. John tried PRO to leave early, and Bill did too.

b. John thinks that PRO feeding himself will be difficult, and Bill does too.

Bouchard (1985)

(13a) can only mean that Bill tried (to arrange or plan) *for Bill* to leave early; it cannot mean that Bill tried (to arrange or plan) *for John* to leave early. Conversely, (13b) can mean either that Bill thinks it will be difficult for John to feed John (strict reading), or Bill thinks it will be difficult for Bill to feed Bill (sloppy reading).

Finally, only NOC constructions support a *de re* reading of PRO. Landau gives an example (which he attributes to Hornstein (1999)) involving a war hero ("the unfortunate") who has lost his memory and does not recognize images of himself being given a medal (e.g., on TV). In such a context, (14a,b) can be uttered felicitously, but not (14c):

(14) a. The unfortunate expects that he will get a medal

b. The unfortunate believes that PRO getting a medal would be boring.

c. #The unfortunate expects PRO to get a medal.

(14c) is incompatible with this scenario (hence the crosshatch marking infelicity) in which the war hero does not identify himself with the person receiving the medal on television, because it only supports the *de se* reading; (14a,b) on the other hand, can still be true in the context because they allow a *de re* interpretation of the pronoun and PRO respectively.

Landau notes that the descriptive properties of obligatory control obtain only in cases in which the infinitive is internal to the VP, whereas the opposite pattern obtains elsewhere (we will be in a position to explain why this is so once we discuss his mechanism of control in section 2.2.3). However, within the domain of OC there is a further division according to whether PRO must be identical to its controller or whether it can refer to a larger group that merely includes the syntactic controller. We explore this difference in the next section.

2.2.2 PRO in OC: Partial vs. Exhaustive Control

Landau's system is able to account for a little-noted division within the realm of OC: partial vs. exhaustive control.[7] Partial control verbs permit a reading in which PRO merely includes the controller, rather than being identical to it; exhaustive control verbs do not allow this option. Put another way, partial control verbs permit a mismatch in number between PRO and controller. For instance, consider a sentence like the following:

[7] To my knowledge, Landau's system is the only complete account of partial control, although previous studies have at least noted the phenomenon: Lawler (1972), Martin (1996) and Petter (1998).

*John likes *for me/for us/PRO to meet at the café.* As the judgments on the overt options indicate, *meet* is a collective predicate, requiring a plural subject. And yet the version of the sentence with a PRO subject is grammatical with the singular *John* as the controller. Landau argues that this is a case of partial control: PRO actually refers to a contextually-relevant group which includes the structural controller *John* but is not limited to him.

Different classes of verbs behave differently in this respect. Verbs which allow the partial reading are dubbed partial control (PC) verbs; those which require identity between controller and PRO are exhaustive control (EC) verbs. Using collective predicates as a diagnostic, the difference between EC and PC can be shown. If the collective predicate is embedded under a partial control verb, the sentence is grammatical even with a singular subject; but if it appears under an exhaustive control verb, which demands identity between PRO and the controller, it is ungrammatical:[8]

(15) <u>EC verbs: ungrammatical under partial control reading</u>

a. *John told Mary that he_i forgot PRO_{i+} to meet at 6:00.

b. *The $chair_i$ dared PRO_{i+} to convene during the strike.

c. *John told Mary that he_i had PRO_{i+} to separate before it was too late.

<u>PC verbs: grammatical under partial control reading</u>

d. John told Mary that he_i preferred PRO_{i+} to meet at 6:00.

e. The $chair_i$ decided PRO_{i+} to convene during the strike.

f. John told Mary that he_i intended PRO_{i+} to separate before it was too late.

[8] As Landau notes, some context or world knowledge is needed to license the partial control reading. The hearer must be able to access some individual or set of individuals who could plausibly be part of the group that includes syntactic controller. This can be achieved by embedding the sentence in a linguistic frame that makes the other referents explicit, or by using an NP like *chair* or *head*, which presumably makes salient some group such as a committee or department.

Landau identifies the classes of verbs which fall into the partial and exhaustive control categories. Each category encompasses a few different semantic classes, and it seems that the category membership is not predictable from the semantics of the verbs:

(16) Exhaustive Control (EC) verbs:

a. Implicative (*manage, avoid, forget, make sure, refrain*)

b. Aspectual (*begin, start, continue, finish*)

c. Modal (*have, may, should, need, must*)

(17) Partial Control (PC) verbs:

a. Factive (*like, dislike, regret, glad, sad*)

b. Propositional (*believe, think, suppose, say, claim*)

c. Desiderative (*want, prefer, hope, arrange, decide, agree*)

d. Interrogative (*wonder, ask, find out, inquire, know*)

Although the semantics of the verb classes do not predict the EC/PC split, there is a syntactic difference between the two types of complements that these verbs take: PC verbs take a tensed complement, whereas EC verbs take an untensed complement. A **tensed complement** defines a tense domain distinct from that of the matrix clause. To demonstrate that verbs differ in this respect, consider the following pair of sentences:

(18) a. *Yesterday, John managed to solve the problem tomorrow. (EC verb)

b. Yesterday, John hoped to solve the problem tomorrow. (PC verb)

In (18a), the untensed complement to the EC verb cannot host a time adverbial which is independent from the tense of the matrix clause; this is true of all of the EC verbs in (16). With a tensed PC complement, however, the tense of the embedded clause can be different from that of the main clause. Again, the PC verbs in (17) are also uniform in this

respect. In the next section we will see how Landau's mechanism of control is able to derive the interpretive difference between EC and PC verbs from the syntactic difference in tense.

The ultimate goal of this discussion is to establish a comprehensive account of control in the adult grammar. By specifying the mechanism of control in verb complements, we can better understand the mechanism which is responsible for control in adjuncts. Furthermore, with a clear understanding of the adult grammar, we will be better able to address the patterns which emerge in the child data.

2.2.3 Agree as the Mechanism of Control

Following Borer (1989), Landau attributes anaphoric properties to both PRO and the infinitival Agr. This means that both elements must have their features valued by some other element in the sentence. More specifically, PRO looks to the infinitival Agr for phi-features, but Agr, being anaphoric, has no features to provide. Valuation must take place from outside the infinitival clause. In the minimalist program (Chomsky 1995, 1998) this valuation is implemented through the operation of Agree, in which a functional head with an uninterpretable feature looks down into the structure to find a goal that can check off its features. Typically it is the uninterpretable features of the probe which are thought to trigger an operation. However, our concern here is primarily the goal rather than the probe, as the issue at hand is how PRO gets valued. A principle like Lasnik's (1993, 2003) "enlightened self-interest" might help to explain the driving force for Agree in this situation. This principle allows either a probe or a goal to motivate Agree, so long as both elements have unsatisfied requirements that are satisfied by virtue of the operation. A

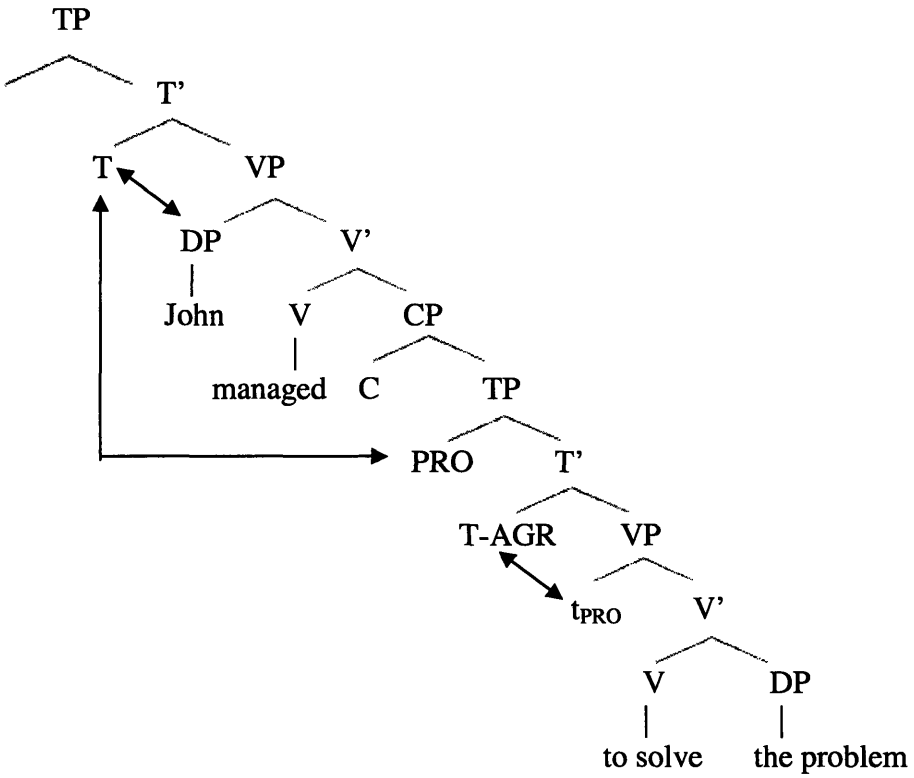
goal can only be accessed by Agree if it is active in some way. In this system, PRO and Agr are active because of their anaphoricity. The probe, which is active because it hosts uninterpretable features, is the functional head of the matrix clause (e.g., Tense). Since both probe and goal will have unvalued or uninterpretable features, Lasnik's condition is met.

This mechanism of deriving control is strictly local. The goal of Agree must be found within the same phase as the probe, or at the edge of the phase immediately below it. We follow Chomsky (1998, 1999) in taking vP and CP to define phases.[9] In this way, the distinction between OC and NOC falls out of the system: NOC obtains when an Agree relation with a higher element is impossible because of intervening phase boundaries. For the moment, we will focus on obligatory control. We return to the interpretation of PRO in NOC in section 2.2.5.

As mentioned above, the domain of OC is divided between exhaustive and partial control. Tensed control infinitivals can receive the partial control interpretation; untensed ones cannot. Landau's system is able to derive this difference based on whether Agree is implemented with the infinitival T-Agr or PRO itself. In exhaustive control (EC), PRO itself is the target of Agree; the functional head of the main clause (e.g., T) enters into an Agree relation with the controller (e.g., the subject) and also with PRO. The tree in (19) (from Landau (2000)) demonstrates this process. The arrows indicate Agree relations:

[9] The definition of a phase will be explored in more detail in section 2.4.

(19) Exhaustive Control: *John$_1$ managed PRO$_1$ to solve the problem*



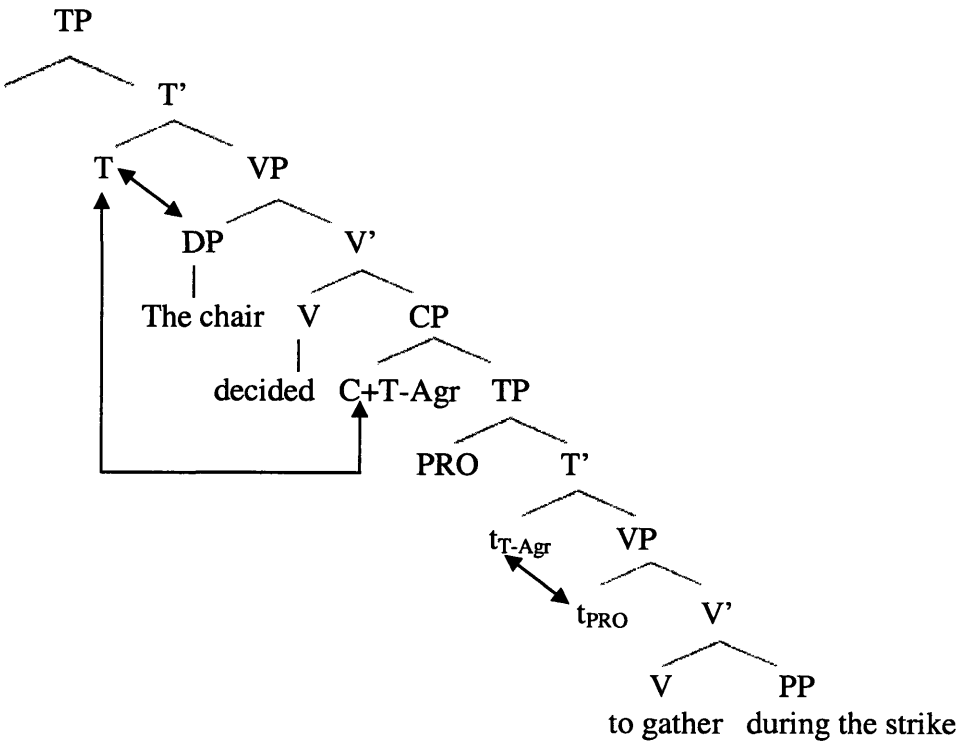
In this structure, the main clause T-Agr probes into the phase to find a goal which can check off its uninterpretable features – this goal is the DP *John*. T in turn transmits its features via Agree to the embedded PRO. Thus a chain is formed between these elements, and the features of the subject DP are transferred to the embedded Agr and PRO.

In a structure with a partial control verb, the situation is slightly more complex. The Agree relation holds between the main clause T-Agr and the embedded T-Agr, as opposed to PRO itself. For this to be possible, the lower T-Agr must be accessible within the lower phase. In its base position it is not accessible, being below the edge of the phase. However, following Pesetsky and Torrego (2000) and others, Landau assumes that T moves to C in the embedded clause. Pesetsky and Torrego argue that T, which bears an interpretable tense feature, moves in order to value the uninterpretable tense feature on C.

Overt T-to-C movement is robustly attested cross-linguistically, in the form of auxiliary inversion and V2 effects, suggesting that this is a valid assumption. As C marks the phase edge, T-to-C movement makes T accessible to the next higher phase.

Importantly, T-to-C movement does not obtain in untensed infinitives; this is the root of the difference between EC and PC verbs. Landau argues that tensed and untensed clauses differ in whether they mark their head C with a T-feature: tensed clauses do, untensed ones do not. So, in untensed clauses there is no uninterpretable feature which motivates the movement of T. According to standard minimalist assumptions (e.g., Last Resort), this means that movement will not take place. T-to-C only takes place in tensed clauses. The result is that the infinitival T-Agr is at the edge of the phase, and thereby accessible to Agree, in PC cases but not in EC. The tree in (20) diagrams the Agree relations which hold in a PC context:

(20) Partial Control: *The chair$_1$ decided PRO$_{1+}$ to gather during the strike.*



In this case, the main clause T-Agr Agrees not with PRO, but with the T-Agr of the embedded clause. The valuation on the embedded T in turn values PRO (as one can see in the tree above, technically the trace of the moved T values the trace of the moved PRO; the effect is the same).

The task remains to explain how it is possible to get the partial control reading when (and only when) control is mediated by T-Agr – i.e., only with tensed, PC verbs. Recall that the partial control reading amounts to a mismatch in number between PRO and the controller. Landau assumes that DPs enter the derivation with a lexical specification for number which is somewhat independent from syntactic/morphological number (consider, for instance, collective nouns like *committee*, which are lexically plural but syntactically singular). Landau calls this feature *semantic plurality* (SP). It is a meaningful feature on DPs, which come from the lexicon specified as either [+SP] (as in *group, family, committee*) or [–SP] (as in *boy, mother, professor*). However, like other phi-features, [SP] appears on functional heads as an uninterpretable feature. Because of this, the [–] value and [Ø] (unvalued) form of the feature are non-distinct on functional heads. What this means is that the [–SP] and [ØSP] values don't clash. So, it will be possible for a derivation to converge even if an Agree relation holds between a DP valued [–SP] and a T-Agr which is unvalued. In contrast, a DP valued [+SP] will clash with an unvalued Agr, resulting in a derivation which does not converge. Furthermore, it is assumed that the PRO is not able to value this feature on functional heads, because it is anaphoric and therefore has an incomplete set of phi-features.

This can be made more clear by examining the configurations which obtain when EC and PC verbs take a singular subject, as shown in (21) and (22). The three Agree

relations which hold in each case are laid out according to the elements which participate in the relation and their value for the SP feature (either [+], [–] or [Ø]):

(21) PC verb: mismatch in number allowed

a. The $chair_1$ decided PRO_{1+} to gather during the strike.

b. Agree: $T_{main[-]}$, $DP_{[-]}$ Agree: $T_{main[-]}$, $T_{embed[Ø]}$ Agree: $T_{embed[Ø]}$, $PRO_{[+]}$

In (21), the T of the main clause enters into an Agree relation with the subject of the main clause, and the two match in being valued [–SP]. In the next Agree relation, the matrix T and embedded T do not match in their value, but it is assumed that [–] and [Ø] are non-distinct and therefore a mismatch does not result in the derivation crashing. Finally, when Agree takes place between the [+SP] PRO and the [Ø] T, no problem is encountered because PRO is not able to value the functional head. So, the derivation is valid. Not so in (22), a sentence with an EC verb:

(22) EC verb: mismatch in number not allowed

a. *The $chair_1$ saw fit PRO_{1+} to gather during the strike.

b. Agree: $T_{main[-]}$, $DP_{[-]}$ *Agree: $T_{main[-]}$, $PRO_{[+]}$ Agree: $T_{embed[Ø]}$, $PRO_{[+]}$

In this case, the problematic relation is the one between the matrix T and PRO: there is a mismatch between the [–SP] Tense and the [+SP] PRO. In this configuration, PRO must be [–SP] in order to match with the main clause T, but the embedded verb *gather* requires a plural subject, forcing PRO to be [+SP]. The result is that the derivation crashes.

2.2.4 Further Issues

Landau's mechanism of obligatory control requires two non-trivial technical assumptions about the nature of Agree: (1) it is possible for a probe to enter into two Agree relations,

and (2) Agree is able to "see" PRO in the EC cases even though it's not at the edge of the phase. These assumptions require two slight modifications to Chomsky's original formulation of phases.

As we saw above, in obligatory control the probe T Agrees with the main clause subject and also with PRO or T-Agr. In order for a probe to enter into two Agree relations, its uninterpretable features must still be visible or accessible to syntactic operations despite being checked off by the first relation. In fact, Chomsky (1998, 1999) argues for just such a modification, the result of which is that checked features do not immediately erase, but instead remain accessible until the end of the phase. Given this change, the uninterpretable features on T are accessible to another Agree relation despite already being valued by the subject DP.

The second assumption, that PRO is accessible to Agree in EC, requires modifying Chomsky's Phase Impenetrability Condition (PIC). Chomsky (1998, 1999) uses the PIC to derive the locality of syntactic movement. It requires that the Move operation proceed in a successive cyclic fashion, with the moved element landing at intermediate sites at the edge of any phase boundaries it crosses. If this does not happen, the moved element will not be able to move beyond the first phase boundary because, by the PIC, it will not be accessible:

(23) Phase Impenetrability Condition

If HP and ZP are strong phases, and ZP the minimal one that dominates HP:

The domain of H is not accessible to operations at ZP, but only H and its edge

(where edge = spec(s) and adjuncts to HP)

Referring back to the tree in (19), we see that PRO is not at the edge of the infinitival CP

phase; as such, it should be inaccessible according to the formulation of the PIC given in (23). But Landau argues that interpretable features should remain accessible to a probe even if they are not at the edge of the phase. He suggests that this is an "innocuous" modification, since uninterpretable features continue to be accessible only at the edge of the phase. The standard cases of movement which are regulated by the original PIC involve uninterpretable features and hence will not be affected by this change.

Even with these modifications, the OC Agree relation is strictly local. When PRO appears in an IP-subject, or some types of adjuncts or extraposed infinitives, Agree will not be able to hold. Control in these cases must be achieved through non-syntactic mechanisms, and as such, it may not be surprising that the range of interpretations available is different from the cases of structural control. I now turn to Landau's formulation of this relation, dubbed non-obligatory control.

2.2.5 The Nature of NOC

I have already mentioned that PRO in non-obligatory contexts can be assigned an arbitrary interpretation. In addition, there are cases in which PRO has a specific referent that is nonetheless found outside the minimal clause. For instance, Bresnan (1982) showed that NOC PRO can take its reference from the context:

(24) a. Tom felt sheepish. PRO Pinching those elephants was foolish.

b. Frankly, I'm worried about Mary. What has she gotten herself into? Don't get me wrong: I think it was fine PRO to join the group. But PRO getting herself photographed with those starving wolves was dangerous.

Previous accounts have characterized NOC PRO as a pronoun, in the sense that it picks up its reference from the context, as seen in these examples. However, as we will see, in many cases the reference of PRO is more restrictive than that of pronouns, which can refer to anyone who is sufficiently salient in the discourse.

Following in the tradition of Bresnan and others, Landau also identifies discourse features as being relevant to NOC PRO. But, he argues that PRO in NOC contexts is a **logophor** in the sense of Reinhart & Reuland (1993). These authors first drew upon the notion of logophoricity to explain occurrences of reflexives which seemed to violate the binding principles governing the distribution of reflexive and pronominal anaphora, as in *People like myself love to read*, or so-called "picture anaphora" (exemplified in (25) below). The meaning of a logophor is determined by discourse features such as focus, perspective, source or target of a mental or communicative report. The following examples demonstrate that these factors affect the acceptability of non-licensed instances of overt anaphors (examples from Kuno, 1975, cited in Landau, 1999):

(25) a. John said to Mary that there was a picture of herself with a Mafia figure in the newspaper

b. *John said about Mary that there was a picture of herself with a Mafia figure in the newspaper

In these examples, the relationship between *Mary* and *herself* cannot be syntactic, as they do not occupy the same minimal CP. According to Reinhart and Reuland, the difference between (25a) and (25b) is that *herself* can be licensed as a logophor in the former case, because *Mary* is the target of communication, but this is not possible in the latter case, where she is merely mentioned in the sentence. Similarly, the sentences in (26) contain instances of PRO which are too remote from their controllers to be syntactically connected by the Agree relation, and therefore can only occur as a logophoric anaphor:

(26) a. John said to Mary that it would be easy PRO to prepare herself for the exam

b. *John said about Mary that it would be easy PRO to prepare herself for the exam.

Corresponding examples with overt pronouns are grammatical in both conditions:

(27) a. John said to/about Mary that there was a picture of her with a Mafia figure in the newspaper.

b. John said to/about Mary that it would be easy for her to prepare herself for the exam

Based on this, we can see that the principles licensing the use of logophoric anaphora are more restrictive than those licensing pronouns. Whereas the referent of a pronoun need only be familiar in the discourse, the referent of NOC PRO must fulfill some additional criteria (namely, it must be the logophoric center of the utterance).

The examples of NOC structures in this section all involve extraposition or gerundive subjects; what about adjuncts? Landau also classifies them as non-obligatory control structures, based on the assumption that they are syntactic islands and therefore inaccessible to Agree. As such, they should be subject to discourse-governed control. But, as I will discuss in section 2.4, it does not seem as though the formulation of NOC PRO as a logophor accounts for the control judgments in adjuncts. Before turning to control in adjuncts specifically, I present some alternatives to Landau's framework.

2.3 Alternative Theories of Obligatory Control

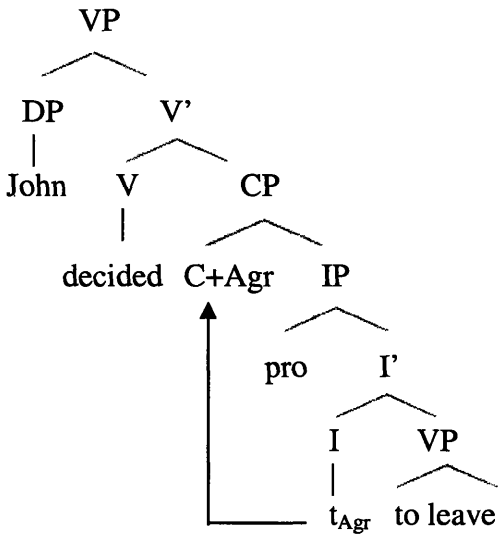
Before Landau (2000), there were a number of linguists who put forth theories of control. My discussion will focus on Williams (1992) and Kawasaki (1993), because their theories have explicitly addressed the issue of control in adjuncts. In fact, both have argued that adjunct control is not a uniform phenomenon. They posit that there are two types of control: one which is structural, holding in verb complements and some adjuncts,

and one which is discourse-governed, holding in other adjuncts. Under both accounts, adjuncts which are c-commanded by the main clause subject fall under the domain of structural control, whereas the interpretation of PRO in other cases is subject to discourse considerations. Although these authors differ on the syntactic and discourse mechanisms of control that they take to be operative in each case, the two accounts largely divide the data in a similar fashion. In this section, I will examine their accounts of structural control; the discussion of discourse-governed control appears in section 2.4, where I focus specifically on control in adjuncts.

2.3.1 Kawasaki (1993)

Kawasaki's approach is similar to Landau's in that she takes Agr to be the seat of anaphoricity, meaning that the infinitival Agr lacks phi-features. Unlike Landau, however, Kawasaki argues that the anaphoric Agr must be A-bound (like a reflexive) in order to be valued. The null subject of the infinitival clause is a potential binder of Agr: it c-commands the infinitival Agr and appears within its binding domain. As such, the expectation is that the null subject would serve as the binder. But, as it also lacks inherent features, it is unable to provide the content that Agr is seeking. Instead, Kawasaki assumes that Agr raises to C, taking it out of the domain of the null subject and into the domain of the main clause subject, as shown in (28) for the sentence *John decided to leave*:

(28)



In this configuration, Agr must be coindexed with the main clause subject in order to be appropriately bound within its governing category. It is thus valued with the subject's phi-features. But, how does this yield the right interpretation of the null subject? Kawasaki follows Borer (1989) in taking the null subject of infinitival clauses to be an instance of pro; that is, she conflates the "big PRO" of nonfinite clauses with the "little pro" of finite clauses in pro-drop languages. Pro in both cases is licensed and receives content (phi-features) through coindexation with T-Agr.[10] In the case at hand, the moved T-Agr transmits its features to its trace, and coindexation between the trace and the null subject yield the features for pro.

The infinitival Agr must be bound, as do other anaphoric elements, but Kawasaki argues that it does not always move to C in order to achieve this. Agr can optionally stay in situ and be bound by pro itself, even though pro cannot provide phi-features. When this happens, Agr is properly bound in a structural sense, but it has not received phi-features because the null subject is not specified for them. In this case, pro cannot value

[10] Given the conflation of PRO and pro, we need an explanation for why pro cannot appear in tensed clauses in a language like English. To derive this, Kawasaki assumes that the morphological properties of verbs in non-pro-drop languages do not license pro in tensed clauses, but that untensed T-Agr nonetheless licenses null subjects cross-linguistically.

Agr, and Agr cannot value pro. A "last resort" rule will insert generic/arbitrary features just in case the binder does not provide features. This results in the PROarb reading which we observe in cases of non-obligatory control. But, the mechanism by which the "arb" features are inserted is somewhat unclear. Based on discussion of null subjects in Italian (Rizzi 1986), Kawasaki formulates the rule of arb assignment is as follows:

(29) Assign *arb* to pro with no phi-features. (last resort)

This formulation involves assignment of arb to pro itself, rather than assignment to Agr and transfer to pro. This is somewhat strange given that traditional accounts of null subjects (in, e.g., pro-drop languages) involve feature assignment going in the opposite direction, from Agr to pro. The problem in this case is that both pro and Agr require valuation, making it impossible for the traditional relationship between Agr and null subjects to hold.

This issue leads us to a discussion of some points of contention with Kawasaki's system. First, it is troubling that there are two elements which are dependent on each other for interpretation, and yet the dependency is circular and incomplete by definition. Pro is licensed by the infinitival Agr and looks to it for phi-features, but Agr is dependent on pro to provide featural content through binding. Agr, being anaphoric, cannot provide pro with any features, and binding of Agr by pro furthermore does not provide the features that Agr needs. So, although pro and Agr must look to each other for interpretation, neither is actually able to value the other – hence the need for Agr to move out of its base position and find features from an outside element. Landau's account of control as Agree retains one aspect of the system: PRO and Agr, being anaphoric, require valuation by an outside element. However, at no point in the derivation is there a circular

relationship in the dependency between PRO and Agr; they are connected through their mutual anaphoricity, but not through binding as well. It is the same mechanism which provides valuation for both elements, regardless of whether it is PRO or Agr that initially gets valued.

The second problem I wish to mention concerns Minimalist assumptions about optional operations. Kawasaki assumes that movement of T-Agr is optional; as we have seen, there is a different interpretation when the operation applies or doesn't apply. When Agr moves to C, it is able to be bound by the subject NP and thus pro is coreferential with the main clause subject. When Agr does not move, it is bound by pro itself and a default rule inserts "arb" features. But, it is not completely clear what motivates movement under this account: is it the need for Agr to be valued? If so, movement should never be possible, since there is a way for Agr to be valued when it stays in situ – namely, through insertion of generic/arbitrary features. The "arb" reading should be the only one available.

In order to motivate Agr-to-C movement, Kawasaki assumes that "the category CP cannot exist at S-structure (or at LF) unless the head Comp is filled... Predicates can have a lexical specification as to what should fill in the position of Comp in their complement" (1993, p. 46). So, if a predicate specifies that Agr should fill this position, it will obligatorily move; if a predicate requires, e.g., a +WH head (as in *ask how/whether to X*), then C will be filled independently; in such a case, Kawasaki assumes that Agr can, but need not, move as well. This is illustrated in the examples below (from Kawasaki; the null subject is indicated by the underscore):

(30) a. John asked Mary [___ to bake a pie]

b. John asked Mary [how ___ to bake a pie]

c. John asked Mary [how ___ to bake the pie]

Example (30a) only has the reading where Mary is the one who bakes the pie; pro cannot receive a generic interpretation (which would presumably be something like *for someone to bake a pie*). Kawasaki takes this as an indication that Agr has moved to C, and is bound by *Mary*. Sentence (30b), on the other hand, admits a generic reading (something like *John asked Mary how one should bake a pie*), while (30c) seems to only allow a specific reading (*John asked Mary how he should bake the pie*). These latter two examples involve a meaning of *ask* which requires an indirect question as a complement, triggering a +WH realization of the head C. So, the C head is filled independently by the question word *how*; movement of Agr is not required for the purpose of filling the C head. Kawasaki proposes that the movement is optional in this case, which is why pro can be interpreted either as generic (30b) or specific (30c). This variation, however, is not explained. Under common Minimalist assumptions, optional syntactic operations are undesirable because they do not conform to the idea that movement must be triggered.[11] In this case, we might ask why the non-motivated movement is still possible. What determines whether Agr moves or stays in situ? Clearly, we require some diagnostic independent from the interpretive difference to decide whether Agr-to-C movement has taken place. Recall that under Landau's account, there was independent motivation for the movement of Agr and the relation it establishes with the element higher in the structure. T-to-C movement was dependent on the tense and clausal structure of the

[11] Of course, there are some operations in grammar that are irreducibly optional. However, when possible it seems advantageous to adopt an account that can motivate the movement or lack of it without appealing to optionality.

infinitive. The difference in interpretation (partial vs. exhaustive control) was simply a side effect of the existing structure which independently did or did not license movement.

Let me bring up one additional point. Under a theory such as this, there is no separate control mechanism; instead, control and binding are conflated, although it is Agr which is subject to binding rather than an NP. In section 2.1 I pointed out some significant obstacles to reducing control to binding, such as differences between PRO and anaphors in terms of distribution, interpretation, and possible binders/controllers. The present account bears the same burden of explanation as any other theory under which control reduces to binding. Based on these considerations, I conclude that we find greater theoretical parsimony in Landau's account of control.

2.3.2 Williams (1992, 1994)

Williams argues for a radical revision of control theory. He posits that the relation between some infinitival null subjects and the overt subject of a main verb is not a control relation at all. Rather, for him, in these cases the embedded predicate is directly predicated of the main clause subject, without an intervening NP to absorb the second theta role. For example, for him the sentences in (31) do not contain instances of PRO, but instead, involve direct theta role assignment from the adjunct to the main clause subject (where subscripts indicate theta roles):

(31) a. John$_{i/k}$ arrived$_i$ angry$_k$.

b. The device$_{i/k}$ arrived$_i$ while spewing$_k$ forth sparks.

This approach derives from work by Williams (1983) and Williams and Di Sciullo (1986), which attempts to reformulate a number of phenomena (raising, passives) such

that they are understood not in terms of movement rules, but as direct theta role assignment under function composition. Williams (1994) identifies three pertinent characteristics of theta role assignment: it is **obligatory, unique,** and **local,** in the following ways. It is obligatory in the sense that there must be an argument present to which the verb can assign its theta role.[12] It is unique in the sense of Chomsky's (1981) Theta Criterion, which requires a one-to-one relationship between theta roles and arguments in a sentence. It is local in that it (almost always) holds between sister nodes.

However, these characteristics must be reconsidered or reformulated in order to include the cases in (31) under the domain of predication. One complication which arises is that the structures violate uniqueness: they involve two predicates assigning separate theta roles to a single NP, in violation of the Theta Criterion. Stowell (1983) and Chomsky (1981) suggest that the examples from (31) actually contain a null (PRO) subject, forming a structure as in (32), which prevents a Theta Criterion violation from occurring:

(32) a. John_i arrived_i PRO_k angry_k.

b. The device_i arrived_i while PRO_k spewing_k forth sparks.

Avoiding such violations was part of the original motivation for positing the existence of PRO. Having a structurally-represented null subject serves to fulfill the selectional restrictions of the two predicates in the sentence. The coreferentiality between the main subject and the null subject is then derived through other principles.

[12] Williams assumes that phonologically null arguments in pro-drop languages are nonetheless represented at LF, and hence obey this principle.

In order to maintain the Theta Criterion alongside a theory under which the structures in (31) involve theta role assignment, Williams argued that the criterion should be reformulated to only apply to co-arguments of a single predicate:

(33) The Restricted Theta Criterion

In an argument complex, each phrase is assigned only one theta role.

(where an argument complex consists of a predicate, its arguments, its arguments' arguments, etc.)

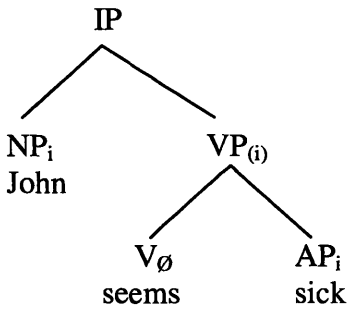
Williams (1992, p. 304)

Because the second theta roles in (31) come from adjunct clauses rather than complements to the verb, the structures do not violate the Restricted Theta Criterion that Williams proposes. In these cases, then, PRO is unnecessary. Notice, however, that Williams cannot capture cases of control into verbal complements in the same way; structures such as *John persuaded Mary to leave* must contain a PRO subject, or else they will violate even the modified Theta Criterion given in (33). This is an important point regarding the theoretical desirability of Williams' account, because it indicates that not much has been gained by labeling the adjunct cases as predication rather than control. This formulation does not allow Williams to eliminate PRO or control theory from the grammar; it simply changes the boundaries of the domains in which each mechanism applies. Furthermore, the revision in the restricted criterion seems to lack independent motivation: it exists solely to eliminate the need for PRO in some contexts.

Let us return to the issue of locality. Williams (like many others) assumes that theta role assignment is fundamentally a local phenomenon, holding between sister nodes. Less local cases which Williams nonetheless attributes to theta role assignment are

actually made up of individual relations that respect locality. In these cases, an unassigned theta role can be 'vertically bound' to the next node up, assuming that no other theta role interferes by being vertically bound along the same path. This is how (in Williams' system, although not in traditional treatments of raising) the theta role of *sick* in a sentence like *John seems sick* is able to reach the subject:

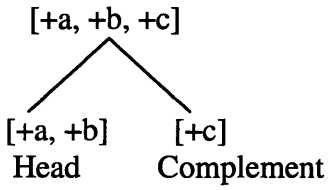
(34)



In a structure such as (34), the main verb has no theta role to assign, hence the theta role of the AP is able to 'percolate' up to the VP node and subsequently be assigned to the subject NP in a local manner. Crucially, vertical binding can only occur when the head of the dominating phrase has no external argument; if the sentence contains a non-raising verb, it will not be possible for the external argument theta role of the verb and the theta role of its complement to both be vertically bound – ruling out, for instance, **John wants sick.*

To derive the difference between raising and non-raising verbs, Williams posits the notion of *relativized head.* The *absolute head* of a phrase is what is traditionally thought of as the head, whereas the relativized head is a lexical item which passes along some feature to the maximal projection, making it the head relative to this certain feature. This can only occur when the absolute head is not specified for the feature in question, as shown in (34):

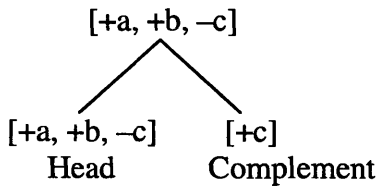
(35)



In (35), the complement is the head with respect to the feature [±c], while the "real" head remains the head for all other features. Bringing this back to the situation at hand, Williams takes the relevant feature to be 'having an external argument.' The external argument of the complement will be passed up to the VP node just in case the absolute head, the verb, is not specified for this feature.

This conception of the feature [±external arg] is somewhat troubling, in that it rests on the assumption that there is no difference between being specified for the [–] value of the feature and being unspecified for the feature. Presumably, traditional accounts would hold that raising verbs are not unspecified for this feature, but rather, they are specified as [–external arg]. Graphically, this situation would be akin to (36) rather than (35):

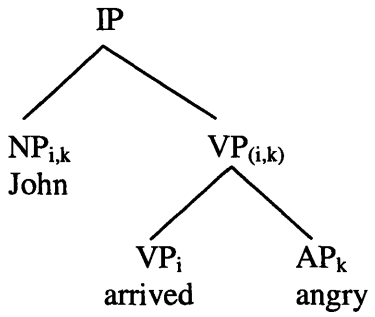
(36)



If (36) is in fact the correct representation for [seems sick], it does not appear that the notion of relativized head helps in explaining how the theta role of the AP is able to apply to the subject. The verb remains the head for all features, and it specifies that the VP has no external argument to assign, blocking the vertical binding of the complement's theta role.

The account runs into additional problems with the adjunct cases. Consider (31a) again, which presumably has the structure in (37):

(37)



When dealing with verb complements, Williams assumes it is not possible to vertically bind two theta roles; this is why raising verbs can pass up the theta role of their complement but non-raising verbs cannot. However, the conditions must be different for adjuncts, because the (grammatical) example in (37) requires that the role of *arrive* and the role of *angry* are both bound to the same VP node. Williams assumes that the Restricted Theta Criterion handles this issue by dictating that assigning two theta roles to the same NP is not *a priori* ruled out: it is allowed so long as the theta roles come from separate "argument complexes." But this modification still fails to explain how the *mechanism* of theta role assignment is able to apply to this structure, in which two theta roles travel along the same vertical path in order to reach the subject *John*. Williams' account fails to explain how the local, unique relation of theta role assignment is able to hold here. It would seem that the structure does not actually support a predication relationship between the predicate in the adjunct clause and the subject of the main clause.

The phenomenon of secondary predication (e.g., *John walked home eating an apple*) faces a similar issue. Many accounts assume that these structures involve predication of the sort described by Williams, however, they too suffer from uncertainty

regarding the actual mechanisms of theta role assignment. The issue is somewhat unresolved in this domain as well. In the absence of a non-stipulative explanation for how "double" theta role assignment is able to hold, it seems best to adopt an analysis which does not require such a mechanism (i.e., one in which a null PRO can absorb the "extra" theta role).

2.3.3 Conclusion: Agree as the Mechanism of Control

To summarize section 2.3, we examined two alternatives to Landau's theory of control. Overall, the accounts essentially seek to explain the same set of facts, but they differ in the theoretical mechanisms which are argued to govern the interpretation of null subjects. One account sought to capture control facts through binding theory, and the other, through predication. For each, I identified some theoretical concerns and inconsistencies which are not problematic for Landau's account of control as Agree. Furthermore, Landau's account offers greater empirical coverage within the domain of obligatory control. As such, I argue that there is sufficient motivation for adopting Landau's system rather than Williams' or Kawasaki's approach to control.

Below is a brief review of what I take to be the fundamentals of the "control as Agree" theory. Throughout the remainder of this thesis, I will assume that this is the mechanism by which control is implemented, when a structure is amenable to obligatory control:

(38) **Principles of Structural (Obligatory) Control**

a. PRO is valued through Agree with a matrix functional head.

b. Structural/obligatory control obtains if and only if Agree relation can hold.

c. A number mismatch between PRO and controller is structurally possible only when Agree targets T-Agr.

d. In Partial Control, Agree targets infinitival T-Agr

e. In Exhaustive Control, Agree targets PRO itself.

In what follows, I will examine the case of adjunct control in more detail. It will be demonstrated that the theory outlined above can account for the control patterns which are found in some adjunct structures. This is an important point for the study of adjunct control in child language: given that children show largely adult-like control in complements (C. Chomsky 1969; Cohen Sherman and Lust 1993), we have evidence that they are able to implement the mechanism of control. If the mechanism of control is the same in verb complements and (at least some) adjunct structures, we expect that they will be able to implement control in adjuncts as well. The following section will also address the matter of adjuncts which are not amenable to obligatory control. I will maintain that these structures are governed by a separate mechanism from the cases discussed already. The discourse features which govern this type of control will be identified and argued for.

2.4 Focus on Adjuncts: A Comprehensive Account

2.4.1 The Basic Patterns of Adjunct Control

Given the theoretical backdrop I have heretofore assumed, it is relevant to ask whether control in adjuncts falls into the domain of OC or NOC (or, structural vs. discourse control). A starting point for determining this should be a closer examination of native speakers' judgments regarding control in these cases. Let me briefly review the prototypical features of OC and NOC, according to Landau: OC cases involve rigid control patterns which are not sensitive to features of the discourse; PRO in these structures is not amenable to long-distance or arbitrary control. In addition, OC structures only permit a sloppy reading of PRO under ellipsis. Conversely, there is no structural locality requirement between PRO and controller in NOC structures. Instead, NOC requires reference to properties of the discourse in some way; one possibility that I have brought up is that the referent of PRO will be the logophoric center of the sentence. In addition, it is possible to get an arbitrary interpretation of PRO in NOC, as well as both strict and sloppy readings under ellipsis.

We note that for VP-level adjuncts such as *without, before*, *after* and *while*, adult English speakers demonstrate an overwhelming preference for choosing the (c-commanding) main clause subject to be the controller. For instance, the preference for subject-oriented control seems to hold regardless of the nature of the subject; so, a non-human in subject position is taken to be the controller of PRO despite not being appropriate as a logophor (unexpected if these are NOC structures):

(39) The car$_i$ hit my mailbox before PRO$_i$ running a red light.

Although control into adjuncts cannot be lexically determined, since adjuncts are not included in a verb's subcategorization, there seems to be some structural factor determining control in these cases.

The following examples (with pronouns and reflexives in the adjuncts) offer further evidence that PRO in adjuncts permits interpretations more like OC than NOC. PRO is a potential binder for a reflexive inside the adjunct. As such, an anaphoric link is created between the reflexive, PRO and the (intended) controller in the next-higher clause. Conversely, pronouns do not tolerate a local binder; with a pronoun in the adjunct clause, PRO must receive the arbitrary interpretation in order to avoid a Principle B violation. Using this diagnostic, we can examine whether the resulting sentence is grammatical; if it isn't, the problem is the connection between PRO and its controller:

(40) a. *Bill talked to Mary$_i$ before/after/while PRO$_i$ buying herself$_i$ lunch.

(cf. Bill$_i$ talked to Mary before/after/while PRO$_i$ buying himself$_i$ lunch.)

b. *Mary$_i$ said that Bill phoned before/after PRO$_i$ buying herself$_i$ lunch.

(cf. Mary said that Bill$_i$ phoned before PRO$_i$ buying himself$_i$ lunch.)

c. *John$_i$ was embarrassed before/after PROarb praising him$_i$ in public.

(cf. John$_i$ was embarrassed before/after PRO$_i$ praising himself$_i$ in public.)

What we find is that an NP other than the subject cannot serve as controller (40a); a local controller cannot be skipped in favor of one further away (40b); and PRO cannot receive an arbitrary reading (40c). As for cases of ellipsis, we find that PRO in these adjuncts only permits a sloppy interpretation, like OC structures:

(41) John fell asleep while PRO watching the movie, and Bill did too.

The elided portion in this example can only be taken to mean that Bill fell asleep while Bill watched the movie, not that Bill fell asleep while John watched the movie. Finally, control in low-attaching adjuncts like before, after and while is not sensitive to considerations of logophoricity, as would be expected if they were NOC structures. For instance, an inanimate object can serve as controller even though it is not appropriate as a logophoric center (a); and manipulation of logophoricity does not affect control judgments:

(42) a. The cake$_i$ looked delicious before PRO$_i$ falling on the floor.

b. *The noise frightened John$_i$ before PRO$_i$ realizing that it was a surprise party.

c. *John said to Mary that the noise frightened him$_i$ before PRO$_i$ realizing that it was a surprise party.

From these facts, we can see that the low-attaching adjuncts fit Landau's descriptive criteria for OC rather than NOC. However, other types of adjuncts do not pattern like these cases. For instance, as noted by Williams (1992), absolutive adjuncts do not seem to require a structural relationship between PRO and controller. In (43a), *Bill* does not c-command the null subject and therefore cannot serve as a structurally-determined controller. In (43b), the referent of PRO is not mentioned in the sentence at all; rather, it is understood that the implicit argument of *be clear to* is the controller:

(43) a. PRO$_i$ Being new in town, the grand old hotel impressed Bill$_i$.

b. Upon PRO arriving in town, it was clear that the sheriff was asleep.

Williams' examples all involve non-subject controllers, presumably to emphasize the lack of a locality condition on the control relation. Importantly, however, absolutive adjuncts attach very high in the structure and thus are not c-commanded by the main

clause subject even when they are reconstructed to their base position. Absolutive adjuncts are NOC contexts even when PRO is controlled by the main clause subject (as in a sentence like *PRO being new in town, Bill headed straight for the main hotel*).

Unlike the examples in (39) – (42), grammaticality in these cases seems to be sensitive in some way to the thematic role of the potential controller, or the meaning of the sentence and adjunct:

(44) *PRO Having just arrived in town, the main hotel collapsed on Bill.

At first glance, then, it seems reasonable to think that there is more than one control option in adjuncts, depending on the kind of adjunct in question. Further evidence for this is that the examples in (43) vary in acceptability across speakers, whereas judgments on examples with clause-final adjuncts appear to be relatively stable.

Based on these facts, I assume that some adjuncts fall under the domain of structural control, and some are governed by discourse considerations instead. This difference will be relevant in the acquisition of adjunct control, since the two mechanisms could very well develop along different timelines. We should note that Landau (p.c.) suggests that some mechanism other than control must be responsible for the appearance of obligatory control, since adjuncts are typically syntactic islands. However, I will argue in the next section that the mechanism governing OC in complements is responsible for OC-like patterns we find in some adjuncts. The task remains to show that structural control could in theory be possible in these adjuncts. If these adjuncts are in fact instances of OC, it seems reasonable to expect them to pattern with other OC structures in acquisition.

2.4.2 Phases and Agree in Adjuncts

The account of structural control that I follow involves an Agree relation between PRO or infinitival Agr and a functional head from the higher clause. Clearly, this relation should be subject to the same locality constraints that are normally taken to govern Agree. More specifically, since Agree is sensitive to phase boundaries, obligatory control should be as well. Within the domain of complement control, Landau (2000) shows that this in fact obtains (e.g., cases of extraposition are split between OC and NOC depending on whether the infinitive is VP-internal or not).

My previous discussion of this account (section 2.2) assumed some degree of familiarity with the notion of phases; but at this point, it may be helpful to consider the definition more closely. Chomsky (2001) defines a phase as a propositional unit which, once complete, is inaccessible to further syntactic operations. Chomsky identifies vP and CP as phases, according to these conditions.[13] Completed phases are passed on to the phonological component of the grammar to undergo Spell-Out at the level of the next higher phase, thereby reducing computational complexity and demand on memory resources. Movement operations such as extraction are sensitive to these boundaries: once spelled out, the content and linear order of elements in the phase cannot be modified. This is captured with the Phase Impenetrability Condition (PIC). As discussed previously, the PIC dictates that only the edge of a phase is accessible to operations in the next phase up. Evidence for these conditions (and the choice of C and v* as phase heads) comes from the successive cyclic nature of movement in many languages. When a wh-word moves from an embedded phase, it must occupy intermediate landing sites at the

[13] Unaccusative and passive vPs constitute *defective* phases, however, as they do not specify an external argument and are thus assumed to not be propositionally complete. This division between defective and non-defective phases is what allows movement out of passive and unaccusative vPs but not transitive vPs.

edge of each phase it passes through. Some languages provide overt evidence for this effect (for example, complementizer agreement in Irish: McCloskey 2001). When this cyclic movement is not possible, the moved element is not able to escape the phase.

2.4.2.1 The Structure of Nonfinite Adjuncts

In order to examine the impact of phase theory on control in adjuncts, we must determine the structure of the nonfinite clause. The goal is to establish whether there is a phase boundary intervening between the adjunct and the higher functional head. The first relevant issue to consider is what type of phrase the adjunct is. The lexical items that we have been discussing (*before, after, while, without*) are typically considered prepositions. This would mean that the adjuncts are prepositional phrases, which in fact are not normally taken to constitute a phase. This is a positive result – it means that the syntactic mechanism of OC can hold in low-attaching adjuncts.

Perhaps a caveat is in order, though. The difference between arguments and adjuncts in terms of extraction has been greatly discussed in the literature: many adjuncts are barriers to extraction, and are therefore called *syntactic islands* (Chomsky 1986). In light of the previous discussion, it would seem that islands and phases have overlapping but not identical properties. Both exhibit restrictions on movement operations, although the limits do not derive from the same source under the Minimalist Program. For this reason, it should not concern us that the adjuncts being studied here are typically islands.

In any case, it seems as though the islandhood of adjuncts is independently not fatal to the control-as-Agree approach; it turns out that not all adjuncts are islands. Some

defy this generalization by permitting apparent extraction (examples from Borgovono and Neeleman 2000 and R. Truswell p.c.):[14]

(45) a. What time did John go to work [at *t*]?

b. What did John drive Mary crazy [trying to fix *t*]?

cf. John drove Mary crazy trying to fix the roof.

c. What did John hurt himself [trying to fix *t*]?

d. Who did you leave the party [after talking to *t*]?

On the standard assumption that Move consists of an Agree operation plus pied piping of phonological material, the reality of wh-movement out of these adjuncts guarantees the availability of Agree.

Given these considerations, it seems plausible that Agree might be able to see into the adjunct. One further issue to consider is the structure of the clause which is a sister to the prepositional head. This is actually the minimal phrase containing the null subject and the infinitival T-Agr. So, we must be sure that there is not some phase boundary within the adjunct which would block Agree. In what follows, I consider the structure of the gerund more closely.

2.4.2.2 The Nominal Analysis of Gerunds

There is some debate about the structure of nonfinite clauses like *PRO filing the document*. One possibility is that it is a TP/IP; or, it could consist of a full CP. Another option is that it is a DP. Abney (1987) analyzes gerund constructions extensively, and provides a great deal of evidence that gerunds are nominal at some level of the structure. In fact, gerunds typically have the external structure and distribution of a noun phrase.

[14] Thanks to Robert Truswell for bringing these cases to my attention.

For instance, they can serve as the subject of a sentence, and (must) occur in a case-assigning position such as the object of a preposition. Both of these are positions normally filled by nominal constructions and not IPs as shown in (46):[15]

(46) a. [PRO throwing a party] is very exciting.

a'. [$_{DP}$ Birthday parties] are very exciting.

a''. *[$_{IP}$ John has a party] is very exciting.

b. We approve of [PRO throwing a party]

b'. We approve of [$_{DP}$ the party]

b''. *We approve of [$_{IP}$ John will have a party]

Abney argues that all *-ing* forms (excluding participial constructions like the progressive *-ing*) involve nominalizations of some level of (verbal) structure. He distinguishes between nominal and verbal gerunds; we will be primarily concerned with the structure of the verbal gerunds. The types differ in the level at which they are nominalized, affecting the extent to which they have noun-like versus sentence-like properties. In fact, Ross (1973) suggested that these constructions along with several others exist on a continuum, with nouns phrases at one end and sentences at the other:

(47) ← more sentence-like more noun-like →

Tensed S > ... > infinitives > verbal gerunds > nominal gerund > ... > concrete N

The structures in question are interesting precisely because they fall in the amorphous space in the middle of this continuum. The verbal gerunds are (1) Acc-ing, whose subject appears in accusative case (e.g., *him filing the document*), and (2) Poss-ing, whose subject

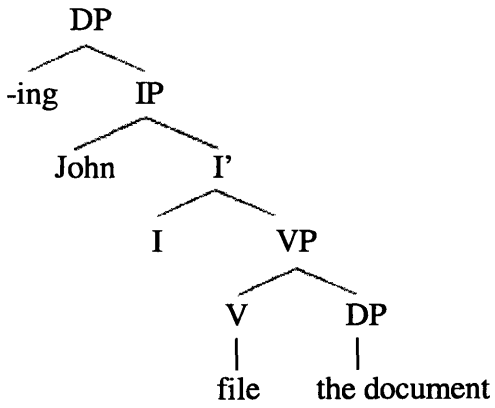
[15] In English, CPs can serve as the subject of a sentence, but not the object of a preposition:

(i) [$_{CP}$ That John threw a party] was very surprising.

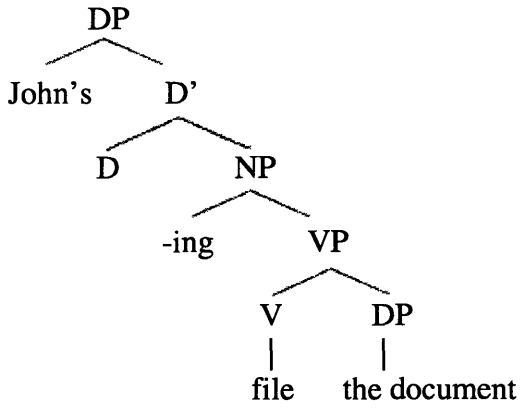
(ii) *We approve of [$_{CP}$ that John threw a party].

appears in possessive case (e.g., *his filing the document*).[16] Their structures according to Abney are as follows:

(48) a. Acc-ing: nominalization of IP Example: *John/him filing the document*



b. Poss-ing: nominalization of VP Example: *John's/his filing the document*



What about the PRO-ing gerund? Presumably for reasons of parsimony, Abney and others have suggested that the null subject gerund is a subtype of one of these structures, rather than a unique type. Abney largely remains agnostic about its characterization, although he leans in the direction of lumping it with the Poss-ing gerund. Reuland (1983), however, argued that it belongs with the Acc-ing type. By a

[16] The nominal, or Ing-of gerund (e.g., *the filing of the document*), contains the least verbal structure of the three, and is therefore the most noun-like in its properties.

number of diagnostics, PRO-ing behaves more like Acc-ing than Poss-ing. For instance, when two Poss-ing gerunds are conjoined, they trigger plural agreement, like conjoined nouns; conjoined Acc-ing and PRO-ing gerunds do not, similar to typical instances of conjoined CPs/IPs:[17]

(49) a. NPs: John and Mary *bothers/bother me.

b. Poss-ing: John's arriving late and Mary's leaving early *bothers/bother me.

c. CPs: That John arrived late and Mary arrived early bothers/*bother me.

d. Acc-ing: John arriving late and Mary leaving early bothers/*bother me

e. PRO-ing: PRO Arriving late and PRO leaving early bothers/*bother me.

Also, extraction is possible from Acc-ing and PRO-ing gerunds, but not from Poss-ing:

(50) a. Poss-ing: We remember his describing Rome

a'.*the city that we remember his describing *t*

b. Acc-ing: We remember him describing Rome

b'. the city that we remember him describing *t*

c. PRO-ing: We remember PRO visiting Rome

c'. the city that we remember PRO visiting *t*

[17] Higginbotham (1992) argues that CPs lack the Number phi-feature, which is why they do not typically trigger plural agreement. However, some authors have noted that CPs can trigger plural agreement in certain circumstances. McCloskey (1991) argues that this happens when the two conjoined propositions are contradictory. Compare (i) and (ii):

(i) That the president will be reelected and that he will be impeached is/are equally likely.

(ii) That the shares are overvalued and that a decline is likely is/??are widely believed on Wall St.

Iatridou and Embick (1997) argue that the crucial feature is actually individuation: if the CPs are properly individuated (as indicated with terms like *equally, both*), they will trigger plural agreement:

(iii) That Susan married Tom and that she took up scuba-diving bother me equally.

There is also an interpretive difference between Poss-ing and Acc-ing. In the former but not the latter, the event which is expressed by the verb carries a presupposition of existence.[18] PRO-ing also patterns like Acc-ing in this respect:

(51) a. Poss-ing: John dreamt about Mary's yelling at the dean

b. Acc-ing: John dreamt about Mary yelling at the dean

c. PRO-ing: John dreamt about PRO yelling at the dean

The (b) and (c) sentences do not carry the presupposition that the event in question actually occurred. So, they could be felicitously continued with something like *...but s/he never actually did.* The Poss-ing gerund, on the other hand, presupposes that the event occurred, making such a continuation infelicitous.

Given these similarities between the Acc-ing and PRO-ing gerunds, it seems plausible that they share a common syntactic structure. This is a positive result for the control-as-Agree theory. Looking back to the structures in (48), we see that the Poss-ing gerund does not contain a Tense/Agreement node, since the only verbal structure it contains is a VP. If PRO-ing had the structure of Poss-ing, this control account would not be able to apply in the same way it does in other OC constructions. The Acc-ing gerund, being a nominalization of IP, does have a T-Agr node. If the PRO-ing gerund is parallel to it in this respect, Agree should have an appropriate target.

However, there are environments in which PRO-ing can occur but not Acc-ing or Poss-ing, possibly suggesting that all three have unique structures. Temporal adjuncts and

[18] Portner (1995) captures this difference by positing that Poss-ing is always definite, whereas Acc-ing can be indefinite. His account differs from Abney's in arguing that both types involve nominalizations of VP; however, he acknowledges that the semantics he assigns to gerunds can be captured through Abney's syntactic analysis as well.

without adjuncts differ in this respect: the former cannot take a gerund with an overt subject, while the latter is able to:

(52) a. John read the document before/after PRO/*Mary/*his filing it.

b. John read the document while PRO/*Mary/*his filing it.

c. John read the document without PRO/Mary/his realizing it.

The source of the difference in grammaticality in (54a) is unclear. It may be the case that the PRO-ing gerund has a different structure depending on the environment in which it occurs. Possible evidence for this idea is that these prepositions differ in the complement types that they take. *Before* and *after* can take both clausal and nominal complements; *while* can only take clausal complements[19] and *without* can only take nominal complements:

(53)

John called Mary before/after	a. [$_{DP}$ the party].
	b. [$_{IP}$ he went to the party].
John called Mary while	c. *[$_{DP}$ the party].
	d. [$_{IP}$ he was at the party].
John called Mary without	e. [$_{DP}$ the address of the party].
	f. *[$_{IP}$ he had the address of the party].

Let us compare the paradigm in (53) with the pattern of nonfinite adjuncts in (52). *Without* is unable to take an IP complement (53f), and it allows the full range of gerunds (52c), which is unproblematic for the DP analysis of gerunds. *While* is unable to take a DP complement (53c), and yet it allows the PRO-ing gerund, suggesting that there might be some other structure involved in this case. The data for *before/after* are harder to

[19] The complete range of complement options for *while* is not completely clear (cf. *I called Tom while angry/in the airport,* which appear to be reduced relatives (Sabine Iatridou, p.c.)).

interpret, since DP and IP are both grammatical complements to these prepositions; still, one gerund type is grammatical while the others are not. In this respect, the three temporal prepositions pattern alike. This may mean that the PRO-ing gerund in this context is not nominal, even though the evidence suggests that it is nominal when following other prepositions.

However, an additional piece of the puzzle comes from the work of Larson (1988), who addressed the issue of ambiguities in sentences with temporal clauses. Combining his analysis of *before/after* clauses with Abney's DP analysis of gerunds allows us to account for the range of interpretations which are possible in finite and nonfinite temporal adjuncts. Larson discusses the temporal prepositions *before* and *after,* presenting examples such as (56) below, which exhibit so-called "Geis ambiguities" (Geis 1970):

(54) John kissed Mary before he said that he had to leave.

This sentence can be interpreted in two ways, depending on whether the temporal adjunct is taken to modify the event of the main clause, or the "saying" event of the adjunct. So, the sentence can be interpreted as either (55b) or (c):

(55) a. John kissed Mary before he said that he had to leave.

b. John kissed Mary before the time x, such that *he said at x* that he had to leave.

c. John kissed Mary before the time x, such that he said that *he had to leave at x*

These ambiguities have been taken as evidence for the presence of an **empty temporal operator** (ETO) which fixes the time of the embedded clause. The operator is generated in a base position and then moved to the edge of the embedded clause. The different interpretations come from a difference in the base position of the operator. The meaning

which is paraphrased in (55b) has the structure in (56b) while the meaning in (55c) has the structure in (56c) below:

(56) a. John kissed Mary before he said that he had to leave.

b. J kissed M [$_{PP}$ before [$_{CP1}$ Op_i he said [$_{CP2}$ that he had to leave] t_i]]

c. J kissed M [$_{PP}$ before [$_{CP1}$ Op_i he said [$_{CP2}$ that he had to leave t_i]]]

In these structures, it is assumed that the preposition *before* takes a CP complement. Having this level of structure provides a scope site for the moved operator.

Adjuncts headed by *while*, on the other hand, do not demonstrate a similar ambiguity: *John kissed Mary while he said that he did* has only one interpretation. This preposition is not able to assign case, as evidenced by its inability to take a nominal complement. Larson posits that there is no operator in the *while* case, which is why there is no possibility of ambiguity. Recall that in the case of *before* and *after*, a CP node under the preposition was necessary to provide a landing site for the operator. Since there is no operator under *while*, we have less motivation for positing a full CP structure. In the interest of parsimony, we might argue that the preposition takes simply a bare TP complement:

(57) a. John kissed Mary while he said that he had to leave.

b. J kissed M [$_{PP}$ while [$_{TP}$ he said [$_{CP}$ that he had to leave]]]

Larson noticed the correlation between the ability of a preposition to assign case and the existence of an ambiguity. He argues that the chain formed by the operator (Op_i) and its trace (t_i) must receive case, and hence can only appear in a case-assigning position. Prepositions which can assign case are those which can take a noun phrase as a complement (which also require case assignment). *Before* and *after* differ from *while* in this respect, as we observed in the previous section: *while* selects for a clausal complement only; it cannot take a nominal complement.

Based on this correlation, Larson concluded that *while* cannot have a temporal operator following it because it is unable to assign the case that the operator requires.

There is another factor to consider. An ETO can only occur under a preposition which can take a nominal complement, but an ETO and a DP complement cannot occur in the same sentence: this configuration will prevent one or the other from receiving case. As such, a derivation containing both will be unable to converge. So, the ETO can only appear following a preposition which is able to assign case but in the relevant sentence does not have a noun phrase complement which gets case. Put another way, ETOs are only possible when *before/after* exercises the IP complement option.

Related to this is a fact which has been noted in the literature but never accounted for. Sentences with a preposition like *before* followed by a gerundive complement do not exhibit the ambiguity described above. Consider, for instance, the sentence in (58a), for which the only available interpretation is (b).[20] Assuming that the structure of (a) is parallel to that of (56), we are left with the mystery of why there is no ambiguity when the complement to the preposition is a gerund:

(58) a. Gary fell before saying that he had to leave.

b. Gary fell before the time x, such that *he said at x* that he had to leave

b'. Gary fell [$_{PP}$ before [$_{IP}$ Op_i [PRO saying [$_{CP}$ that he had to leave] t_i]]]

c. ≠ Gary fell before the time x, such that he said that *he had to leave at x*

c'. Gary fell [$_{PP}$ before [$_{IP}$ Op_i saying [$_{CP}$ that he would t_i]]]]

Despite the fact that the presence of the ambiguity was the original motivation for positing the existence of ETOs, and the fact that these sentences are *not* ambiguous, for the sake of uniformity Larson and others posited that the sentences with gerunds

[20] From Larson (1988)

nonetheless contained an ETO.[21] The lack of ambiguity in (58) was left unexplained in Larson's work. Johnson (1988) notes the lack of ambiguity, but attributes it to a problem with extracting the temporal operator out of the complement to a gerund (i.e., the ambiguity does not obtain because the extraction shown in (58c') is barred for some reason).

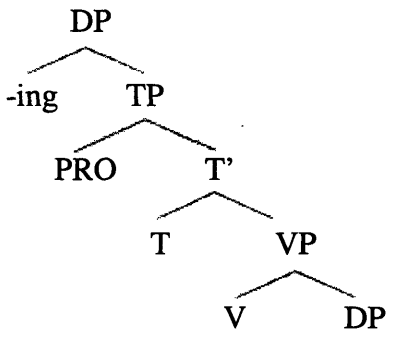
I suggest that consideration of Abney's (1987) work explains this lack of ambiguity more satisfactorily. Recall the very specific claims regarding the distribution of NPs and ETOs: due to their mutual case assignment needs, they appear in complementary distribution. Taking into account both Larson's analysis of ETOs and Abney's analysis of gerunds, we are forced to the conclusion that there *couldn't be* an ETO in (60). In this example, the gerund under *before* is nominal; it and the temporal operator both require case, leading to a conflict. Larson's account states that, in such a situation, the derivation will crash. The only way out is for there to not be an operator in the structure, as Larson argues for any other case in which a temporal preposition takes a garden variety nominal complement (e.g., *before the party*). In fact, the lack of operator matches our intuitions regarding the lack of ambiguity in the gerund case, actually lending further support to Larson's case-based analysis of the distribution of temporal operators.

Taken together, the work of Abney and Larson argues strongly for an analysis under which the gerunds in *without*, *before* and *after* clauses have the structure in (59):

---

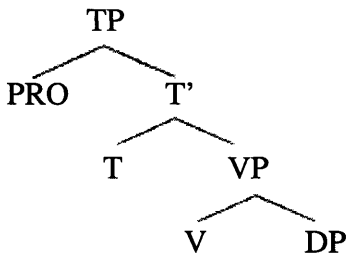
[21] "When temporal prepositions are followed by a finite clause, that clause must have a Comp containing *Op*... The simplest assumption would be that this requirement also holds when temporal prepositions are followed by clausal gerunds." (Johnson 1988, p.590)

(59)



Based on the inability of *while* to assign case, it would seem that clauses which are embedded under *while* cannot have the DP structure shown above. I suggest that they, like finite sentential complements to *while*, are headed by a TP:

(60)



With these structures in mind, I turn to a final characterization of the control possibilities in these adjuncts. Following that, I discuss the control mechanism in adjuncts that do not fall under structural control.

2.4.2.3 Conclusions: Structural Control in Adjuncts

Once we accept that Agree is able to penetrate these adjuncts, it is relevant to ask whether control is implemented with T-Agr or PRO itself. As discussed in section 2.2, in tensed complements T-Agr is made accessible through T-to-C movement, which puts T at the edge of the phase. This influences the range of interpretations that PRO can have: when Agree targets T-Agr, partial control is possible; when it targets PRO, the only possible interpretation is one in which PRO is identical to the controller. As before, the way to

probe for the partial control reading is to use a singular subject with a collective predicate. For instance, the predicates *gather* and *play together* require plural subjects. If PRO can be interpreted as merely including the main clause subject rather than being identical to it, then sentences with a singular subject and a collective predicate in the nonfinite adjunct should be grammatical.

Judgments from native speakers tell us that *before/after* and *without* adjuncts only permit the exhaustive reading:

(61) a. *The chair$_1$ wrote up an agenda before PRO$_{1+}$ gathering at 6:00.

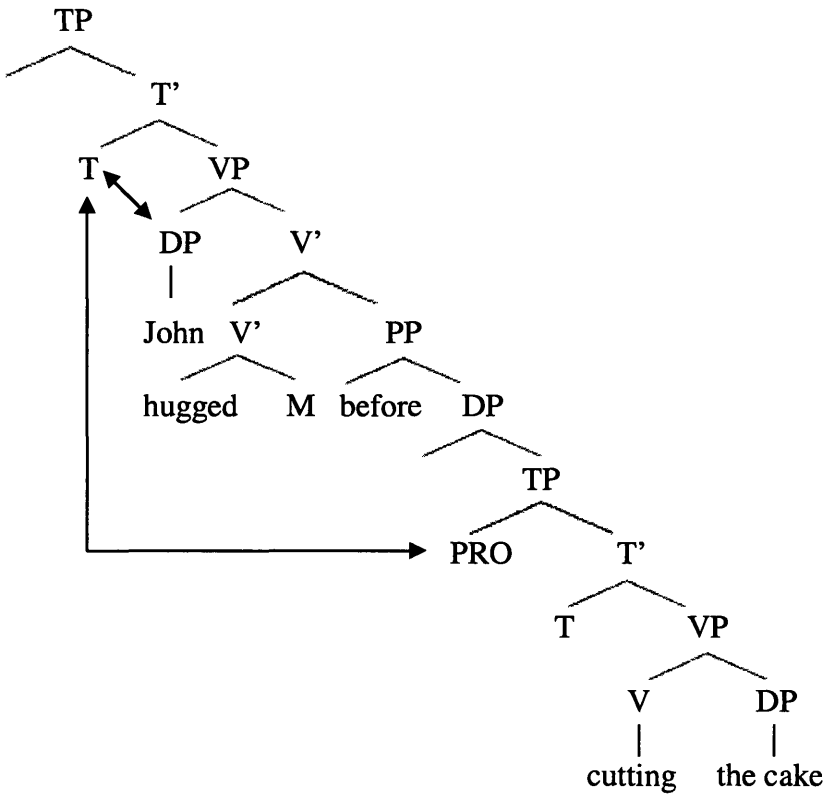
cf. a'. The committee wrote up an agenda before PRO gathering at 6:00.

b. *Mary was upset that John$_1$ left the party without PRO$_{1+}$ dancing together.

cf. b'. The angry couple left the party without PRO dancing together.

In fact, this fits with the proposed structure for these sentences. The following tree exemplifies the Agree relations which would hold between the main clause T and the embedded PRO in sentences like the grammatical (a'/b') ones above:

(62) John hugged Mary before PRO cutting the cake



Being closer to the main clause T node, PRO rather than T-Agr is the target of Agree. This is similar to the structure of exhaustive control verbs, which also involve Agree with PRO itself, and do not permit a partial control reading. In the case of exhaustive control in complements, the infinitival T-Agr is actually inaccessible to Agree by virtue of not being at the edge of the CP phase. In the present case, there is no CP node and therefore no phase boundary preventing Agree with T-Agr.[22] However, PRO would act as an intervener by virtue of being closer to the main clause T than the embedded T-Agr. By the Minimal Link Condition (or Shortest Link or the like), PRO will be selected as the target rather than T-Agr in the structure given above.

[22] There have been some suggestions in the literature that D might be a phase head in addition to C and v*. Agree should not be affected in the present case even if this is correct, as long as we adopt Landau's modification of the PIC which makes interpretable features visible within the lower phase. In this scenario, PRO would continue to be accessible but T-Agr would not.

We must also consider the control patterns in nonfinite adjuncts headed by *while*. Again, the partial control interpretation does not seem to be available:

(63) a. *The secretary$_1$ took notes while PRO$_{1+}$ gathering in the conference room.

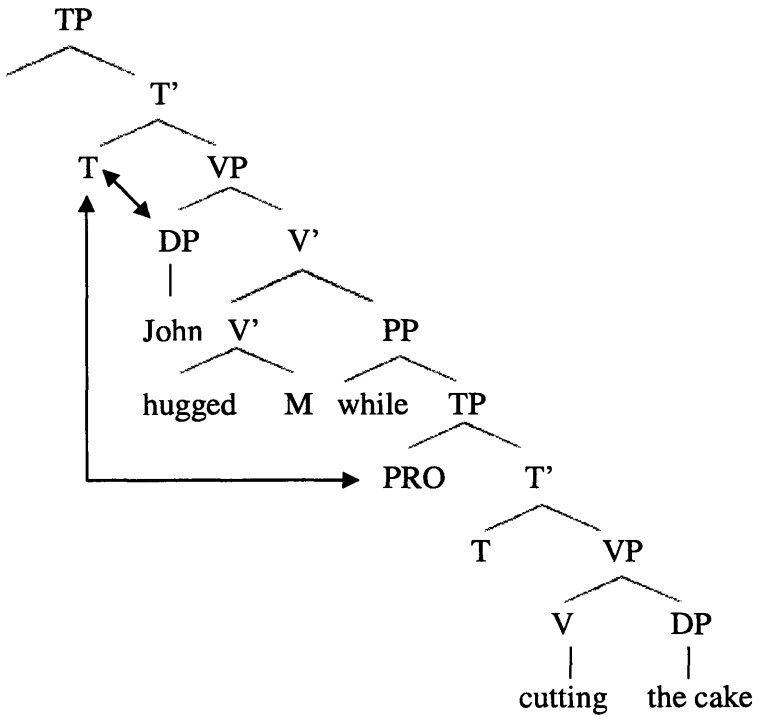
cf. a'. The committee took notes while PRO$_{1+}$ gathering...

b. *Mary was upset that John$_1$ left the party while PRO$_{1+}$ dancing together.

cf. b'. The angry couple left the party while PRO dancing together.

Once again, the unavailability of the partial control reading is expected given the structure we have assigned to the *while* clause. We hypothesized that the complement to the preposition was not dominated by a CP node, but rather, consisted of a bare TP. Without a CP node, there is no possibility of T-to-C movement. So, in these sentences the infinitival T-Agr will remain embedded at a level below the null subject, as shown below:

(64) John hugged Mary while PRO cutting the cake



In conclusion, I summarize these facts below. The reader will find that the principles are parallel to the ones which were given for control in complements (see (38)). This is expected given that the same mechanism is responsible for the patterns in both the nonfinite adjuncts and complements:

(65) **Structural Control in Adjuncts**

a. PRO is valued through Agree with the main clause T-Agr

b. Structural/obligatory control obtains only in low-attaching adjuncts, such as those headed by *before, after, while* and *without.*

c. Exhaustive Control obtains because PRO rather than T-Agr is accessible to Agree.

In the following section, we turn to PRO in adjuncts which do not fit the structural requirements for obligatory control.

2.4.3 Discourse Control

In section 2.4.1, we observed that some adjuncts allow PRO to pick up its reference from a remote or implicit antecedent, or a discourse referent, similar to PRO in nonfinite clausal subjects. The pattern underlying all of these cases is that the sentences are grammatical even though there is no structural relationship (such as c-command or some degree of locality) between PRO and controller. In other words, they fall into the domain of non-obligatory control. IP-level subjects and adjuncts group together in terms of control precisely because the syntactic mechanism of obligatory control is unable to penetrate them. They do not attach low in the structure, or more specifically, they are not internal to the phase containing the main clause T-Agr (or the lower phase) and as such

they cannot be targeted by Agree. In many cases, they are not even within the c-command domain of the main clause T-Agr, which is necessary for Agree to hold. Interpretively, however, it is not the case that "anything goes" in the NOC cases; there are still conditions of some sort which govern the reference of PRO. In this section, I wish to examine the interpretive pattern of PRO in NOC adjuncts and gerundive subjects more closely. We will return briefly to the three accounts of control which have been discussed thus far: Landau, Williams and Kawasaki.

2.4.3.1 NOC PRO as a Logophor

Landau's account identified logophoricity as being the relevant factor in choosing a controller for non-obligatory control PRO. Williams, too, argues that the referent of PRO in these cases must be the logophoric center of the sentence. He clarifies this by saying that the controller "must at least be a thinker, perceiver, or some such, whose thoughts or feelings are reported by the sentence" (1992, p. 300). As we observed in section 2.2.5, the notion of logophoricity captured the facts on PRO and reflexives in extraposed structures. What about PRO in gerundive subjects and NOC adjuncts?

Williams (1992) provides the following contrast as evidence for the role of logophoricity:

(66) a. PRO Having just arrived in town, the grand old hotel impressed Bill.

b. *PRO Having just arrived in town, the grand old hotel collapsed on Bill.

In (66a), *Bill* is the logophoric center in the sense that the sentence expresses his outlook or state of mind; not so in (66b). Williams suggests that a similar pattern obtains with

control by implicit argument, for instance, in passives. He offers (67) as evidence for logophoricity as the defining feature in these cases:

(67) *The box was wrapped beautifully PRO thinking it was for Mary.

He explains the ungrammaticality of this sentence by saying that "the implicit controller is human, but can hardly be considered an appropriate antecedent, as it is not the 'logophoric center' of the matrix, being a 'wrapper' and not a 'thinker,' 'perceiver,' or some such" (ibid.). However, there must be some factor other than logophoricity which is problematic for this example. Consider (68):

(68) The box was wrapped beautifully PRO using satin ribbon.

This example is parallel to the previous case in that the implicit agent is equally inappropriate as a logophoric center, and yet the example is grammatical. The implicit wrapper of the present is the controller of PRO, i.e., s/he is the one who used ribbon. The root of this contrast is not completely clear; it seems to derive from the nature of the adjunct or the predicate in the adjunct. The point is simply that the non-logophoric nature of the main clause agent is not what causes the ungrammaticality.[23]

Williams himself mentions an example which is problematic for the logophoric account, pointed out by an anonymous reviewer of his 1992 paper:

(69) PRO Having run smoothly for years, it was finally time for my car to be serviced.

Here, the initial null subject is clearly understood as being coreferential with the NP *my car*. Neither the conditions for structural nor logophoric control are met, and yet, the

[23]There is some debate as to whether control by an implicit argument should be considered obligatory (structural) control or not. Some linguists (Roeper 1987; Baker, Johnson and Roberts 1989) have argued for accounts under which an implicit argument is projected in the syntax in some way, and occupies an appropriate position to serve as a structural controller. However, the phenomenon shows some properties of discourse control; namely, sensitivity to the nature of the implicit argument. This will be addressed in more detail in the following section.

sentence is grammatical. In response to this, Williams says "it will be necessary to maintain that this sentence expresses the 'point of view' of the car" (p. 309). However, this seems to be a somewhat undesirable extension of the notion of logophoricity, which was originally intended to encompass solely the source or target of a mental or communicative report. For instance, why should (67) be ungrammatical, when it could be said to express the point of view of the gift-wrapper?

A better alternative, I suggest, is to find a parameter other than logophoricity which appropriately captures the adjunct PRO interpretations. For this, we look to Kawasaki's account of discourse-governed control. She suggests that T-Agr carries the feature [+topic-oriented] instead of [+anaphoric] in sentences which are not amenable to structural control. In the next section, I address the properties of sentence topics in more detail. Some of these traits overlap with the properties of logophors, suggesting that the features they have in common may offer a clue about the orientation of NOC PRO.

2.4.3.2 Properties of Sentence Topics

Following Kawasaki, I pursue the idea that topichood is relevant to the choice of controller in adjuncts. However, her discussion does not offer a very precise consideration of sentence topics. In order to appropriately motivate this analysis, I provide an in-depth look at the properties of sentence- and discourse-level topics.

The notion of topic plays an important role in the grammars of many languages. For instance, in Japanese a speaker can mark a noun phrase with the morpheme *-wa*, which has been argued to mark the topic of a sentence. The entity marked with this suffix must be familiar in the discourse in order for this usage to be grammatical. Consider, for

instance, the sentences below (taken from Portner and Yabushita, 1998), in which (b) is intended as a continuation of (a):

(70) a. otoko-no-hito-ga neko-o mitsukemashita
man-NOM cat-Acc find-PAST
'A man found a cat.'

b. *are onna-no-hito-wa sono neko-o uchi ni tsurete-kaerimashita
some woman-TOP that cat-ACC home LOC taking-return home
'A woman took the cat home.'

The sentence in (b) is ungrammatical as a continuation of (a), because it marks as topic an entity which is unfamiliar in the discourse. Similarly, if a speaker wants to identify an entity using information previously mentioned in the context, it is most felicitous to use information which was predicated of the entity when it was a topic, rather than information which was introduced when it was simply mentioned in the sentence (Portner and Yabushita, 1998).

English does not use morphological marking to pick out topics, but it does have syntactic mechanisms which can be used to identify or switch topics in a discourse. One such mechanism is to embed a sentence in the frame *"X said about Y that __"* (for instance, *John said about the man that he found a cat*). In this case, the resulting sentence will only be felicitous if Y can be accurately called the topic of the embedded sentence (according to some criteria that will be discussed below). Another way to syntactically mark the topic is to set an NP apart from the sentence in an "*as for* construction" (for example, *As for the man, he found a cat*). Again, this structure will sound odd to native speakers if X does not fit the criteria for topicality.

These examples illustrate two features which are traditionally taken to characterize sentence topics: old information status and pragmatic "aboutness." Reinhart

(1982) points out that, although useful at a very general level, the old information criteria so often taken to be paramount in identifying sentence topics is in fact neither necessary nor sufficient. The aboutness feature, although inherently somewhat vague, may help to narrow down the choice of topic. In what follows, I first discuss some prototypical properties of topics, then consider an intuitive definition of aboutness and finally present a more formal metric for selecting the sentence topic. Note that, following Reinhart, I limit the discussion here to NP topics; she suggests that it is possible for predicates to serves as topic expressions, but does not delve into a possible analysis.

As noted by Givón (1976) and Reinhart (1982) (among many others), there are a number of factors which affect the likelihood of an NP to be taken as the topic of a sentence. In a subject-oriented language like English (which has no morphological marking of the topic), the unmarked situation is for the subject position to host the topic. This is especially true for sentences which have an unmarked "topic-comment" structure (i.e., simple active, declarative sentences). In addition to the subject-as-topic preference, Reinhart identifies other discourse-pragmatic factors which affect topichood, such as continuity between sentences in a discourse (e.g., repeated mention of a referent). She notes that pronouns and definite noun phrases are preferentially used to refer to topics in comparison to full and indefinite NPs. Note that the former two require that their referent already be established in the discourse; this correlates with the likelihood of the topic to be old information.

However, ruling out all indefinites as topics based on their information status will yield the wrong result for some of them. For instance, specific indefinites and generics

can serve as topics.[24] According to Reinhart, the relevant issue here is not information status but the referential nature of the NP: an NP can only serve as a topic if it is taken to be "pragmatically" referential (p. 65) – that is, if the context supports an interpretation of the quantified NP as denoting an individual or set of individuals. For instance, a universally quantified NP like *all adults* can serve as topic if the entire set is understood to be the topic, and the proposition in the sentence asserts something about the set or its members (e.g., *She said about all adults that they disregard what children say*).

A further condition is the preference for a [+human] NP to serve as topic. Givón (1976) suggests that this factor simply reflects the anthropocentric nature of human interaction: at a basic level, people tend to be most interested in discussing and learning about other people. In a search of actual text, Givón found a high correlation between humanness of referent, likelihood of repeated mention and pronominalization and structural position (subject). He argues that the notion of topic is crucial to the morphological agreement that appears on nouns and verbs – that is, cross-linguistically, the more prototypical properties of topics an NP has, the more likely it is to enter into agreement with the verb. He distills the relevant factors into a set of binary relations, presented in (71) below, which factor into identification of the sentence topic:

(71) a. human > non-human
b. definite > indefinite
c. more involved > less involved participant
d. 1st person > 2nd person > 3rd person

The motivation for (a) and (b) has been discussed. The relation in (c) concerns thematic roles: for instance, agents are most likely to be the topic of the sentence they occur in.

[24] Thus a generic but not a garden-variety indefinite can be grammatically used in the *as-for* construction:
(i) As for cats, they make great pets.
(ii) #As for a cat, it would make a great pet.

Givón suggests that this factor is connected to the high instance of [+human] agents in actual text and discourse. However, independent from this issue, Keenan and Comrie (1977) also argue that structural position is relevant to topicality, such that a direct object is more likely to be topical than an indirect object or the object of a preposition. These structural positions tend to correlate with certain thematic roles, and reflect the relative ordering given in (c). Finally, the relation in (d) reflects the high salience and accessibility of discourse referents in an actual discourse. However, this factor will only be relevant when a discourse participant is mentioned in a sentence. I therefore take it to be less relevant for the bulk of examples that we will consider. It is possible, though, that a speaker who generally requires the topic to appear in subject position would make exceptions for mentions of the speaker or hearer but not for other referents (e.g., *me* or *you* could serve as topic in object position, but not *him, her*). In the absence of additional data and native speaker judgments, I leave this aside for now.

In explaining the notion of aboutness, Reinhart paraphrases one of Strawson's (1964) classic criteria for identifying the topic, the *principle of relevance*, as saying that "an expression will be understood as representing the topic if the assertion is understood as intending to expand our knowledge of this topic... the crucial thing here is not what can be assumed to be already known, but what can be assumed about the purpose of the utterance" (p. 59). So, identification of the topic of a sentence will be affected by the existing context and the perceived intention of the speaker. Choice of topic will be relevant to the way in which the discourse participant builds up the context set.[25] As incoming propositions are evaluated and added to the context set, the hearer will store

[25] cf. Stalnaker (1978): the context set is the set of (possible worlds compatible with) the propositions accepted to be true at a given point in the discourse.

them under the mental entry for the topic of the sentence. In this way, the context set is not just an amorphous mass of facts, but rather is structured so as to facilitate retrieval of information.

Strawson also points out that although topichood is independent from the truth value of a sentence (being a discourse rather than semantic property), it is relevant to the truth verification strategy. That is, in determining truth value of a sentence, one will consult the mental entry for the topic to assess the validity of the proposition which is asserted. To provide a classic example:[26] upon hearing the sentence *Some crows are black*, a speaker will evaluate the truth of the utterance by consulting his knowledge of crows rather than, e.g., his knowledge of the set of things which are black, even though these methods of evaluation are logically equivalent. Presumably, this is because the sentence is taken to be an assertion about the set of all crows.

Based on these considerations of aboutness, Reinhart offers a metric for picking out the pragmatic assertions which a given sentence can introduce into the context set. The possible pragmatic assertions of a sentence ($PPA_{(S)}$) are all of the possible pairings in a given context between the proposition expressed by the sentence and (the interpretation of) an NP which occurs in the sentence. The PPAs of a sentence are first identified, and then narrowed down by a selection function to identify the topic of the sentence. In (72) below, I present Reinhart's metric for picking out the possible pragmatic assertions of a sentence:

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[26] From Goodman (1972), cited in Reinhart (1982).

(72) $PPA_{(S)} = P + \alpha$

where P = the proposition expressed by the sentence, and α = the interpretation of an NP in S.

This formula will isolate pairs of the form $<\alpha, P>$ for each NP in the sentence. The next step is to examine the pairs and identify a single α_i as the topic expression. The α_i selected will influence the assessment and mental storage of the sentence, in that the proposition P "will be assessed by the hearer... with respect to the subset of propositions already listed in the context set under α_i, and... if P is not rejected it will be added to the context set under the entry for α_i" (p. 81).

The selection function is used to pick out the single pair $<\alpha_i, P>$ which corresponds to the topic of the sentence matched with the proposition expressed by the sentence:

(73) Selection function

1. Select $<\alpha_i, P>$ if α_i is already in the context set
2. If more than one pair, or no pair, is selected by 1, select the NP highest in the following accessibility hierarchy: (where [±H] = [±Human])
   [+H] subject > [+H] direct object > [-H] subj. > [-H] direct obj. > indirect obj.

The first condition of the selection function captures the preference for a topic to be already established in the discourse.[27] The second condition of the selection function becomes relevant when condition 1 is unable to narrow the choice to one single NP. This will happen when no NP is old/given information, or when more than one is. In these cases, a higher NP that is new information will be overlooked in favor of a previously

[27] For simplicity, I have omitted the "unless" clause which was included in the first part of Reinhart's version of the selection function; it was formulated so as to allow first-mention specific indefinites to be topics despite not being previously present in the discourse. Other indefinites are unsuitable as topics regardless of their status on the accessibility hierarchy.

mentioned NP that is further down on the accessibility hierarchy. The hierarchy captures the preference for the grammatical subject to serve as the topic, with the caveat that it is sensitive to the nature of the subject NP.[28] At the lowest level on the hierarchy the nature of the NP ceases to be important, because the structural position makes it highly dispreferred as a topic.

To sum up, in (74) I identify the prototypical properties of topics. The selection function given above will evaluate the discourse and select the argument which best fits this collection of properties, and identify it as the sentence topic.

(74) **Prototypical Properties of NP Topics**

a. Human or animate

b. Previously mentioned/established in discourse

c. Syntactically represented in subject position

Having established the properties of sentence topics, we are in a position to examine the relevance of these properties to control. To the extent that PRO in NOC is sensitive to topicality, the selection function will accurately select the controller in these structures.

2.4.3.3 Topic-oriented PRO

Kawasaki (1993) first identified the relevance of topicality to control. She noted that it is only possible to get control by the agent in a passive when the surface subject of the main clause is not human:[29]

[28] Following Givón (1976), I have adapted the hierarchy to include reference to humanness in addition to grammatical role. Reinhart states that the accessibility hierarchy she uses is consistent with the "functional" hierarchy of Givón and Keenan and Comrie (1977).

[29] I maintain the notation under which the null subject is represented as PRO. As discussed previously, Kawasaki conflates this category with the "little pro" null subject of tensed clauses in pro-drop languages.

(75) a. Before PRO_i leaving for New York, the office was locked up by the $manager_i$.

b. *Before PRO_i leaving for New York, Mary was criticized by $John_i$.

In addition, she found that speakers presuppose that the null subject has a specific referent which is established in the discourse context. So, for instance, the sentence in (a) below is best paraphrased as (b) rather than (c):

(76) a. After PRO getting some money, a back account was opened.

b. S/he_i opened a bank account after s/he_i got some money.

c. #$Someone_i$ opened a bank account after s/he_i got some money.

Based on data like this, Kawasaki made the following observations:

(77) a. Control by a passive agent is best when the agent is human and the derived subject of the main clause is non-human.

b. Control by a passive agent is possible only if the agent and the missing subject refer to an individual whose existence has been established in the discourse.

(1993, p. 168)

From the previous section, we see that humanness and old information status are precisely those properties which are most relevant for choosing the topic of a sentence. Clearly, they are relevant to control in NOC as well.

Kawasaki's observations on overt passive agents in fact hold whether the controller is overt or implicit. Consider the passive sentences below. In each, I have constructed the adjunct clause such that it is infelicitous when PRO is taken to refer to the surface subject. When the subject is inanimate, control by the implicit agent seems to be readily available (a,c). When the surface subject is human/animate, speakers require control by the subject as opposed to the agent (b,d), leading to infelicity in these cases:

(78) a. The trash was dumped (by John$_i$) without PRO$_i$ checking the bag for holes.

b. #John was dumped (by Mary$_i$) without PRO$_i$ explaining why.

c. The cat was fed (by its owner$_i$) before PRO$_i$ leaving for work.

d. #The little girl was fed (by her mother$_i$) before PRO$_i$ leaving for work.

Data like these suggest that all cases of control by passive agent group with NOC in being sensitive to properties of the discourse, regardless of whether the agent is implicit or explicit. The issue of implicit arguments is complicated and I largely remain agnostic about their status (i.e., whether they are syntactically represented).[30] The point that Kawasaki made still holds: control by the agent in a passive behaves more like discourse control than structural control.

It is not clear to me why or how structural control by the subject can be circumvented in these cases; clearly there is some effect of the passive construction, since this switch in control is not possible with active sentences. However, if we accept that these cases involve NOC, we find that the topic considerations derive the correct controller. If we assume that all NPs in these sentences above are new information (i.e., that there is no discourse context), the selection function will be relevant to choosing the controller. In (78a,c), the [-human] subject is skipped in favor of the [+human] object; in (b,d), the [+human] subject is the highest on the accessibility hierarchy and therefore not able to be skipped.

In addition to these cases, there are other structures for which the "PRO as topic" account makes the right prediction. Bresnan (1982) originally argued that PRO in a gerundive subject can take its reference from the context, but it must refer to an

[30] For a recent review of some issues surrounding implicit arguments, I refer the reader to Bhatt and Pancheva (2001)

established discourse referent. She showed that, in the absence of context, control by a pronoun was better than control by a full NP; the explanation is that a pronoun is more likely to refer to a person already mentioned in the discourse. Kawasaki followed up on this finding by noting that control by a definite NP, but not an indefinite, is grammatical in gerundive subjects:

(79) a. PRO contradicting himself will demonstrate the lawyer is a liar.

b. *PRO contradicting himself will demonstrate a lawyer is a liar.

As we have seen, topics are sensitive to information status: a first-mention indefinite cannot serve as the topic of a sentence. So, the pattern of grammaticality in these examples fits the hypothesis that PRO is oriented toward the sentence topic.

Let us return to the cases of absolutive adjuncts which were first discussed by Williams. Although Kawasaki does not address this type of structure, I will show that they group with other discourse control cases. Absolutive adjuncts are typically attached very high in the structure (whether fronted or in-situ), making them natural candidates for non-obligatory control. Williams argued that control was logophoric in these cases. In order to maintain this account, however, he needed to extend the notion of logophoricity in a rather unnatural way, to say that the relevant feature was a simplistic type of "point of view." I suggest that the notion of topicality more appropriately captures this element. Naturally, the topic of a sentence will determine its perspective. Consider again the example below, which was problematic for the logophoric account:

(80) PRO Having run smoothly for years, it was finally time for my car to be serviced.

By the selection function given previously, the NP *my car* will be selected as the topic. (Other than the non-referential *it*, this is the only NP in the sentence and therefore a rather

obvious choice). Consider a similar sentence in which a different NP would be selected as the topic (also mentioned by Williams, but essentially left unexplained):

(81) *PRO Having run smoothly for years, it was finally time for Joe to service my car.

In this sentence, the selection function will choose *Joe* as the topic: this NP is both [+human] and in a subject position (albeit the subject of an embedded nonfinite clause). The inanimate NP *my car*, in object position, carries no properties which make it more likely to be the topic. With the understanding that there is a correlation between topicality and control, we can derive the grammaticality of (80) and the ungrammaticality of (81).

Finally, let us reconsider a contrast which was able to be captured under the logophoricity account:

(82) a. PRO Having just arrived in town, the grand old hotel impressed Bill.

b. *PRO Having just arrived in town, the grand old hotel collapsed on Bill.

Under Williams' system, (a) is acceptable because it expresses Bill's point of view; (b) is unacceptable because Bill is not the center of consciousness. How does the topicality account fare on this contrast? The topic metric given above distinguishes between these two examples because Bill occupies the direct object position in one case and an indirect (or prepositional) object position in the other. These structural positions reflect a difference in the thematic role of Bill in each sentence. In the first example, Bill is an experiencer, whereas in the second one he is a patient. Therefore, in the (b) sentence Bill fits the least criteria for topicality. We can account for the ungrammaticality of this example by assuming that an NP which falls into the lowest category on the accessibility hierarchy cannot readily be chosen as a topic, and therefore cannot serve as controller.

At this point, we may wish to ask whether it is possible that the topic-oriented PRO account is actually able to capture *all* cases of control in adjuncts, i.e., even those I have grouped under structural control. For instance, the subject-as-topic principle could be responsible for the overwhelming choice of the main clause subject as controller in low-attaching adjuncts. However, control by main clause subject does not generally vary by speaker, or show sensitivity to properties of the discourse in the way that NOC does. For instance, as long as an indefinite is used felicitously in subject position, it can serve as controller. Also, in the absence of context, it is difficult if not impossible to sway control judgments away from the subject position for active sentences. We can attempt to do so my manipulating the discourse properties. For instance, making the main clause subject inanimate will serve to remove a prototypical property of topics. Consider the following example, in which control by the matrix clause object is forced by the semantics of the adjunct. To speakers of English, (83) sounds odd; given the grammar's initial choice of the subject as controller, the adjunct is temporarily semantically anomalous:

(83) #The horror movie frightened Mary before PRO going to bed

A relevant question to ask, though, is whether the judgments are influenced by a discourse context which changes the topicality conditions. If we embed the sentence in a context which introduces *Mary* into the discourse but not *the horror movie*, we have shifted another of the prototypical topic properties from the subject to the object:

(84) As for Mary, she didn't sleep at all last night.
?The horror movie frightened her$_i$ before PRO$_i$ going to bed.

In (84) the subject of the second sentence is a new entity in the discourse, whereas *Mary*, the object, is already established in the context and is favored as topic by virtue of being

[+human]. According to the selection function from the previous section, *Mary* will be chosen as the topic for this sentence. To some extent, it appears that providing the context as in (84) improves control by the main clause object; however, many speakers still rejected this sentence.

A similar example can be set up in which we have two alternative sentences as continuations of the same context:

(85) Context: Jane shares an office with Steve. Steve likes to listen to music throughout the day. Jane, on the other hand, likes to work in silence.

a. *Steve often bothers her_i while PRO_i trying to get work done.

b. ??The radio often bothers her_i while PRO_i trying to get work done.

For some speakers, it seems that changing the discourse context improves control by the object of the main clause somewhat. However, most speakers ruled out this type of control regardless of the discourse conditions. It seems then that the availability of structural control precludes topic control to some extent.

2.5 Final Remarks

To conclude, in this chapter the control theories advocated by Williams, Kawasaki and Landau were considered. Landau's account of complement control was found to be the most empirically comprehensive, with theoretical advantages over the characterization of control as binding or predication. Under this system, control is implemented through syntactic Agree, in which a functional head from the matrix clause probes into the structure to find an appropriate target. This account is able to capture the difference in interpretation between partial and exhaustive control verbs, which differ in whether

Agree targets PRO or the embedded T-Agr. Because Agree is sensitive to phase boundaries, we saw that obligatory (structural) control can only obtain when the infinitive is accessible to the phase containing the main clause T-Agr node. I sought to extend Landau's account by showing that some adjunct clauses – namely, the temporal adjuncts and ones headed by *without* – fit the structural conditions for obligatory control. This explains the preponderance of OC-like properties of PRO in these adjuncts.

The main focus of this dissertation is on control in adjuncts, and how the theory of control can help us understand the child data on these structures. Given the account I argued for, we expect to find that children are able to implement control in low-attaching adjuncts to the same extent that they can implement complement control, since the same mechanism is active in both cases. Throughout the literature on the acquisition of control, it is assumed that the control principles are innately encoded in UG, and are thus available to the child. Following in this tradition, we expect that any non-adult performance on structural control in adjuncts is actually due to some other factor. The next chapter will seek to identify what factor could lead to non-adult control in temporal adjuncts.

Under the control-as-Agree approach, we saw the attachment height of an adjunct is crucial in determining whether structural control can obtain. Adjuncts which attach high in the structure are inaccessible to structural control from the higher clause because they do not fall within the same phase as the probe of Agree, nor are they c-commanded by it. By this diagnostic, absolutive adjuncts and gerundive subjects were identified as falling into the category of non-obligatory control. These are precisely the structures for which there is no apparent locality constraint on the controller of PRO. In these cases,

coreference between the null subject and some 'controller' is not regulated by a syntactic mechanism; rather, there are discourse features which factor into the interpretation of PRO. In this domain, we parted ways with Landau and Williams, and extended Kawasaki's account by arguing that topicality rather than logophoricity is the relevant discourse feature. Kawasaki showed that choice of controller in some adjuncts is sensitive to factors such as humanness and definiteness. I presented a more formalized account of the properties of sentence topics and demonstrated that these properties correlated with the choice of controller in the relevant NOC structures.

Barring complications with other aspects of adjunct structure, the control-as-Agree account predicts that children will be able to implement the mechanism of structural control in low-attaching adjuncts. However, since the mechanism of control is different in the discourse cases, we do not necessarily predict comparable success on non-obligatory control. In the next two chapters, children's performance on all of these structures will be investigated.

Chapter 3: Adjunct Control in Child Language

In this chapter, we turn to the issue of acquisition. Child language research within the Chomskyan tradition has demonstrated that there are fundamental principles of language which constrain the acquisition process from the earliest stages and need not (and, arguably, could not) be learned from language exposure. Nevertheless, there is no question that learning on the basis of language input is also a significant factor; otherwise, the language of a child raised in Chile would not differ from the language of one raised in China. Most acquisition research in the past 20 years has focused on identifying the innate principles of Universal Grammar. However, the innate and learned components of language need not be in conflict; nor should any aspects which are subject to learning or development be mere side notes in the study of acquisition (Bates and Elman 1996; also see Yang 2002, 2004 for an acquisition model in which parameter setting is supported by statistical learning).

With these issues in mind, I turn to the acquisition of control. This chapter begins with an overview of previous research on the acquisition of control in complements and adjuncts. For many years, the prevalent assumption in the acquisition literature has been that the principles of obligatory control (namely, the mechanism and the choice of controller) are innately specified in UG. Most accounts of control in child grammar have sought to attribute apparent delays to some other aspect of grammar that is subject to maturational constraints or gradual learning. I focus on two such previous accounts: the **nominalization hypothesis** (Wexler 1992), and the **adjunct misattachment hypothesis** (Hsu et al. 1985; Cairns et al. 1994; McDaniel et al. 1991). These theories will serve to

motivate the approach that I present. Their experimental findings offer valuable insight into the child patterns, but each account faces some theoretical inconsistencies which weaken their explanatory force. In showing this, I will raise questions regarding discrepancies between these theories and the literature on theoretical syntax. The model of child grammar that I set forth will ideally build upon a stronger theoretical basis. While maintaining the assumption that the obligatory control principles are innate, I look to the theory of control in the adult grammar to determine what other aspect of grammar might be responsible for the difference in control patterns from child to adult.

The theory presented in Chapter 2 states that control in obligatory contexts is implemented through syntactic Agree, a relation which is restricted by certain c-command relations and locality constraints. These constraints are crucially relevant to control in adjunct clauses, since their attachment height will determine whether they are accessible to obligatory control or instead fall into the domain of discourse control. More specifically, obligatory control of the sort that obtains in verb complements can only hold in low-attaching adjuncts; an adjunct that attaches at the TP level will be inaccessible to Agree from the higher clause.

This theory predicts that, all else being equal, children who are able to implement adult-like control in complements should be able to do so in structural control adjuncts as well, since the syntactic mechanism is the same in each case. However, a number of studies have shown that control in *before* and *after* adjuncts may be delayed beyond the age at which complement control is mastered (Broihier and Wexler 1995; Hsu et al. 1985; Cairns et al. 1994; McDaniel et al. 1991). Until now, it was unknown whether there were any adjunct control structures which were *not* problematic for children. In Chapter 4

I will offer experimental evidence that children show adult-like control in *without* adjuncts from age 3;0 or possibly younger. This finding suggests that it is not the mechanism of control in adjuncts which is problematic for children; there is some other factor specific to the temporal adjuncts which leads to non-adult control in those cases. The goal of this chapter is to identify this factor and determine how children are able to recover from it to reach the adult state.

Under the model of acquisition that I adopt, children's grammars are constrained to UG-compatible syntactic structures. However, this does not negate the role of learning in the acquisition process. Specifically, I assume that an aspect of language which must be learned from the input is how phrase structure maps onto particular lexical items. To give a general example, Universal Grammar might provide the child with innately specified information on the structure of verb phrases (e.g., c-command relationships between the external argument, the verb and its complement), but the child must still learn which verbs subcategorize for a direct object and which ones do not. Similarly, although the mechanism of recursive embedding is hypothesized to be innate, a child must still learn which lexical items are used to embed a clause within another and which ones are used to coordinate clauses.[31]

A number of linguists have found that adjunct attachment height can vary both within and across languages (Ko 2005; Rapp and von Stechow 1999; Tomioka 2006). As such, it seems reasonable to assume that adjunct structure must be learned from the language input. Lexical learning is one component of this process; the child must learn how to map the phrase structure of her language onto specific lexical items. I will argue

[31] These arguments are similar to the ones made by Tavakolian (1977) to argue for a conjoined clause analysis of relative clauses and other structures.

that the type of complement that a lexical item takes will be a determining factor in the child's structural analysis of the word. If a preposition is superficially compatible with more than one structural analysis because of its subcategorization properties, it may be subject to an initial misanalysis. For example, the temporal prepositions *before, after* and *while* can take a full tensed sentence as a complement, similar to a coordinator like *and.* This and other apparent similarities between temporal prepositions and conjunctions (to be discussed in more detail in section 3.4) could lead children to conclude that they share a common syntactic structure. Conversely, adjuncts that are unambiguous in their structure should be correctly attached from a young age. The preposition *without*, for instance, only subcategorizes for DP complements; so, it will not appear to be compatible with the syntax of coordination.

To bring this back to the issue of control, recall that the attachment height of an adjunct is crucial in determining whether structural control can 'see' into it. Although the control principles are innate, their implementation in adjuncts is contingent upon the child learning the adult-like attachment height for each adjunct type in his language. We thus predict that adjunct control will not be a uniform phenomenon in child language; it will depend upon the adjunct type. An adjunct which has been mistakenly attached high in the structure (i.e., outside the VP) will fall into the domain of discourse control rather than structural control, resulting in non-adult interpretations of PRO. Once the structure of a low adjunct has been learned, adult-like control will follow. Therefore, an adjunct whose structure is acquired earlier will show adult-like control earlier.

In section 3.4 of this chapter, I will elaborate further on the motivation for this account. The properties of specific adjuncts will be investigated in more detail, in the

interest of predicting their relative age of acquisition. The predictions and implications of my account, both within and beyond the domain of control, will be discussed in section 3.4.6. In section 3.5 I will address the issue of discourse control, which is not governed by an innate mechanism and is therefore dependent upon additional development. Then, in chapter 4 I turn to the experimental evidence in support of this analysis.

3.1 Background on the Acquisition of Control

Early studies on control (C. Chomsky 1969; Goodluck 1978; Maratsos 1974) established that children have generally mastered control in verb complements by age 3;6-4;0, although they may persist in assigning object control with the verb *promise* in English. These results were confirmed in a later study by Cohen Sherman and Lust (1993), in which data were gathered from 108 children in the 3;0-8;0 age range. They used an elicited imitation task and an act-out task to examine choice of referent as well as the correlation between null subjects and nonfinite tense. In the adult grammar for English, a null subject can only be used with a nonfinite verb; they sought to determine whether children obeyed this parameter as well. In the imitation task, children made repetition errors on 44% of the test sentences, and yet only 7% of their errors involved changing the tense or pro-form independently from the other. On the basis of this finding, the authors argue that children know the syntactic distribution of PRO vs. overt pronouns with respect to tense.

In the act-out task, sentences were prefaced with a pragmatic lead toward either the subject or the object of sentence (e.g., *This is a story about John. John told Tom PRO to leave*). They found that children were largely adult-like in not allowing the context to

sway them from choosing the object as controller for object-control verbs. However, like earlier studies they found gradual development with respect to the verb *promise*; it was only in the oldest age group (mean age 7;4) that children consistently gave more correct subject responses than object responses for this verb.

Several studies have found children who are mostly adult-like on control in complements and yet are nonetheless delayed on control in adjunct clauses. Hsu et al. (1985) tested 64 children between the ages of 3;2 and 8;3 on an act-out task with sentences like the following:

(1) a. The zebra touches the deer after PRO jumping over the fence.

b. Daisy jumps over Pluto in order PRO to climb the ladder.

In both of these sentence types, some children incorrectly allowed the object of the sentence to serve as the referent for PRO. Hsu et al.(1985, 1989) argued for a stage-based development of the grammar of control in both complements and adjuncts, in which children may allow only subject control, only object control, or a mix of the two.[32] The authors classified 45% of the subjects as having an object-oriented grammar for PRO in adjunct structures, and 14% as having a mixed object and subject control grammar. Hsu et al. (1989) also found variation among subjects in whether they would allow the object of a preposition to serve as controller (in, e.g., *Mickey talked to Daisy before PRO climbing the ladder*).

Goodluck (1987) also studied control in adjunct clauses in children. She tested 24 subjects aged 5;0 to 6;0 on sentence-final *after*-clauses like *Mickey hugged Daisy after PRO climbing the ladder*, using an act-out task. She reports that subjects were adult-like

[32] The stages were found to overlap a great deal in terms of age across 3-8 year old children, although adjunct clauses persisted in being delayed longer.

in choosing the main clause subject as controller approximately 66% of the time. They chose the object as the controller 28% of the time. Again, this supports previous findings that children are allowing PRO in adjuncts to have non-adult interpretations.

These Hsu et al. and Goodluck studies utilized act-out tasks, in which children heard a sentence and then had to act it out using a set of toys and props provided by the researchers. There are drawbacks to this methodology, however. Act-out tasks require children to pick a single interpretation of a sentence in order to act it out. Even if a researcher collects data from a number of subjects, s/he cannot determine whether the child's grammar allows other meanings that were not chosen to be acted out. For example, children might always choose from the characters that were named in the test sentence, for performance or processing reasons (i.e., not because of grammatical constraints), even if multiple dolls or toys are provided for acting out the sentence (Crain and McKee 1985; Crain and Thornton 1998). These studies do not necessarily indicate whether it is possible (even if dispreferred) for adjunct PRO to find its reference outside of the sentence. However, they do provide evidence of non-adult control patterns, since some of the children allowed object control.

A later study of adjunct control (Broihier and Wexler 1995) established that children allow an even broader range of interpretations of PRO in adjuncts; their responses are not limited to subject and object control. These authors performed a truth value judgment task with 14 children aged 3;10 to 5;5 (Crain and McKee 1985). The subjects watched the experimenters act out a story with props and then listened to a puppet say a target sentence that was intended as a description of the story. Children were asked to judge whether the puppet was right or wrong about what happened in the story.

In this way, the experimenters were able to control the context in which the sentences are uttered. Broihier and Wexler presented children with contexts in which three different characters were highly salient, even though only one or two of them were mentioned in the actual test sentence. For example, they would provide a story about Mickey Mouse, Donald Duck and Pluto, in which Donald and Pluto are having a jumping contest. The children would hear a test sentence like *Mickey Mouse hugged Pluto before jumping over the fence*, in a context where Mickey hugged Pluto before *Donald* jumped over the fence; Mickey would then jump over the fence sometime later. For an adult, the test sentence is false in this context. Children were tested on four stories like this in which the test sentence was true (but ungrammatical for an adult) with 'external' control; four which made the object control reading true, and four which made the subject control reading true.

Broihier and Wexler found 6 children who were adult-like in requiring subject control, and 8 children who allowed object and external control.[33] The percent acceptance of non-adult control varied across the 8 children from as low as 13% to as high as 88%. On average these children accepted both the external and object control readings 53% of the time. Contra the Hsu et al. studies mentioned previously, these authors found no evidence for a strict object control grammar. They suggest that the apparent object control pattern is due to a processing preference for picking a highly salient, recently-mentioned character as the referent when acting out a sentence. The truth value judgment task, on the other hand, was able to probe for meanings that the children might *allow*, albeit not *prefer* when the interpretation is left open. On the basis of these findings, they

[33] Given the small number of subjects in this study, the findings certainly warrant further confirmation, especially using the same methodology. The experiments I report in Chapter 4 will serve to provide additional data using a truth value judgment task.

argue that non-adult children do not require any particular structural relationship between the controller and the null subject. Instead, they allow any salient referent from the discourse to control PRO. This is a significant point for the account that I present, since it strongly suggests that non-adult children are treating the temporal adjuncts as domains for non-obligatory control. Recall that it is appropriate to consult the discourse context to find a controller in non-obligatory control but not in obligatory control structures.

Descriptively, this pattern of interpretation means that children pick out a referent for adjunct PRO in much the same way that they (and adults) would for an overt pronoun. Several researchers have discussed this parallel between overt and covert pro-forms (Goodluck 1987; Lust et al.1986; McDaniel et al. 1991; Tavakolian 1977). An interesting question is whether (or, in what ways) children distinguish between overt and null anaphora. Lust, Solan, Flynn, Cross and Schuetz (1986) conducted a set of act-out and imitation tasks with 101 children aged 3;1-7;11. They directly compared children's interpretation and production of null subjects and overt pronouns in temporal clauses. The experiment examined both forward and backward anaphora with null and overt subjects, in structures like the following:

(2) a. Billy dropped the penny when he saw the cat.

b. When he colored the books, Tommy drank the milk.

c. Johnny washed the table when PRO drinking juice.

d. When PRO dressing the baby, Daddy dropped the book.

The goal was to examine children's interpretations of pro-forms in adjuncts to determine if they were sensitive to two factors: (1) the use of a pragmatic lead mentioning a specific character, and (2) the direction of the anaphoric relationship (pro-form preceding or

following the referent). The pragmatic lead took the form of "I'm going to tell you a story about X," followed by a test sentence containing a name and a null or overt pro-form.

In the act-out task, children showed significantly greater success in interpreting overt pronouns in comparison with PRO. They allowed the pragmatic context to influence their choice of referent for both types of anaphora, even though this is appropriate in the case of overt pronouns but not PRO. This is perhaps surprising, taken in conjunction with the Cohen Sherman and Lust (1993) finding that children did not let the context influence controller choice in verb complements. However, this difference can be accounted for under the analysis that I present later in this chapter: if children mistakenly treat temporal adjuncts as domains for discourse control rather than structural control, then the conversational context in fact is relevant to controller choice.

The results of the imitation task conducted by Lust et al. indicate that development primarily occurred in the 3;0-5;0 age range, with the number of errors decreasing through this period and then leveling off. Children made significantly more errors on backward anaphora than forward; independent from this factor, they also made significantly more errors on preposed adjuncts than clause-final ones. When imitating sentences, the children more frequently converted null elements to overt ones rather than vice versa, suggesting the primacy of overt forms in their grammar. Despite this, they overwhelmingly demonstrated knowledge of the correlation between finiteness and overt vs. covert pro-forms. For instance, a child would sometimes convert a sentence with PRO into one with an overt pronoun. In 84% of these cases, the child also accurately switched from a non-finite to a finite verb form, as in (3):

(3) a. Experimenter: When PRO dressing the baby, Daddy dropped the book.

Child: When he was dressing the baby, the Dad dropped the book.

b. Experimenter: Johnny washed the table when PRO drinking the juice.

Child: Johnny washed the table when he was drinking the juice.

This result is similar to the Cohen Sherman and Lust finding that children only rarely produced a null form with an inflected verb, or an overt form with a nonfinite verb. Taken together, these results robustly demonstrate that children have mastered the syntactic properties of PRO – namely, that it is a null anaphor and it is associated with nonfinite tense. However, this does not explain why children differ from adults in the way they interpret PRO in adjuncts. In what follows, we will consider two previous accounts of this finding.

3.2 The Nominalization Hypothesis

The nominalization hypothesis is an account which is pursued and expanded in Wexler (1992) and Broihier and Wexler (1995), based on an idea from Carlson (1990). The original version of this account (e.g., Broihier and Wexler 1992) maintained that children do not have PRO in their grammar at an early age. This would appear to be inconsistent with the findings mentioned previously, i.e., that children are mostly adult-like on control in verb complements but not adjuncts (Cohen Sherman and Lust, 1993). The later version of the theory which I will consider here looks to the linguistic structure of temporal clauses to find an explanation for the child errors on adjunct PRO. According to this account, the problem for children is not actually with PRO at all, but rather with the need to represent and manipulate the empty temporal operator (ETO) which appears in

structures with *before* and *after*. An ETO is essentially equivalent to a null *when,* which serves to fix the temporal relationship between the main clause and the embedded clause (Larson 1988). Recall from chapter 2 that ETOs are thought to appear whenever *before* or *after* takes a sentential complement. Wexler's account assumes that the *adult* structure for a sentence like (4a) is (4b):

(4) a. John kissed Mary before PRO cutting the cake.

b. John kissed Mary [$_{PP}$ before [$_{IP}$ Op_i PRO cutting the cake t_i]]

When faced with such a sentence, it is claimed that children will have difficulty representing the ETO. The difficulty is attributed to maturational factors concerning empty operators. To avoid this problem, children must represent the structure as something which does not contain an ETO. Recall from our discussion of Larson's case-based analysis of temporal operators in chapter 2 that a sentence in which *before/after* takes a nominal complement cannot contain an operator. This would result in the failure of either the operator or the complement to receive case. So, in the case of temporal adjuncts, there is an escape hatch for children: if they can represent the complement to the preposition as a nominal, the structure will not contain an operator and hence will not be problematic. Wexler argues that the adult structure (5a) will be represented as (5b):

(5) John kissed Mary [before PRO cutting the cake]

a. [$_{PP}$ before [$_{IP}$ Op_i PRO cutting the cake t_i]]

b. [$_{PP}$ before [$_{DP}$ (the) cutting (of) the cake]]

Essentially, this means that the children misrepresent the verbal gerund as a nominal gerund. The reason for doing so is not an inability to represent PRO, but rather, an inability to represent the empty operator. The substituted structure without the temporal operator is interpretable by the child; however, the new structure is assigned a different

interpretation, in accordance with the adult grammar. More specifically, the nominal gerund in (5b) does not specify the agent of the cutting action; like adults, children would accept any person from the context as the agent in (5b). For adults, however, the structures in (a) and (b) are not equivalent in this respect; a genuine instance of the PRO-ing gerund does not exhibit free interpretation, but instead the null subject must be coindexed with the main clause subject.

A problem which arises for this account concerns the nature of the adjunct clause in the adult grammar. Wexler accurately follows the case-based theory of Larson (1988) in assuming that there will not be a temporal operator present if the complement to the preposition is nominal. But, he assumes that the syntactic object [PRO + V_{ing}] in *before PRO cutting the cake* is a sentence (i.e., an IP), meaning that the conditions for the presence of an operator hold. As discussed in chapter 2, Abney (1987) presents a great deal of evidence that all types of gerunds are nominal at their highest level. Other linguists (Baker 1985, Milsark 1988, Pires 2001, Portner 1995) have disagreed on the exact structure of the PRO-ing gerund, but they all argue that it must receive case, which is the property that is crucial to this discussion. If we accept that the PRO-ing gerund culminates in a DP node, another crucial property follows: there cannot be a temporal operator in the structure. If there is no operator, then there is no motivation for the child to substitute one structure for another. We are left without an explanation for the non-adult readings, since this structural substitution was the source of the non-adult interpretations under this account.

Wexler's account also dictates that empty operators are subject to maturational constraints, such that they are unavailable to children until a relatively late age (6 years or

older). He draws on this to explain children's trouble with purpose clauses, which are also thought to contain an empty operator. A sentence with a purpose clause would receive the following structure in the adult grammar:

(6) Big Bird chose Cookie Monster$_i$ [Op_i PRO to read to t_i].

He suggests that the child, being unable to represent the operator, is unable to correctly interpret the sentence. However, the claim that children are uniformly unable to represent empty operators does not accord with other child language research.[34] Vainikka (1993) and Vainikka and Roeper (1994, 1995) cite production data showing that children younger than 3;6 produce grammatical purpose clauses. They also conducted an experiment with 21 children aged 3-6 to investigate whether the subjects represented the operator in the purpose clause. The children listened to short stories and then had to answer questions like the following:

(7) a. Where did the boy plan to splash it on his face?

b. Where did the boy buy it to splash on his face?

Sentence (7a) does not contain a purpose clause, and can be interpreted in two ways: as a question about where the boy made a plan (the short distance answer), or a question about where the splashing would occur (the long distance answer). The (b) sentence on the other hand contains a null operator as in (6), which blocks wh-movement out of the lower clause. As such, only the short distance answer (in which *where* modifies *buy*) is possible. Vainikka and Roeper found that 83% of the children's responses to questions like (7a) were of the long distance sort. In contrast, they gave only 2% long distance

[34] The following papers argue that children are able to represent and manipulate empty (and overt) operators in relative clauses: Foley (1996); Guasti et al. (1996); Labelle (1990, 1996); McKee, McDaniel and Snedecker (1998). The non-adult behavior of children is actually attributed to overgeneralization of operators. However, it is feasible that temporal and non-temporal operators could develop independently in child grammar.

answers to sentences like (7b). The authors conclude that the children, like adults, blocked the long distance reading because of the presence of the operator.

To summarize, it would appear that the presence or absence of an operator does not correlate with children's ability to implement adult-like control. I have presented several theoretical reasons to doubt that there is an empty operator in temporal adjuncts with a gerund complement. However, this rests upon a particular theoretical approach which argues that the gerund is nominal at the highest level of structure. An alternative analysis which takes the nonfinite clause to be a CP or IP could very well make a different prediction regarding the presence of an empty operator. For this reason, it is important to also find experimental evidence that the nominalization hypothesis does not accurately delineate which structures are problematic for children.

Let us briefly review the predictions of the nominalization hypothesis. The source of difficulty for children is thought to be the presence of an empty operator in the *before/after* clause. Being unable to represent the operator, children are forced to reanalyze the structure. In doing so, however, they substitute a structure which is assigned a different interpretation from the original sentence. Clearly, under this account control should be unaffected in a structure that does not contain an empty operator. Such a structure would be an adjunct headed by *without*, e.g., *John cut the cake without PRO blowing out the candles*. In addition, as discussed in chapter 2, *while* never occurs with a temporal operator despite expressing a temporal meaning. Because of this, a control structure under *while* should pattern like a control structure under *without*: both are expected to be unproblematic from a young age. To summarize, the nominalization

hypothesis makes the following predictions regarding controller choice by children who cannot represent temporal operators:

(8) Table 3.1: Predictions of the nominalization hypothesis

Adjunct head	**Predicted performance**
before	non-adult: free control
after	non-adult: free control
while	adult-like: subject control
without	adult-like: subject control

In Chapter 4, I will present data from two experiments in which a total of 53 children aged 3;0 to 6;0 were tested on adjuncts headed by *without*, *while* and *after*, and 30 children were tested on *before* adjuncts. To anticipate the results, we will find that the patterns in the data do not reflect the predictions of the nominalization hypothesis. Instead we see that all three temporal adjuncts (*before, after, while*) are delayed, suggesting that some factor other than the presence of a temporal operator is responsible for the delays in adult-like control. In section 3.4, I will argue that children's success on control is dependent on whether they have embedded the adjuncts in an adult-like manner. This is similar in some ways to another previous account, to which I now turn.

3.3 The Adjunct Misattachment Hypothesis

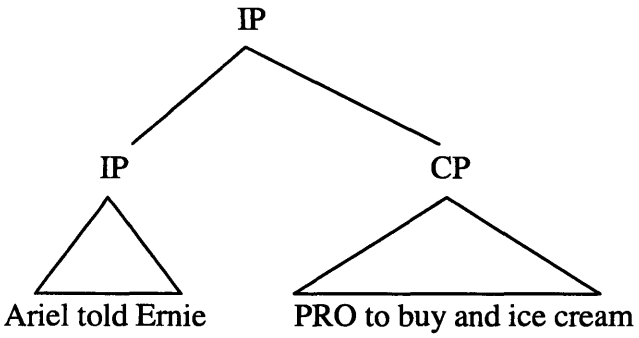
Hsu et. al. (1985), McDaniel et al. (1991) and Cairns et al. (1994) have argued for a different account for the child control patterns. Similar to other accounts, they maintain that children know the grammatical principles of control from a very young age; that is, they argue that children's grammars include the adult rule that PRO must co-refer with a c-commanding antecedent. Child errors instead come from building up syntactic

structures such that there is not always a c-commanding controller available. The lack of a structural controller presumably leads to the characteristic 'free' reference of PRO. The authors claim that this is on par with the "arbitrary" reading that adults assign to PRO in cases where there is no structural controller available (such as, *PRO to give to charity is a noble deed*). However, as Wexler (1992) points out, it is something of a stretch to derive children's interpretation in these sentences from the adult PRO_{arb} reading. For adults, this is equivalent to a generic interpretation (e.g., *for (any)one to give to charity is a noble deed*). The children, however, are clearly assigning a specific referent to PRO, although they allow a relatively wide range of options in choosing the referent from the discourse. This is not equivalent to the adult PRO_{arb} interpretation. So, it is not clear that this account truly maintains consistency in the principles of control from child to adult, as the authors contend.

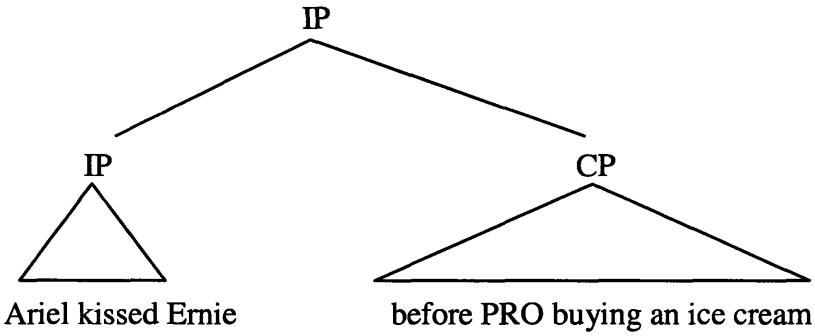
Superficially, the account which Hsu, Cairns and McDaniel propose is similar to the account I present in section 3.4, since I also argue that children may misattach adjunct clauses. However, Hsu et al. attribute structures to the child which suggest that the mechanism of recursive embedding is not innately available. They argue for a series of developmental stages from ages 3 to 6 during which the child is unable to correctly subordinate both complement and adjunct clauses. They claim that children slowly learn to embed these structures during the pre-school years, starting with complement clauses and slowly extending to adjunct clauses. At the earliest stage, children represent all sentences without embedding, instead conjoining clauses at a high level, as shown in (9) and (10):[35]

[35] These structures, which have been adapted from the original to reflect modern phrase structure, are taken from Guasti (2002).

(9) No embedding of complement clause (stage 1)

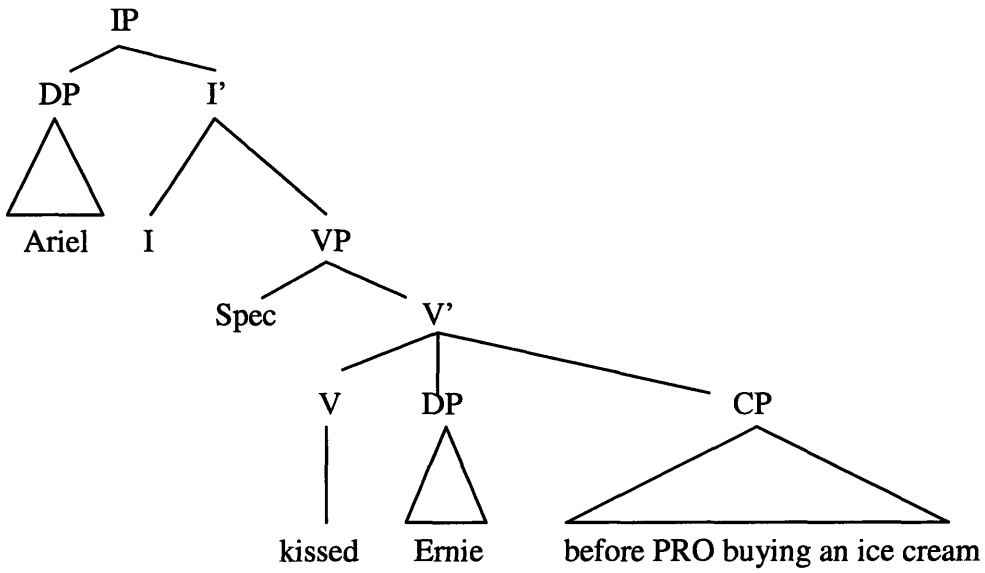


(10) No embedding of adjunct clause (stage 1,2)



In later grammatical stages (there are four under this account), children succeed on embedding complements but still show variation in attaching adjuncts. However, there is no explanation for the (apparently universal) earlier success on complements than on adjuncts; under their account, there is no reason why development could not proceed in the reverse order. In stage three, children recognize that adjuncts are subordinate clauses, but mistakenly assume they attach as a sister to the verb, i.e., on par with complements as shown in (11). The result is that PRO in the adjunct is c-commanded by both the subject and the object:

(11) Low misattachment of adjunct (stage 3)



In this structure, the object of the main clause is the closest c-commanding NP, which accounts for children who primarily take the object to be the controller of PRO.[36] In stage 4, the last stage prior to achieving the adult grammar, children vary in attaching the adjunct at the V' level as shown above, and at the I' level such that only the subject c-commands PRO. In this stage, they vary in picking the subject or the object as controller.

This account of the child data is problematic in several ways. Regarding the proposed first stage (no embedding), we should note that it is only very young children (below 3 years old) who demonstrate overly liberal control in verb complements. A simple, plausible explanation for the observed development is that it takes some time for children to learn the lexical properties of each control verb (C. Chomsky 1969; Cohen Sherman and Lust 1993). This explanation avoids the need to claim that young children are unable to embed complement clauses. The authors claimed this because they sought to attribute the non-adult control patterns to some factor other than the principles of

[36] Goodluck (1981) gave a similar argument to explain inappropriate object control responses in adjuncts.

control. They assume that control principles are given by UG and should therefore be identical for child and adult. In order to maintain this view, they attributed the non-adult patterns to the child's immature syntax of subordination. They argue that this approach respects the Continuity Hypothesis (Lust 1986; Crain 1991; Pinker 1984), which assumes that the same innate principles underlie both child and adult grammars. We must note, though, that the account simply shifts the burden of continuity away from control and onto the syntactic phrase structure. It posits a stage in which children assume a completely flat linguistic structure, i.e., one with no embedding or subordination. However, recursive embedding is a fundamental, perhaps definitional feature of human language. It is therefore very unlikely that the hierarchical nature of language is a property of grammar which must be learned over time. Furthermore, we know independently that children as young as 3;0 have grammars that are based on structure-dependent rules rather than linear patterns in strings of words (see, e.g., Crain and McKee 1985; Crain and Nakayama 1987; and many others). So, empirically, it is inaccurate to claim that children do not or cannot represent embedded structures. In addition, many researchers beginning with Goodluck and Tavakolian (1982) and Hamburger and Crain (1982) have argued that children correctly embed relative clauses by age 3;0 or 4;0. Under the misattachment account, it is unclear why children would succeed on embedding these structures but not control complements.

Let us move on to the third developmental stage posited in this theory, in which it is assumed that children have learned to embed adjunct clauses but have mistakenly allowed them to attach as a sister to the V head, as shown above in (11). A similar theoretical concern arises in this case: cross-linguistically, complements and adjuncts

exhibit differences in their structural representation – optional elements have a more remote connection to the head – and the primacy of arguments is thought to have a conceptual basis. A 'mistake' of the sort described here would indicate a serious misunderstanding of the difference between the way that subcategorized elements and optional elements are represented in syntactic structure.[37] Moreover, a study by de Villiers et al. (1990) offers experimental support that children aged 3;0-6;0 correctly distinguish complements and adjuncts for the purposes of wh-extraction. In the adult grammar, a wh-word can be extracted from an adjunct in an embedded clause only if the Spec, CP of the lower clause is empty, allowing successive cyclic movement. If, for instance, another wh-word appears in this position, the wh-adjunct can only be extracted from the higher clause. This can be demonstrated by considering context-question pairs as below in (12), which were used by de Villiers et al. to test this in children:

(12) Context: This little girl went shopping one afternoon, but she was late getting home. She decided to take a short way home across a wire fence, but she ripped her dress. That night when she was in bed, she told her mom, "I ripped my dress this afternoon."

a. When did she say she ripped her dress?

b. When did she say how she ripped her dress?

The question in (a) can be interpreted in two ways, depending on whether *when* is extracted from the higher clause (short distance movement) or the lower clause (long distance movement):

[37] Of course, it is possible that the conceptual difference between arguments and adjuncts is innate while the structural difference is acquired through language exposure.

(13) a. Short distance movement: When$_i$ did she say t_i she ripped her dress?

Answer: at night/in bed

b. Long distance movement: When$_i$ did she say she ripped her dress t_i?

Answer: in the afternoon

The (b) question, however, does not permit the long distance interpretation. With another wh-word in the lower Spec, CP, the landing site of *when* is occupied; as such, it can only move out of the higher clause:

(14) a. Short distance movement: When$_i$ did she say t_i how she ripped her dress?

Answer: at night/in bed

b. *Long distance movement: When$_i$ did she say how she ripped her dress t_i?

However, many people judge the long distance extraction as grammatical if the wh-word corresponds to an argument of the embedded clause rather than an adjunct:

(15) What did she say (how) she ripped t_i?

Answer: her dress

De Villiers et al. presented children with contexts like the one above and then asked questions like these. They found that children gave long-distance answers to both argument and adjunct questions 30-40% of the time when it was grammatical for adults (as in (13) and (15)). However, they gave only 6% long-distance answers to a question like (12b)/(14b). To the extent that the study made the long distance answer equally accessible in the two conditions, these findings suggest that children in this age range correctly represent complements differently from adjuncts.

Let us return to the misattachment account. In some of the grammatical stages, it is argued that children incorrectly coordinate adjunct clauses (as in (10), given

previously) instead of subordinating them; that is, they attach them at a high level in the structure, equivalent to the way that conjoined clauses are attached.[38] Cairns et al. (1994) correctly point out that this hypothesis makes predictions regarding non-control structures. If children do indeed attach adjuncts as if they were coordinate clauses, then we expect parallels in their judgments of adjuncts and genuine coordinate structures. One aspect of this involves the tense of coordinated clauses: for adults, a null subject can appear in a coordinate structure only if the verb is tensed in both cases (16a,b); only a subordinate clause can be untensed for adults (16c):

(16) a. The pig hugs the sheep and __ jumps into the water.

b. *The pig hugs the sheep and __ jump/jumping into the water.

c. The pig hugs the sheep before __ jumping into the water.

If children are treating the *before* clause in (16c) as a coordinate structure, it follows that they should allow untensed clauses in genuine coordinate structures as well. To test this, Cairns et al. gave 15 children aged 3;10 to 4;11 explicit practice and training in giving grammaticality judgments, using sentences with improper verb conjugation (e.g., *The tree are brown*), improper subcategorization (*Cookie Monster is sleeping Big Bird*) and missing elements (*Big Bird ate cake and*). Furthermore, they were taught that a grammatical *phrase* does not necessarily make a grammatical *sentence*. So, for instance, they were able to correctly judge that a grammatical verb phrase like *Was climbing the tree* is ungrammatical when it stands on its own. Over the course of the study, each child judged more than 200 sentences like these (in addition to well-formed controls) for well-

[38] These authors are drawing on Tavakolian (1977, 1981), who also offered a conjoined clause analysis to explain children's non-adult interpretations of relative clauses.

formedness; the authors express great confidence in the children's understanding of the task.

Perhaps surprisingly then, several children judged sentences like (16b) to be grammatical. Out of the 15 children who participated, Cairns et al. identified 9 who had a grammar in the relevant developmental stage (free reference of PRO in adjuncts). These nine children were tested on two different occasions, yielding a total of 18 judgments on sentences like (16b). In 17 of the 18 observations, the nine children who gave non-adult control judgments also judged sentences like (16b) to be grammatical.[39] This is precisely what is predicted by a misattachment account in which the adjuncts are conflated with coordinate structures. It suggests that children have not yet learned the properties of coordinated sentences.

These parallels between coordinated clauses and adjunct clauses in the grammars of the non-adult children will serve as the building blocks of my analysis. This aspect of the old misattachment account, although not the previous claims on complement clause misattachment, will be maintained under the account I will propose.[40] The control theory I presented in chapter 2 identified adjunct attachment height as a crucial factor in the adult grammar of control. As a result, success on control depends on successful embedding of the adjunct. Given this, it makes sense to consider whether children might

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[39] Even more intriguing, Cairns et al. found that in 17 of 18 observations, these children ruled out (i) but accepted (ii) as a grammatical sentence:

(i) __ was jumping over the fence.

(ii) __ jumping over the fence.

This suggests that the non-adult aspect of their grammar might be that they allow an untensed *main* clause. This seems to be a real finding, although it is hard to reconcile with the well-known claims regarding the optional infinitive stage (Wexler 1994), argued to be over by age 3, in which children allow untensed main clauses. Interestingly, the difference between (i) and (ii) means that the Cairns et al. children did obey the English parameter setting in allowing a null subject only in a non-finite clause.

[40] Importantly, the theoretical concerns and experimental counterevidence which were brought up in connection with the other grammatical stages will not be relevant to my analysis.

be non-adult with respect to adjunct attachment rather than the principles of control. In the following section I pursue the issue of adjunct misattachment in more detail, examining in particular some facts about temporal adjuncts which might lead children to misanalyze them as coordinate structures.

3.4 My Account: the Interaction Between Adjunct Attachment and Control

3.4.1 Introduction

Previously in this chapter, I discussed several studies that found a difference between control in complements and adjuncts in terms of age of acquisition. The experimental work which I will present in Chapter 4 also uncovered a discrepancy between different adjunct types. Why do these differences exist, if control is governed by the same mechanism in all cases? Why are children able to implement control in complements and some adjuncts but not others? In accounting for this discrepancy, I will identify structural properties of temporal adjuncts which could lead to non-adult control even if the control principles are active in the child's grammar. One of the goals of the account presented here is to explain children's non-adult control judgments in a way that provides a viable path of acquisition. We seek to understand how it is that the child initially differs from the adult and yet comes to achieve the adult grammatical competence.

We turn to the account of control in chapter 2 in search of answers to these questions. This theory maintained that two mechanisms of control are operative in adjuncts: one which requires reference to structural properties of the representation, and one which requires reference to properties of the discourse context. It has long been assumed, in both the theoretical and acquisition literature, that the principles of structural

control are specified in UG and should therefore be innately available to the child (Chomsky 1981 et seq.; Landau 2000; also see all references to the acquisition of control in this chapter). Why, then, would a 3;0 to 5;0 child show non-adult behavior on control in temporal adjuncts, which are subject to structural control in the adult grammar? I argue that the non-adult feature of the child's grammar lies not with control, but with two aspects of the grammar which are not specified innately and must be learned from the language input: the mapping of phrase structure onto specific lexical items, and the attachment height of adjunct clauses.

In the acquisition process, children acquire mappings between word meanings and phonological form; they must also learn the syntactic properties of each lexical item – for instance, its argument structure and associated phrase structure. In the case of prepositions and conjunctions, children must determine whether they conjoin two clauses at a high level or subordinate one to another. These syntactic properties, although constrained by universal principles, can vary to some degree from language to language and from structure to structure (Ko 2005; Rapp and von Stechow 1999; Tomioka 2006). For example, we observed in Chapter 2 that adjunct clauses in English can vary in their attachment height.

During this process of acquisition, the child will draw upon the subcategorization properties of a lexical item as evidence for its clausal structure; however, in some cases this evidence will not be definitive. I hypothesize that a preposition which appears to be compatible with more than one structural analysis could initially be assigned the wrong structure. In particular, prepositions which can take a full tensed sentence as a complement (for instance, the temporal prepositions *before, after* and *while*) will appear

similar to a coordinator like *and*, which is used to conjoin two clauses at a high level. Given such evidence, the child may wrongly analyze the head of the adjunct as a lexical item which conjoins one clause with another rather than one which subordinates a clause. This attachment height is similar to that of an absolutive adjunct, which means that it is compatible with the syntax of adjuncts in English. In making such a mistake, the child has not created a structure in violation of UG-given principles; instead, she has substituted one possible structure for another. On the other hand, a preposition which cannot take a tensed sentence as a complement should not be subject to such a misanalysis. Instead it will be properly embedded at a younger age, and adult-like control will follow.

If these hypotheses about adjunct misanalysis are accurate, they allow us to account for the child data solely in terms of grammatical properties that are subject to learning. The principles of obligatory control, which are widely assumed to be encoded in Universal Grammar, are fundamentally the same at all ages. The non-adult control patterns are instead due to variation in an aspect of syntactic structure that must be learned from the input.[41] Since the attachment height of adjuncts is relevant to control in the adult grammar, it is not surprising that misattachment would change the control properties of the adjunct. Under the misanalysis described above, the structural control relation between PRO and controller cannot hold; recall from chapter 2 that a lack of obligatory control is expected under the adult grammar for an adjunct in this position. Thus, children who have misattached the temporal adjuncts are treating them as domains for non-obligatory (i.e., discourse-governed) control. As might be expected, however, the

[41] In section 3.4.4, I will consider the sources of evidence which are available to eventually lead the child to the adult-like structural analysis.

exact discourse features licensing PRO in discourse control structures must be learned; there is no innate information regarding anaphora which are not syntactically licensed. This means that children might be non-adult in an additional way, namely, in how they choose a controller in discourse contexts. This issue will be explored in more detail in section 3.5.

First, I will take a closer look at coordinated and subordinated structures in the adult grammar, and explain the misanalysis account in more detail. I will also consider the issue of learnability, i.e., how the child is able to converge on the adult grammar, in section 3.4.4. In section 3.4.5 I turn to the predictions of this account, focusing on the way that adjunct misanalysis will affect control and pronoun interpretation. In chapter 4, the experimental evaluation of this theory is presented.

3.4.2 More on Misanalysis: Subordination vs. Coordination

Let us consider the notion of adjunct misanalysis more closely. It should be made clear that, unlike the previous misattachment account, the mechanism of recursive embedding is assumed to be innately available to the child as part of the human language faculty. Some theoretical reasons for abandoning the reverse hypothesis (i.e., that subordination is a feature of language which must be learned) have already been discussed. In addition, there is experimental evidence (which McDaniel et al. themselves cite) that children are adult-like in embedding propositional complements (such as *Grover told Bert that he jumped...*). Again, under the previous misattachment hypothesis, there is no explanation for success on the embedding of complements alongside failure to embed adjuncts.

The present account seeks to explain why verbal complements and some adjuncts are properly embedded at a young age, whereas other adjuncts are subject to misanalysis. The answer to this question is based on consideration of the aspects of grammar that must be learned and those that are specified innately. More specifically, I assume that the subordination of verbal complements – i.e., the existence of c-command relations within the VP – is not something that must be learned. On the other hand, various adjuncts within a language may differ in whether they attach inside or outside the verb phrase (Rapp and von Stechow 1999). There is also cross-linguistic variation in prepositional adjunct attachment (Tomioka 2006). These facts suggest that the child must learn from the language input the right height at which to integrate various adjuncts.[42] Of course, we should confirm that there are actually sources of evidence available to children in learning the right attachment height of adjuncts. I suspect that the type of evidence will vary by language and construction; as a result, different adjuncts will be mastered at different ages, depending on the evidence available.[43] However, with respect to a single language and specific adjuncts in that language, we expect to find uniform development across children of a given age group.

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[42] Cinque (1990, 1999) notes that there are cross-linguistic regularities in the attachment height of various types of adverbs. For instance, manner adverbs tend to attach low in the structure, whereas speech act adverbs attach high. The exact relevance of this finding to adverbial structures (i.e., optional phrasal elements like PPs) is not completely clear; these may show some regularities as well. In any case, it would be reasonable to assume that the *relative* order of attachment has a semantic basis, whereas the *exact* attachment height must be learned from the language input.

[43] Let us consider an example independent from the topic of adjunct control. Ko (2003) theorizes that *why* and *where* clauses in Korean differ in attachment height, since they exhibit different word order permutations with negative polarity items (*why* can precede a negative polarity item but *where* cannot). Clearly, this would provide children with a source of evidence for the difference between the two adjuncts. In fact, Ko argues that children acquiring Korean represent the two adjuncts differently. She analyzed the spontaneous speech of one child from age 2;0 to 2;11 and found a significant difference in the ordering of *why* and *where* relative to NPIs. From this result, it seems that the input contained evidence regarding the difference in attachment height, and the child drew upon the evidence in structuring his/her grammar. Given that this was a study of one child, we cannot be too quick to draw conclusions from the acquisition data. However, the difference in adjunct attachment height in the adult language supports my claims regarding the variability of adjuncts within and across languages.

The next question relevant to the case at hand is whether we can predict or explain which adjuncts are likely to be incorrectly attached by the child. In fact, I believe that we can. I hypothesize that children will use the complement type that a lexical item takes as one source of evidence regarding its structural properties. However, in the present case this evidence is not definitive: temporal prepositions allow a full sentence as a complement, but true conjunctions do as well. I suggest that this might lead children to wrongly hypothesize that these lexical items all share a similar structure. More specifically, the adjuncts that are similar to true coordinate structures may be wrongly taken to be instances of conjunction.

It is an interesting and open question why children would make this error instead of the reverse one (i.e., thinking that coordinate clauses are subordinate to the first clause of the sentence). The conjoined-clause analysis of relative clauses (Tavakolian 1977) argued that children are initially unable to utilize recursive embedding in relative clauses, making high-level conjunction the only available option. This explanation is unsatisfactory in relation to the present study, however; it is not compatible with a modern theoretical conception of language and the content of UG, in which recursive embedding is hypothesized to be a fundamental and innate property. Still, a structure without embedding is in some ways simpler than one with embedding. In the terminology of the Minimalist program (Chomsky 1995, et seq.; see also Chapter 2), sentences are constructed and processed phase by phase. An embedded structure which forms a single phase is processed as a unit and must be maintained in memory in its entirety until the completion of the phase. In comparison, a structure in which the same linguistic information is separated into multiple phases is less taxing on the memory, since it will

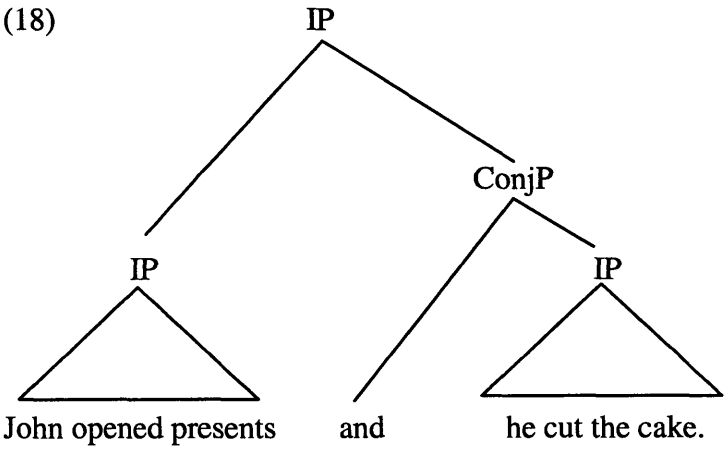
be parceled out for processing in smaller units. Subordinate and coordinate structures differ in this respect. I believe that the primacy of the coordinate structure may derive from this reduction in processing complexity. Of course, these claims are rather speculative, and subject to confirmation through experiments on language processing in adults and children.

Setting aside this issue, let us explore the adjunct-as-conjunct misanalysis further by first looking at an (adult-like) instance of coordination:

(17) John opened presents and he cut the cake.

I assume that a sentence like this, with true conjunction, has a structure like the following:

(18)



The structure of coordinated phrases is somewhat debated in the literature. For our purposes, the important features are simply the lack of c-command and dominance relations between the two conjuncts. To capture this, many linguists have argued that the second element forms a constituent with the connective, as shown above (Progovac 1998a,b).

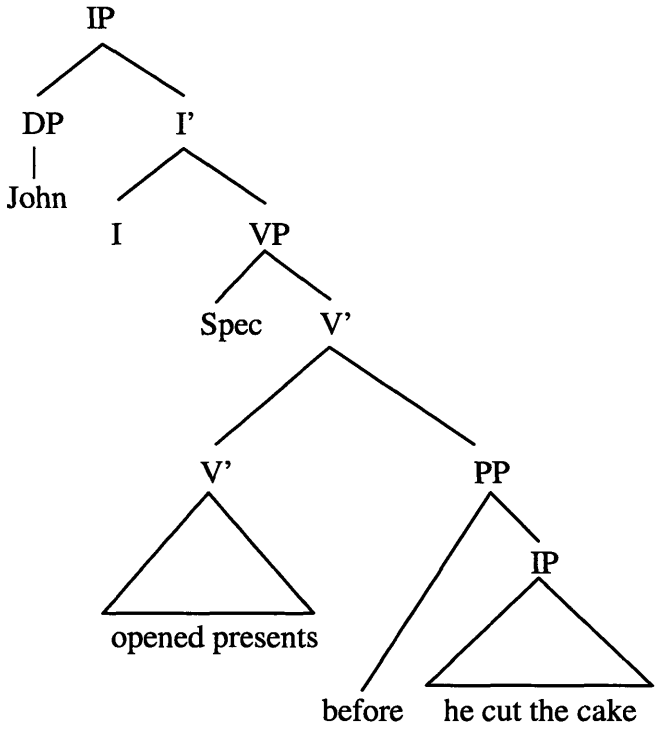
Sentences like (17/18) involve the conjunction of two IPs. Importantly, we note that the temporal adjuncts *before, after* and *while* can similarly take an IP as a complement (in addition to a gerundive with a PRO subject):

(19) a. John opened presents before/after/while PRO cutting the cake.

b. John opened presents before/after/while he cut the cake.

However, for adults, the sentences in (19) involve subordination rather than coordination:

(20)



Unlike the true coordinate structure in (18), in the adult grammar the temporal clause is contained within the VP of the main clause. There is a c-command and a dominance relation between the elements in the main clause and those in the embedded clause.

In addition to the ability to take an IP complement, there are other similarities between the true conjunctions (*and, but*) and the temporal prepositions. For instance, conjunctions can also be used with a null subject in the second conjunct:

(21) Mary opened presents and __ cut the cake.

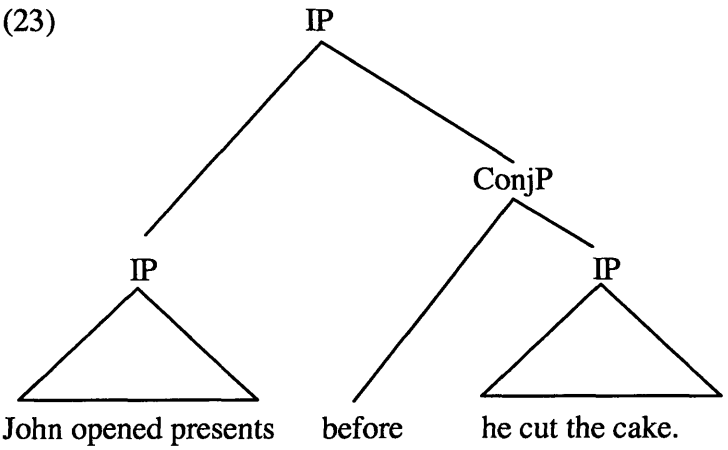
Furthermore, *before/after* and *and* pattern alike in yet another way, in that they can all take garden-variety NP complements as well:

(22) a. John ate the ice cream [and [the cake]].

b. John ate the ice cream [before [the cake]].

These two types of prepositions seem very similar as a result of the complement types they allow.[44] These facts could serve to motivate an analysis under which the two preposition types share a common syntactic structure. As a result, children may initially hypothesize that the temporal prepositions *before*, *after* and *while* act like a true conjunction by coordinating two full sentences, as follows:

(23)



Importantly, although the tree in (23) involves a misanalysis of the status of the adjunct clause, it represents a possible structure in the adult language; it does not constitute a radical departure from UG-given phrase structure. I assume that the problem the child must solve is essentially one of mapping: which prepositions conjoin clauses and which subordinate them? This will generally correlate with attachment height, although sentences like those presented above have the potential to be misleading in this respect, because (even in the adult grammar) they appear to be compatible with either analysis. Of

[44] I assume that children are able to recognize noun phrases and sentences (and, indeed, VPs and PPs) as distinct syntactic objects.

course, there are several ways in which the syntax of coordinate and subordinate clauses differ; for example, the form of the verb in the second clause and the extraction possibilities licensed in the two structures. These disparities surely factor into the child's eventual reanalysis of the temporal clauses as low-attaching adjuncts. In section 3.4.4, I will return to the issues of learnability and reanalysis in the child's grammar, and consider the sources of evidence which are available to the child in reaching the adult state.

So far we have focused on temporal adjuncts, which can take a full sentence as a complement. What about other structures, such as adjuncts headed by *without*? Under this misanalysis account, the type of complement that a preposition allows plays a major role in determining the structural analysis that the child assigns to it. The preposition *without* is more limited in its subcategorization than the temporal terms; it can take a DP complement, but not a full sentence:

(24) a. Mary cut the cake without [$_{DP}$ the knife].

b. Mary cut the cake without [$_{DP}$ PRO using the knife].

c. *Mary cut the cake without [$_{IP}$ she used the knife].

Given these distributional facts, children will not hear any input forms which seem amenable to an IP-level attachment of this adjunct. The resultant prediction is that children will not assign a conjoined clause analysis to *without* adjuncts. These should be properly embedded within the VP essentially as soon as the child has acquired the word *without*. With no misattachment of the adjunct, we expect children to be adult-like on control in *without* adjuncts very close to the age at which they show adult-like complement control, since the mechanism is the same in both cases.

In summary, the account I have presented makes the following claims:

(25) **Claims of the adjunct misanalysis account**

a. The mechanism of Obligatory Control is assumed to be innate.

b. However, the mapping of syntactic structure onto individual prepositions and conjunctions must be learned from the input; a word's subcategorization properties are central to this process.

c. Prepositions which seem to share syntactic properties with true conjunctions may be incorrectly assigned the syntax of coordination.

d. Misanalysis of this sort leads to non-adult control patterns because the structure no longer meets the requirements for obligatory control to hold. It is instead subject to discourse control.

e. Prepositional adjuncts which have been properly embedded are predicted to exhibit adult-like obligatory control from a young age.

3.4.3 A Remaining Issue: Finite vs. Nonfinite Clauses

An issue which I have yet to address is how exactly the misattachment analysis extends to nonfinite clauses. The coordinated clause misanalysis derived from the similarity between the temporal terms and the true conjunctions with respect to *finite* complements: they both can take stand-alone sentences as complements. If children are extending the misanalysis to cases in which the temporal preposition takes a gerund as a complement, it suggests they are equating the two types and assigning an IP structure to both. In fact, this seems to fit with the Cairns et al. (1994) finding that children with non-adult control in

temporal adjuncts allowed null subject, untensed clauses like *jumping the fence* to stand alone as main clauses (see footnote 38 for more discussion on this point).

In chapter 2, however, I presented evidence that the gerunds under *before, after* and *without* are DPs in the adult grammar. And yet, as discussed in that chapter, the status of the [PRO V-ing] form is somewhat uncertain in light of its distribution across different syntactic environments; it appears in positions typically limited to nominals as well as positions in which IPs but not DPs can occur. So, it seems that the null subject gerund may have a DP structure in some contexts but an IP structure in others. For this reason, it is not surprising that children may vary in how they characterize the structure. They have extended the conjoined clause misanalysis in exactly those contexts in which the status of the gerund as a DP or IP is ambiguous. Adjuncts headed by *without*, on the other hand, take only nominal complements and not finite sentential complements. Lacking evidence that *without* can take a finite IP complement, the conservative learner will not hypothesize that the nonfinite clause is an IP. Instead, the subcategorization facts support a DP analysis. So, unlike the temporal adjuncts, (24b) above does not contribute evidence motivating a conjoined clause analysis of *without* adjuncts. Again, this supports an acquisition scenario in which the properties of *without* adjuncts are mastered earlier than the properties of temporal adjuncts.

3.4.4 The Question of Learnability

When children are found to deviate from the adult grammar in some way, as in the way they interpret PRO in adjunct clauses, the question of learnability must be addressed: how is it that the child is able to converge on the adult grammar, given her initial mistake?

Information in the form of **negative evidence** – what interpretations a sentence cannot have, or explicit corrections of grammatical mistakes – is not uniformly available to all children; furthermore, when parents do offer corrections, they are nonetheless rarely used by children to adjust their grammars (Brown and Hanlon 1970; Bowerman 1988; Gleitman, Newport and Gleitman 1984; Pinker 1990). For these reasons, it is generally accepted that negative evidence does not factor into the construction of children's grammars.

I have hypothesized that children who allow non-adult control options in temporal adjuncts have done so because they have assigned a non-adult structure to the adjunct clause. But what, other than negative evidence, might trigger the necessary reanalysis? Importantly, there are several syntactic differences between coordinated and subordinated clauses in the adult grammar, all of which could serve as evidence to the child regarding the nature of temporal clauses.[45] For instance, when a temporal preposition occurs with a null subject, the embedded verb will be nonfinite; in a structure with conjoined VPs, the verb in the second conjunct is finite:

(26) a. John eats cake before opening/*opens presents

b. John eats cake and (then) opens/*opening presents

It is also possible to cleft a subordinate clause but not the second clause in a coordinate structure:

(27) a. It was before John opened presents that Mary cut the cake.

b. *It was and John opened presents that Mary cut the cake.

A number of other limitations on conjoined clauses were noted and captured by Ross (1967) with the Coordinate Structure Constraint (CSC), which states that a transformation

[45] The following list of differences was compiled from McCawley (1988).

can apply to a coordinate structure if and only if it has the same affect on all conjuncts. This does not typically hold for a subordinate clause. For instance, in yes-no question formation, the auxiliary inversion affects the tense of both clauses in a coordinate structure, but only the tense of the main clause verb if the second clause is subordinate:

(28) a. Did John open presents and (then) Mary bring/*brought out the cake?

b. Did John open presents before Mary brought/*bring out the cake?

When raising takes place in a coordinate structure, it must apply to both conjuncts (29a,b); conversely, it must apply to only the main clause when there's a subordinate clause (29c,d):

(29) a. We believe Jane to have smashed the cake and Bill to have stolen the gifts.

b. *We believe Jane to have smashed the cake and Bill stole the gifts.

c. We believe Jane to have smashed the cake before Bill stole the gifts.

d. *We believe Jane to have smashed the cake before Bill to have stolen the gifts

Also, the extraction possibilities are different in subordinate and coordinate clauses:

(30) a. *What$_i$ did you eat t_i and (then) John open presents?

b. What$_i$ did you eat t_i before John opened presents?

A wh-word can be extracted from a main clause independent from its subordinate clause, but not from only one clause in a conjunct.

To recap, the syntactic differences between subordinate and coordinate clauses are manifested in the following structures:

(31) a. The form of the verb in clauses with null subjects

b. Clefted structures

c. Two-clause yes-no questions

d. Two-clause raising structures

e. Two-clause wh-questions

All of these will provide positive input to the child regarding the differences between true coordinate clauses and subordinate ones. It seems implausible that any child's linguistic input would lack all of these constructions and therefore lack the necessary evidence for the nature of the prepositions as subordinators. However, some delay in learning the different properties of these two structures is not surprising, given that the sources of evidence may not be available to the child initially. For instance, raising structures are thought to be subject to maturational constraints (Borer and Wexler 1987; Wexler et seq.) and might not be available as a source of evidence until after age 5;0. In addition, it is conceivable that exposure to such evidence might be subject to some variation in an individual child's experience, suggesting that the duration of the misanalysis could vary from child to child. Furthermore, it does not preclude children who have never wrongly characterized temporal prepositions as conjunctions. I have argued that this is an aspect of language subject to learning rather than innate constraints; as such it seems plausible that variations in experience, attentiveness or general intelligence could influence the duration of this misanalysis in a child's grammar.[46]

Finally, we note that a subordinate clause can be preposed to leftmost position, but the second clause in a coordinate structure cannot:

[46] One of the goals of Chapter 4 is to find experimental evidence of adjunct misattachment. This should provide more information regarding the duration and prevalence of misanalysis in a group of children aged 3 to 6.

(32) a. Before John opened presents, Mary cut the cake.

b. *And John opened presents, Mary cut the cake.

Sentences like (32a) are clearly grammatical for adults; yet we predict that they are ungrammatical for a child who has misanalyzed the temporal clause as a conjunct; they should be equivalent to a fronted *and*-clause as in (32b). It is suggestive, then, that the Lust et al. (1986) study mentioned earlier found that children had greater difficulty with fronted *when* clauses than in-situ ones. Additionally, Goodluck (1987) found that children chose (ungrammatical) sentence-external reference of PRO more often in fronted adjuncts in comparison to clause-final ones. When children are faced with (what they think is) an ungrammatical sentence in an experimental setting, they tend to exhibit problems in interpreting and imitating the ungrammatical forms. This is exactly what was found in these two studies for pre-posed temporal adjuncts.

However, perhaps we should not be too quick to label the fronted temporal clauses as ungrammatical under the conjoined clause analysis. It is worth noting that child speech often contains utterances beginning with the connective *and*. This may indicate a stage during which children are unsure about the properties of conjoined clauses, and may incorrectly believe that the second conjunct can in fact be fronted. Using the CHILDES database (MacWhinney 2000), I conducted a search of three children's spontaneous speech at ages 3;1 and 4;0, and identified all of their uses of *and* in these files. The goal was to investigate a small sample of speech to determine whether the children produced what appeared to be a genuine fronted *and*-clause. The search revealed the following patterns. In the chart below, I provide the total number of times the child used *and*, in addition to the percentage of these which were utterance-initial:

(33) Table 3.2: Use of *and* at age 3;1 and 4;0

Child	**Age 3;1**		**Age 4;0**	
	Total *and*	Utterance-initial *and*	Total *and*	Utterance-initial *and*
Sarah[a]	1	1	19	14
Adam[a]	8	4	24	16
Abe[b]	25	7	35	11
TOTAL	34	12	78	41

[a]Brown (1973); [b]Kuczaj (1977)

Clearly, the usage of *and* overall, not to mention in utterance-initial position, varies a great deal depending on the child. (A larger sample size would ideally permit more robust generalizations). Many instances of utterance-initial *and* in these transcripts could be considered continuations of the child's previous utterance, and are therefore not truly utterance-initial, as in the following exchange between Adam (age 4;0) and his mother:

(34) *MOT: how d(o) you do it?
*CHI: see how you do it?
*CHI: turn it around and den [: then] hold it.
*MOT: what do I turn around?
***CHI: and den [: then] let it go.**

To some extent, these usages are non-adult in that they do not exactly fit the normal adult patterns of turn-taking, a matter of conversational pragmatics. However, they are not ungrammatical in the way that a true fronted conjunct is, as in (32b). A few instances, however, may indicate a genuine usage of a fronted *and*-clause. Consider especially the bolded portion in the following exchange between Abe (age 3;1) and his father:

(35) *CHI: can I have a cookie ?
*FAT: if you pick your cornbread up .
*CHI: ok cornbread **and throw it in the garbage find me a garbage**.

Overall, there are too few cases like this to be sure that the structure is in fact licensed by the child's grammar. But the variation exemplified here seems to indicate that some aspects of conjunction are governed by a gradual learning process rather than an innately specified constraint. Children who have not yet determined the exact properties of conjunction might vary in allowing or disallowing fronted clauses. The implication here is that a child who has misanalyzed a temporal adjunct as a conjoined clause might nonetheless not treat a fronted clause as ungrammatical.

In the following section, I discuss the main predictions of this account.

3.4.5 Predictions of the Account

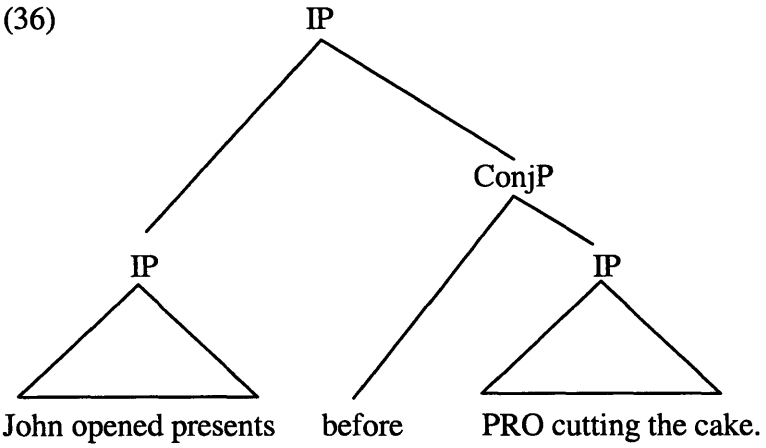
3.4.5.1 The Affect of Misanalysis on Control

In chapter 2 we learned that control for adults is not a uniform phenomenon: sometimes it is regulated by a structural mechanism, and sometimes it is dependent on features of the discourse. The dividing line between structural and discourse control depends on the accessibility of PRO within a phase: structural control obtains only when an Agree relation can be implemented with the null subject. It happens that this correlates with attachment height in adjuncts: An adjunct which attaches sufficiently low in the structure is accessible for structural control, leading to the familiar obligatory subject control pattern. An adjunct which is attached high up in the structure will be inaccessible to structural control because of intervening phase boundaries and the lack of c-command, a necessary component of Agree. In structures like this (for instance, absolutive adjuncts), rather than rule out the occurrence of a null subject, the grammar provides another mechanism of interpretation based on discourse properties. The null subject is oriented to

the topic of the sentence, which is identified through a metric evaluating the structural position and information status of the nouns in the sentence.

Precisely because of the relationship between structural control and phase boundaries, the misattachment of a nonfinite adjunct has the effect of changing its control properties: it no longer fits the conditions for structural control. Consider the structure given previously in (25), and repeated below:

(36)



I assume that this is approximately the structure which children assign to sentences containing a temporal adjunct, if they have wrongly categorized it as a conjoined structure. Even without considering the internal structure of the main clause, we know that as a complete sentence it will constitute its own syntactic phase. Hence, Agree will not be able to hold between an element inside it and an element in the "adjunct." Instead, the structure meets the adult conditions for discourse control.

As we established previously, this account predicts that the temporal prepositions but not *without* may be incorrectly analyzed as lexical items which conjoin clauses at a high level. Because of the complement types that each preposition takes, children are expected to assign this misanalysis to *before, after* and *while* but not *without*. We therefore expect that adult-like performance on control in *without* adjuncts should emerge very close to the age at which we observe adult-like complement control. Not so for temporal adjuncts, which we know already are delayed (see previous references).

In a sense, children who have misanalyzed temporal adjuncts as conjuncts are still following the adult control pattern: they are treating the misattached temporal adjuncts as domains for non-obligatory control, as would adults if the adjuncts actually attached very high in the structure. Hence, it is appropriate for them to consult the discourse context in finding a referent for PRO. Given these considerations, we can better understand the Lust et al. (1986) finding mentioned in section 3.1, namely, that children in this study allowed a pragmatic lead to influence their choice of referent in non-finite *when*-clauses.[47]

Of course, it is still possible that children have not implemented discourse control according to the adult-like principles. The structural account of adjunct misattachment that I have set forth does not provide a prediction regarding the nature of non-obligatory control in child grammar; it merely allows us to delineate the domains in which OC and NOC should apply for the child. We will return to the issue of discourse-governed control in section 3.5.

[47] By comparison, Cohen Sherman and Lust (1993) found that children did not consult the context when interpreting PRO in verbal complements. As these are obligatory control structures, it was appropriate to not let the context influence controller choice.

3.4.5.2 Predictions Beyond the Domain of Control

The effects of adjunct misattachment should extend outside of the domain of control as well. As was already discussed, for adults a subordinate clause but not a conjoined one can be untensed. If children are in fact equating temporal adjuncts and conjoined clauses, it means that they are allowing an untensed clause in a coordinate structure. This suggests that they have not yet mastered all the properties of conjoined clauses. Indeed, the results of McDaniel et al. (1994) provide direct evidence for this: the nine children who showed liberal control in adjuncts also judged sentences with non-adult coordinate clauses to be grammatical, as in *The pig hugs the sheep and __ jump into the water.* For an adult, the second clause should contain a tensed verb.[48]

In addition, any grammatical relation which is dependent upon a c-command relationship (or lack thereof) between the main clause and the temporal adjunct will be affected by misattachment. The interpretation of pronouns and referring expressions is a prime example, because binding is dependent upon c-command. Consider, for instance, Principle C of Binding Theory:

(37) Principle C: All r-expressions must be free (i.e., not bound)

A binds B if A and B are coindexed and A c-commands B

This constraint rules out coreference in sentences like the following:

(38) a. $He_{*i/k}$ ate a snack after the $clown_i$ went for a boat ride.

b. $He_{*i/k}$ found the pig while the $farmer_i$ was up in the tree.

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[48] Again (cf. footnote 7), the children who allowed this structure nonetheless ruled out a null subject with a tensed verb, as in *__ *was jumping over the fence.* This fits with the Lust et al. (1986) and Cohen Sherman and Lust (1993) evidence that children know the correlation between null subjects and nonfinite tense.

Adults must interpret the pronouns in (38) deictically; that is, the pronouns must pick up their reference from the context in which the sentence is uttered.[49] In the adult structure, the adjuncts are subordinate to the main clause and there is a c-command relation between the pronouns and the full DPs. By Principle C, the r-expressions must be free and so it is not possible to get a reading in which the pronouns bind them. However, if the adjunct is misattached such that it is outside the c-command domain of the main clause subject, we expect that coreference is possible. So, the misattachment account predicts that children may allow interpretations which are ruled out by Principle C for an adult.

We want to be sure that children who appear adult-like and rule out coreference in sentences like (38) are doing so because of Principle C and not because of a dispreference for having the pronoun precede its referent. Early research on binding in child language found evidence that children exhibit a general dispreference for backward anaphora, even when it is grammatical in the adult grammar (Tavakolian 1977; Lust, Loveland and Kornet 1980). However, Principle C is *structure-dependent*: it refers to the hierarchical structure of the sentence rather than the linear order of its elements. For this reason, sentences with grammatical backward anaphora as in (39) were included in the study:

(39) a. While $she_{i/j}$ was riding in the boat, the $princess_i$ found a turtle.

b. After $he_{i/j}$ went for a ride, the $king_i$ bought the magic carpet.

If children accept coreference in (39) but not (38), we can conclude that they are doing so because of P(C) rather than a linear constraint. Furthermore, the sentences in (38) are unambiguous for adults whereas the ones in (39) are ambiguous: in the former, the

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[49] Although, Heim (1998) and others have argued that coreference can be established through pragmatic considerations in addition to syntactic binding. Under certain circumstances, intra-sentential coreference will be possible in cases where binding is ruled out by Principles B and C. This will be explored further when the data on this experiment is presented in Chapter 4.

pronouns can only be interpreted deictically; in the latter, they can receive either a bound or deictic interpretation. We wish to determine whether this pattern holds for children as well.

In order to better define the expectations we might have of children's performance on these structures, I will first review some previous findings. Prior acquisition studies on this age group (3 to 6) have found somewhat mixed results on sentences governed by Principle C. Lust, Eisele and Mazuka (1992) found that children rejected backward anaphora more often when Principle C was violated (68%) than when it wasn't (43%), although clearly the 68% is considerably below adult-like performance. Grimshaw and Rosen (1990) found 37% acceptance of illicit coreference in P(C) contexts. However, several studies using Truth Value Judgment tasks have found 85-90% rejection of principle C violations in various structures (Conroy and Thornton 2005, Crain and McKee 1985, Crain and Thornton 1998, Thornton 1990).

Based on these studies, we predict (somewhat tentatively) that children will not readily accept Principle C violations. We expect that a child will only allow an apparent violation of the principle if he has built up the structure such that the principle does not rule out coreference. As we have already noted, adjunct misattachment removes the c-command relation which would otherwise hold between a main clause and an adjunct. A pronoun in the main clause and an r-expression in the adjunct could be coreferential for the non-adult child; this would not constitute a violation of Principle C, because there is no c-command relation and therefore the r-expression is not actually bound. In other words, we expect that children who allow Principle C violations are doing so because of adjunct misattachment. However, it could turn out that there is some additional factor at

work in the Principle C cases, so this claim is somewhat provisional (consider for example the well-known delay of Principle B effect (Chien and Wexler 1990, Grimshaw and Rosen, 1990; Grodzinsky and Reinhart 1993); we will return to this issue in the next chapter. The relevant point is that we do not necessarily expect an *exact* match between control structures and Principle C-governed structures.

Abstracting away from this, we can still make a confident prediction regarding the correlation between the two structure types. The account I have presented argues that non-adult control is wholly due to adjunct misanalysis. Given this hypothesis, we do not expect to find any children who simultaneously exhibit non-adult control and adult-like Principle C. This would be something of a contradiction: the non-adult control patterns would indicate that the adjunct has not been embedded properly inside the VP, but the adult-like rejection of backward binding would indicate that the adjunct is c-commanded by the main clause subject. Conversely, a result of the sort mentioned previously (adult control but non-adult Principle C) is still possible under this analysis, albeit due to other factors.

To summarize, the account I presented here makes the following predictions:

(40) **Predictions of the adjunct misanalysis account**

a. Adult-like control in adjuncts headed by *without* will emerge very close to the age at which adult-like complement control emerges.

b. Adult-like control in adjuncts headed by *before, after* and *while* will show gradual development in the 3;0-5;0 age range.

c. Any child who allows overly liberal control in temporal adjuncts will allow apparent Principle C violations as well.

These predictions were tested in a series of experiments which will be described in Chapter 4. Before turning to this, I address one remaining issue: the status of non-obligatory control structures in child language – structures in which the interpretation of PRO is sensitive to discourse features. The following section discusses the status of discourse control in child language and offers some additional predictions to be tested in Chapter 4.

3.5 The Acquisition of Discourse Control

3.5.1 Review: Discourse Control in Adult Grammar

Let us return to the question of discourse control. These are sentences in which the structural control relation is not possible. Adults will interpret PRO in discourse cases as referring to the topic of the sentence. To recap, the topic of the sentence is selected according to the following metric (see Chapter 2; cf. Reinhart 1983):

(41) Topic Selection Function

1. Select $<\alpha_i, P>$ if α_i is already in the context set
2. If more than one pair, or no pair, is selected by 1, select the NP highest in the following accessibility hierarchy: (where [±H] = [±Human])
   [+H] subject > [+H] direct object > [-H] subj. > [-H] direct obj. > indirect obj.

Some examples of discourse control structures are gerundive subjects (a) and absolutive adjuncts (b):

(42) a. PRO Racing the unicorn made Shrek nervous.

b. PRO Lifting the table, Care Bear found the cat.

In such structures, there is no c-command relation between PRO and the T-Agr node of the main clause; this holds true even if the absolutive adjunct is reconstructed to a clause-

final position, because it attaches very high in the structure. For this reason, structural control is not available. Adults will require that the controller for PRO in these sentences be the character who is mentioned in the sentence – the object in (a) and the subject of the main clause in (b). However, in these cases it is actually the topic metric which selects the controller, and not the structural Agree relation.

We are interested in discovering whether children are adult-like in implementing topic control, and whether their interpretations of PRO in these cases and in temporal adjuncts are similar, as the misanalysis account suggests they will be.

3.5.2 Relevance to the Adjunct Misanalysis Account

The account I presented in section 3.4 argues that the misattachment of a temporal adjunct serves to remove it from the domain of structural control. In the adult grammar, adjuncts in the structurally higher position are instead subject to the topic control rule. If this is accurate, we expect children's control judgments to be similar in temporal adjuncts and true discourse control domains. So, we should determine whether children have correctly implemented the adult-like discourse control rule in these cases. Let us look more closely at the data from temporal adjuncts as a starting point.

I focus here on the Broihier and Wexler (1995) study because it has provided evidence of children accepting the widest range of interpretations of PRO – namely, subject, object and the external or 'free' control.[50] This study used test sentences of the form in (43), either with or without an animate NP in object position:

[50] Act-out tasks tend to find that children *prefer* a sentence-internal referent, although this does not necessarily tell us whether their grammar would have *allowed* some other available discourse referent to serve as controller. In a study on PRO and pronouns in *when* clauses, Lust et al. (1986) found that children chose a sentence-external referent only 2% of the time. However, this study utilized pragmatic contexts

(43) a. Bert scratched Wonder Woman before PRO drinking a gulp of water.

b. Gonzo splashed the seaweed before PRO riding the surfboard.

The characters mentioned in the sentence were all introduced in a preceding discourse. According to the selection function given above, for adults the topic will be the NP which is both familiar in the context and highest on the accessibility hierarchy. As the reader can confirm, in both of these sentences the subject NP fits these requirements and therefore should be selected as the topic. And yet, this study reports that several children allowed PRO to refer to the object of the main clause or even some character not mentioned in the sentence. Clearly, children are allowing interpretations are inconsistent with the topic control rule. However, I hypothesized that children are treating temporal adjuncts as discourse control domains; if this is so, why are they not following the adult discourse control rule?

Let us turn to true discourse control contexts – cases in which the adult grammar specifies control by sentence topic. It appears that children are non-adult in actual discourse control contexts in the same way that they are in temporal adjuncts. Tavakolian (1977) used an act-out task to test children aged 3 to 5 on sentences with infinitival subjects, as in (44):

(44) a. {PRO, For him} to kiss the sheep would make the duck happy.

She found that children actually preferred to assign a sentence-external referent to both types of pro-forms in the subject, choosing some unmentioned character about 60% of the time. This is somewhat surprising in light of the tendency for children to choose

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which supported the subject or object as referent, which may have additionally suppressed external coreference interpretations.

sentence-internal referents in an act-out task. It suggests that children's grammars genuinely do not limit the referent for either PRO or pronouns in this position.

Goodluck (1987) also tested children on sentences like these, in the interest of comparing their interpretations of PRO and pronouns. She used an act-out task as well, and tested 12 children aged 5;0-5;11 and 12 aged 6;0-6;11. The sentence types which are relevant to the discussion at hand were the following:

(45) a. Infinitival subject: PRO to jump quickly over the fence scares the pirate.

b. Gerundive subject: PRO jumping quickly over the fence scares the pirate.

Goodluck reports the mean percentage of sentence-internal responses in the two age groups. In these sentences, there is only one potential sentence-internal referent, so these percentages indicate percent adult-like. The results are given below:

(46) Table 3.3: Percent sentence-internal reference judgments – Goodluck (1987)

Structure Type	5-year-olds	6-year-olds
45a: infinitival subject	39	11
45b: gerundive subject	36	17

Strangely, Goodluck observed a drop in performance from the younger to the older age group. She reports that this trend was not significant, although the statistical values are not given.[51] Overall, the children are exhibiting very low performance on these structures. This suggests that they are actually following some strategy or preference which is contrary to the internal-reference constraint of the adult grammar.

[51] Goodluck reports that three of the 5-year-old subjects were adult-like in consistently choosing internal reference, whereas none of the 6-year-olds showed such a trend; this is the root of the difference in the means shown above.

One possible concern with this task is that the sentences contained non-action verbs in the main clause, and yet children were asked to act out the sentences. It is certainly plausible that children would have found it difficult or confusing to show that a doll was scared, bothered, happy, etc., although this may or may not have influenced their choice of referent. Confirmation of these findings using a different testing methodology will increase our confidence in the patterns. As such, sentences with gerundive subjects were included in the experiments described in chapter 4. An additional discourse control structure was tested as well – absolutive adjuncts. To my knowledge, these have not been tested in young children previously.

3.5.3 Hypothesis on Discourse Delay

Descriptively, children allow PRO in discourse control contexts to pick up its reference freely, much like a pronoun, rather than limiting its reference to the topic of the sentence. We are left with the question of why they allow this overly broad range of interpretations. One possibility is that children have not yet discovered that topicality is relevant to discourse-controlled PRO. If this is the case, however, they seem to face the subset problem in adjusting their grammar (Angluin 1980; Baker 1979; Crain and Thornton 1998): how can they learn (without negative evidence) that the licensing conditions are more narrow for PRO than for pronouns?

Let me offer a different speculation, based on the way that a child might identify the topic: the problem could derive from an immaturity regarding the difference between sentence-level and discourse-level topics. Within a discourse, there is often more than one referent which could reasonably be considered the topic (indeed, the discourse topic

may shift over the course of the dialogue). In contrast, adults typically identify a single NP as the local topic in an individual sentence. If children have not mastered the properties of discourse-level and sentence-level topics, this could lead to a result that is different from adults when implementing the topic metric.

We should recall that the testing materials used in Broihier and Wexler (1995), which elicited both object and external control, always contained more than one salient individual who was mentioned repeatedly in the story that served as the context for the test sentence. This was done on purpose, to ensure that multiple possible referents for PRO were accessible to the child, in case his grammar allowed the option of choosing a sentence-external controller. So, although (for adults) the test sentence has an unambiguous topic and hence an unambiguous controller for PRO, the discourse in which the test sentence was embedded had multiple candidates with topic-worthy characteristics (repeated mention and pronominalization, "aboutness," etc.). A child who equates sentence-level topics with discourse-level topics could certainly vary in choosing among the available discourse referents as the controller, since no single referent will stick out as the most salient in the story. Furthermore, children may be unable to accommodate a switch in sentence-level topic when the context has established a different referent as the discourse-level topic. This might explain why children allow a pragmatic lead to influence their choice of controller in these structures (cf. Lust et al. 1986).

This explanation for non-adult discourse control seems to be the most theoretically viable thus far, in that it provides a reasonable explanation for the delay in control as well as a potential acquisition path. Let us go back to the work of Reinhart (1983) to see how this is so. Reinhart suggests that the difference between discourse-level

and sentence-level topics is not only psychologically real, but also relevant to the way in which we understand and deal with violations of conversational implicatures (Grice 1975). In explaining this, she draws on Grice's well-known example of a person who violates the principle of relevance when writing a letter of recommendation for, e.g., a student. We assume that the request for a recommendation of this sort sets the discourse topic to be the student's scholarly ability, although any given sentence in the letter may have as its local topic the individual himself (a Mr. Morgan, in her example that I repeat below). Consider first (47) as a possible sentence in the recommendation letter:

(47) Mr. Morgan is a careful researcher and a knowledgeable semanticist, but his originality leaves something to be desired.

Clearly, this response provides information that directly addresses the discourse topic (Mr. Morgan's scholarly ability), although this is achieved using Mr. Morgan himself as the sentence-level topic. Not so in (48), on the other hand:

(48) Mr. Morgan has clear handwriting and he is punctual.

In this case, as before, the sentence-level topic is appropriate; but now, the discourse-level topic is not, since it does not provide information which is relevant to evaluating the individual's scholarly achievements. As such it is a violation of the conversational principle of relevance. Adults are able to accommodate such violations by assuming that it *is* relevant in some way to the discourse context: they will interpret it to mean that the recommender had nothing positive to assert about Mr. Morgan's scholarship. Now consider (49):

(49) My Aunt Rosa has clear handwriting/is a careful researcher.

This sentence is inappropriate in terms of both the sentence-level and discourse-level topics which are implicit in the request for a recommendation. Importantly, as Reinhart points out, "with respect to the discourse topic, the answers in both [(48) and (49)] are equally irrelevant" (p. 55). And yet, the former but not the latter can be understood as relevant in this context. Put another way, there is no implicature which will allow the reader to accommodate the violation in (49).

To summarize the point of this discussion, adult speakers are able to productively accommodate violations of discourse-level topics but not sentence-level topics by relying on conversational implicature. This fact could provide positive evidence to a learner regarding the distinction between the two types of topics. However, children are often thought to be insensitive to pragmatic features of language (Chierchia et al. 2001; Gualmini et al. 2001; Noveck 2001). Without a mature understanding of conversational implicature, the evidence regarding the difference between sentence and discourse topics might be unavailable. If this piece of the puzzle is missing, children's control judgments in discourse contexts will be affected. However, it is not clear whether we can predict a timeline of development on discourse control, since research on children's understanding of implicature is still in its early stages.

Additionally, egocentrism may be a factor here.[52] Children often do not have an adult-like understanding of the differences between their view of a conversational discourse and that of their interlocutor (Karmiloff-Smith 1981; Maratsos 1976). Even if a child has mastered the pragmatic knowledge necessary to distinguishing between discourse and sentence topics, she may be unable to accommodate a shift in topic once she has focused on some other character. In the adult topic metric, the salience of an NP

[52] Thanks to Andrea Gualmini for suggesting this.

is certainly relevant: an NP which has been established in the discourse will be preferentially selected as the topic. If a child has selectively attended to one particular referent, the salience of this character in his mind could lead him to choose it as the topic without regard for the attention or intention of the conversational partner. Both of these factors could contribute to non-adult discourse control.

Based on these hypotheses, I offer the following predictions:

(50) **Predictions on discourse control**

a. Adult-like structural control will develop before adult-like discourse control.

b. Non-adult control patterns in discourse contexts will persist well into childhood.

c. Development in this domain might correlate with development in socio-linguistic interaction or adult-like knowledge of conversational implicature.

Although it is beyond the scope of this study to examine (47c), the experiments in Chapter 4 will allow a comparison between structural and discourse control domains.

3.5.4 Further Discussion: Non-licensed Anaphora in Child and Adult Grammar

Abstracting away from these issues, it is an interesting (and open) question why children allow any interpretive option in the discourse cases. For instance, it would be a conceivable situation for children to instead reject any sentence in which PRO does not have a syntactically available controller. A similar question could be posed for non-syntactically-licensed anaphora in adult grammar: how come these structures are interpreted via reference to discourse considerations rather than being outright ungrammatical? For reflexives and pronouns, it seems that we have an answer of sorts:

the principles regulating coreference can be formulated such that they apply only within a certain domain. Consider, for instance, the formulation given by Reinhart and Reuland (1993), which focuses on the nature of the predicate in a sentence:

(51) Definitions

a. A predicate is *reflexive* if and only if two of its arguments are coindexed.

b. A predicate (formed of P) is *reflexive-marked* if and only if either P is lexically reflexive or one of P's arguments is a SELF-anaphor.

Condition A: A reflexive-marked predicate is reflexive

Condition B: A reflexive predicate is reflexive-marked

(R&R 1993, p. 670-71)

This version of the binding principles is able to account for the fact that pronouns and reflexives are not always in complementary distribution (a fact which is problematic and unexpected under standard binding theory). It dictates that they are complementary only when they appear within the subcategorized arguments of a predicate – i.e., a given predicate either requires the use of anaphors or disallows it. Outside of this domain – for instance, in adjuncts – the principles have nothing to say about the distribution of so-called *exempt anaphors* (Pollard and Sag, 1992; Reuland and Everaert, 2001). Logophoric anaphora and PRO in discourse control contexts both seem to fit this category: they are elements which are governed by syntactic constraints when they fall within a certain domain, but outside that domain, their distribution is governed by some discourse consideration instead.

Interestingly, it seems to be cross-linguistically common that discourse properties are used to interpret anaphora in the absence of syntactic rules (Landau, 2000; Koster

and Reuland, 1991). By some mechanism, speakers converge on a strategy for interpreting anaphors that fall outside the domain of the binding principles. I suggest that a parallel situation holds for the grammar of control. In each of the cases I have identified (logophoric anaphora and topic-controlled PRO), the non-licensed element is oriented toward an NP in the sentence whose discourse properties make it prominent or highly salient.

We seem to have evidence that children do not correctly implement the adult-like discourse control rule. As an aspect of grammar requiring reference to properties of the discourse, it is not surprising that children would be delayed in this domain. We have seen that when children interpret PRO via the syntactic relation of Agree, they are adult-like. This strongly suggests that children recognize the anaphoric nature of AGR and its need to have its features identified. When the syntax does not provide a means for identifying the features, however, they have difficulty. A straightforward, parsimonious account for this finding is that speakers are not "told" (by UG or the syntax of their language) exactly which discourse properties are relevant to the interpretation of anaphoric Agr when it's not syntactically licensed. Rather, they must learn this from the input.

This explanation concords with other findings on anaphora in child language cross-linguistically. In Icelandic, for instance, anaphors can appear in certain structures with a long-distance binder. In these cases, the referent of the anaphor must be appropriate as the logophoric center of the sentence. Sigurjónsdottir and Hyams (1992) demonstrated that Icelandic children were mostly adult-like on anaphora subject to the syntactic binding principles, whereas they were more delayed on these long-distance,

logophoric anaphora. Similarly, Avrutin and Cunningham (1997) showed that English-speaking children made more errors interpreting reflexives which relied on discourse-based knowledge. Compare, for instance, (52a) and (52b); the coreference judgments given correspond to the adult interpretations:

(52) a. The man$_i$ near the boy$_k$ is washing himself$_{i/*k}$.

b. The man$_i$ near the boy$_k$ hid a book behind himself$_{i/*k}$.

In the first case, the reflexive is an argument of the predicate and hence governed by syntactic binding principles. In the latter case the reflexive is in a PP adjunct, i.e., it is not an argument of the predicate and requires consideration of logophoricity for interpretation. Avrutin and Cunningham found that children made more errors on the logophoric case than the structural case.

These and other such studies, regarding children's understanding of pragmatically-determined features of language, provide the backdrop for our investigation of discourse-governed control. In the following chapter, I will present an experiment which directly investigates this phenomenon in young children.

3.6 Final Remarks

This chapter focused on the development of a theory to explain child delays on adjunct control. I evaluated some prior research on this phenomenon, focusing specifically on the nominalization hypothesis of Wexler (1992) and the misattachment hypothesis advocated in Hsu et. al. (1985), McDaniel et al. (1991) Cairns et al. (1994), among others. Ultimately I argued for an account which was similar in some ways to the misattachment hypothesis, but which began with a stronger theoretical basis in terms of the adult

grammar of control. My goal was to utilize theoretical work on control to improve our understanding of the child errors. In the adult grammar, the attachment height of an adjunct is crucial to determining whether syntactic or discourse control will obtain. I hypothesized that, even if the control principles are innate, a child might show non-adult behavior if the adjunct clause had not been embedded in an adult-like manner. I offered some hypotheses regarding which adjuncts are likely to be erroneously attached and which will be properly embedded from a young age. The embedded adjuncts will show adult-like control, while the misattached ones will exhibit delays.

These different theories of the child errors make different predictions regarding various adjunct structures. As a test of the competing theories, the first experiment I present in Chapter 4 provides data on control into adjuncts headed by *without* and *while*. Wexler's nominalization hypothesis predicts that children will succeed earlier on these two types in comparison to the other temporal adjuncts. In contrast, the misattachment account that I argued for predicts that *while* will pattern with the temporal adjuncts, whereas control into *without* adjuncts will not be similarly delayed.

The second experiment presented in Chapter 4 seeks to find positive evidence of adjunct misattachment. Misattachment should be evident in non-control structures as well, because it changes the c-command relation between the main clause and the adjunct. Since the interpretation of pronouns and referring expressions is sensitive to c-command, it will be used as a diagnostic of adjunct misattachment. Children who have misattached an adjunct clause should allow interpretations of pronouns which adults disallow because of Principle C. For the child, the interpretation will not be a Principle C violation, because no c-command will exist between the main clause and the adjunct.

Finally, the third experiment tests children on structures which actually fall under the domain of discourse control for adults. The purpose of this was to determine, separately from the structural control cases, whether children in the 3;0-6;0 age range have adult-like knowledge of the discourse properties governing PRO in non-obligatory control cases. Their performance on these structures can then be compared to the case of temporal adjuncts, which were thought to be mistakenly treated as instances of discourse control. More specifically, we are interested in learning whether children are overly liberal in their interpretation of PRO in true discourse contexts, as they are in the temporal adjuncts. In the adult discourse cases, PRO looks to the sentence topic for reference. Children in previous studies, however, permitted a sentence-external character to serve as the referent of PRO in temporal adjuncts. This is not in compliance with the adult topic rule. I suggested that a viable hypothesis explaining this pattern is that children are conflating discourse topics and sentence topics. Topicality can vary somewhat more at the discourse level in comparison with the sentence level, which leads to the broader control possibilities for children. I suggested that there is positive evidence available to the child which will lead them to the adult grammar (i.e., a distinction between types of topics), however the evidence largely derives from the principles of conversational pragmatics. For this reason, it is not surprising that adult-like discourse control is delayed until relatively late in childhood.

With this theoretical framework in place, we will now examine the experimental evidence in support of the adjunct misanalysis account. This will be investigated in the following chapter.

Chapter 4: Experimental Studies

4.1 Introduction

In this chapter, I present the experimental studies I conducted as a test of the adjunct misanalysis account which was argued for in the previous chapter. Three experiments were conducted, using a Truth Value Judgment Task (Crain and McKee 1985). The choice of methodology will be discussed and motivated in section 4.2. The first experiment, presented in section 4.3, tests the hypothesis that children will be able to implement adult-like discourse control in adjuncts headed by *without*, but not those headed by a temporal preposition. The second experiment tests the hypothesis that non-adult behavior in temporal adjuncts is due to misattachment of the adjunct clause, using pronoun interpretation as a diagnostic (section 4.4). The third experiment (section 4.5) tests the hypothesis that children are equating the temporal adjuncts with discourse control domains, by comparing their interpretation of PRO in structures which are subject to discourse control in the adult grammar. The results of each experiment will be presented and discussed in turn.

4.2 Methodological Design

The three experiments presented here utilized a Truth Value Judgment Task methodology (TVJT: Crain and McKee, 1985). The TVJ task is designed to determine whether children assign the same interpretations to sentences that adults do. More generally, it allows us to probe what interpretations children will allow a sentence to have. We control the context in which a test sentence is uttered, by supplying a short narrative (acted out

with props and toys) to situate the test sentence. The context can be set up such that some interpretation ruled out by the adult grammar is actually true in the story. The goal is to ascertain whether the child differs from the adult in the truth value she assigns to the sentence. We wish to determine whether she will accept the true but ungrammatical reading, or reject the sentence as false as an adult would.

It has been noted that children often exhibit a bias to provide a 'yes' answer – i.e., they try to interpret the statement in such a way that makes it true in the given context, as long as this is not in competition with their grammar (Crain and Thornton, 1998; Grimshaw and Rosen 1990). This is why it is often best to make the non-adult reading true in the context: if the child is able to assign the illicit interpretation to the test sentence, we have increased the chances of finding this out. Similarly, by requiring the child to answer *no* to show his adult-like knowledge, we are seeking to find the surest evidence that he is truly adult-like in his interpretation of the test structure.[53] Clearly, this paradigm should prove useful in the present situation: we want to see if children will allow interpretations of adjunct PRO that adults would not accept. If these structures fall under the domain of discourse control for the child, then a wider range of controllers will be permitted.

The testing procedure is as follows. Two experimenters participate in each testing session (generally playing the same role in each session). One narrates the story according to a pre-written script while acting it out with toys and props.[54] The other experimenter plays the role of a puppet (in my studies, Kermit the Frog) who watches the

[53] However, some of the contexts used in these experiments made the test sentences true under the adult reading – i.e., they were designed to elicit a *yes* answer from adults. This will be specified in the Materials section for each experiment.
[54] Efforts were made to have the length and complexity of each story vary minimally.

story with the child. Following each story, Kermit is asked to tell us something that happened in the story; his utterance is the test sentence. The test sentence was uttered twice to ensure that the child heard and attended to it. The child is asked to help out by telling Kermit whether he was right or wrong about what happened, so we can tell whether Kermit was paying attention. She is told to reward Kermit with a treat (here, a plastic strawberry or donut) when he's right, or feed him some peas, to help him get smarter, if he was wrong. The actual goal of having the child judge Kermit's sentence is to determine what interpretation the child assigned to it. This approach has a few advantages over an act-out task: first, we are able to control the context in which the sentence is uttered. This allows us to determine whether a certain interpretation is available in the child's grammar even if it is not the preferred interpretation that is expressed when the child is asked to act out a sentence. In addition, this task reduces the pressure a child may feel by being put on the spot or asked to perform in some way. Kermit is the one who can be right or wrong, not the child. This will ideally lead to a more accurate demonstration of her linguistic competence.

Another advantage of the TVJ methodology is that it allows the experimenter to probe a child's knowledge beyond just eliciting a yes/no answer. When the child responds that what Kermit said about the story is wrong, the experimenter asks, *Why was he wrong? What really happened?* Although some of the youngest subjects (3;0 – 3;9) might not able to justify their responses, the comments from the older subjects are often very revealing. The child can truly demonstrate their adult-like knowledge, sometimes even to the extent of using the test construction in their justification. Or conversely, their comment may clearly indicate a non-adult interpretation of the test sentence. These

justifications were analyzed and compared to the children's *yes/no* answers to ensure that they matched in content. Answers which were unscorable or unclear were discarded (although this was rarely necessary).

The youngest subjects (mostly in the 3-year-old age group) were often not able to provide adult-like justifications, even when they were confident in giving *yes* vs. *no* answers. For this reason, an inability to justify *no* answers was not uniformly grounds for a child's data being discounted from the analysis. When prompted to explain "what really happened," some of these children would simply recite back all the events of the story. After each testing session, the two experimenters would discuss these cases and reach a consensus about how to interpret the child's responses. For instance, we would evaluate whether the child was attentive to the task, and whether or not his responses seemed to fit under a non-linguistic strategy such as always saying *yes* or *no*. If a child answered *yes* or *no* to every test item including fillers, his/her data was not included in the analysis.

4.3 Experiment 1: *without, while, after*

4.3.1 Hypotheses and Predictions

The goal of this experiment was to compare children's performance on control in *after* adjuncts, known to be problematic, with their performance on *without* and *while*. The experimental hypothesis was that control in *without* adjuncts would be adult-like at a younger age than control in either temporal adjunct.

4.3.2 Subjects

23 children aged 3;0 to 5;11 participated in this experiment.[55] The mean age of the group as a whole was 4;4. Children were recruited from two daycares in the Boston area: the Volpe Transportation Center daycare in Cambridge, and the Open Center for Children in Somerville. All children were tested at their daycare facility, usually in a small area set aside for our use. Testing took place in two sessions, done on different days but within 1-2 weeks of each other.

4.3.3 Materials and Procedures

In this experiment, each child received two trials on *while*. Some children were tested on four trials each for *after* and *without*, and some were tested on only two. The discrepancy is due to a post facto concern about presupposition failure in some of the stories, which might have added extra difficulty for children. These test items were not included in the analysis. Due to time constraints, not all children could be re-tested on these structures. 14 children were tested on four trials per structure, and 9 children were tested on two trials per structure.

In each trial, the child would listen to a story and watch the experimenter act it out with toys. A different story and set of toys were used for each test item. All of the relevant characters in the story were visible and accessible throughout the test item, and put away at the start of the next item. After the story, Kermit would be asked to say something about what happened. In every case, Kermit prefaced his sentence with the following linguistic context:

[55] Two children of the original 25 were excluded; one child (age 3;1) seemed too shy to participate and was reluctant to tell Kermit that he was wrong. The second child (age 5;3) gave some non-adult responses to filler questions and seemed to have trouble paying attention.

(1) *Kermit:* This was a story about X and Y, and I know something that happened

The goal of this was to make the two relevant characters from the story readily available in the discourse, in case this influenced a child's willingness to pick a discourse referent as the controller for PRO. The following example illustrates the above considerations (for a complete set of experimental materials, the reader is referred to Appendix 1):

(2) *Experimenter (manipulates toys):* Let me tell you a story about Spiderman and Donald Duck. Spiderman is tired of walking all over the place, so he's going to buy a truck from this guy over here. (Spiderman gives the salesman a coin, and takes a truck). Donald Duck sees the new truck and he wants one, too. But, look, he doesn't have any money. So, Donald goes to the bank and gets out a coin. Now he can buy a truck too! (Donald hands over the coin, and takes a truck).

Kermit: This was a story about Donald Duck and Spiderman, and I know something that happened: **Donald Duck went to the bank after buying a truck.**

As the reader can confirm, the test sentence is false on the adult-like interpretation, because Donald in fact went to the bank *before* he bought a truck. However, if the child's grammar allows a sentence-external referent to serve as the controller, then the sentence is true: Donald went to the bank after *Spiderman* bought a truck.

Every test trial followed this model; they were all designed so that the adult-like interpretation was false in the context, and the external control reading was true. The trials were set up this way in order to avoid incorrectly attributing adult-like knowledge to a child. Importantly, in these structures the adult-like interpretation is compatible with a non-adult grammar in which PRO need only be familiar in the discourse. Let us see why this is so. Consider a sentence like *Donald Duck went to the bank before buying a*

truck, uttered in the context above, which makes it true for the adult. The non-adult grammar dictates that the adjunct is a domain for discourse control rather than structural control. So, a non-adult child will find a controller for PRO by selecting a referent from the discourse context. Naturally, the discourse context includes Donald Duck as well as Spiderman. So, a child could accept this sentence in the context for one of two reasons: either her adult-like grammar chooses the subject of the sentence (*Donald*) as the structural controller, or her non-adult grammar looks to the discourse and identifies Donald as a salient individual in the context. In the second case, the child arrived at the adult-like answer without using the adult-like control mechanism. So if she accepts the adult reading, it is not necessarily indicative of a mature grammar; she must also correctly reject the non-adult reading.

However, this creates a situation where the adult-like answer to every test item is *no*. In order to balance the *yes* and *no* answers, filler trials were interspersed between the test trials. This is done to avoid introducing a non-grammatical effect on the responses (for instance, a child might feel bad for Kermit and say he is right regardless of the truth of the sentence, in order to give him a chance to get the reward). In addition, the experimenters adjusted the expected (adult-like) response to the filler questions to accommodate an individual child's pattern of responses. So, for instance, if the child answered *yes* to three trials in a row, the next filler trial would be adjusted so as to elicit a *no* answer. This allows us to confirm that the child is in fact willing and able to say Kermit was wrong. It also confirms that the child is still paying attention, rather than simply answering *yes* to every test sentence. Finally, it ensures that the child does not

change his responses for a non-grammatical reason, such as a dispreference for giving the same response type many times in a row.

4.3.4 Results

For the purposes of analysis, the children were split into two age groups. The mean age of the younger group is 3;6 and the mean age of the older group is 5;0.

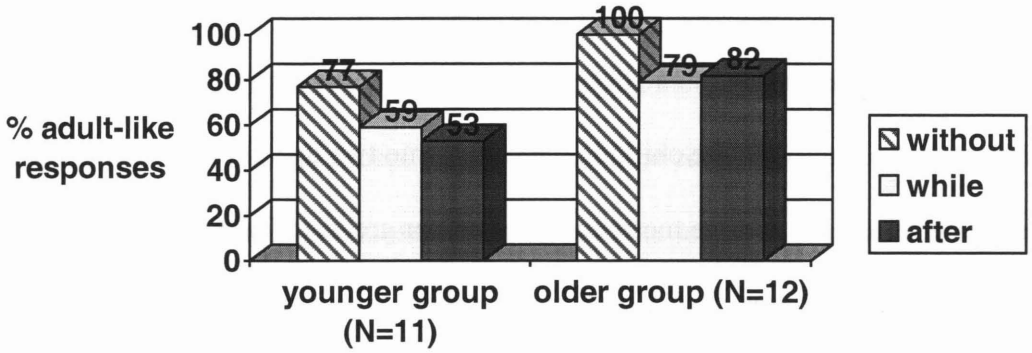
A repeated-measures ANOVA shows that there is a main effect of adjunct type, $F(2,42) = 4.219$, $p = .021$; and age group, $F(1,21) = 5.004$, $p = .036$. In both groups, children are most adult-like in terms of controller choice when the adjunct is headed by *without*. In comparison, the responses to both *while* and *after* adjuncts are less adult-like. These two structures are equivalently delayed. A two-tailed, paired samples t-test indicates that the children's performance on *without* adjuncts was significantly better than *while* ($p = .006$) and *after* ($p = .031$).[56] Children's performance on the two temporal adjuncts did not differ ($p = 1.00$). The table below provides the mean number and standard deviation of adult-like responses (out of a possible 4) for each adjunct type. Figure 1 graphs the percentage of adult-like responses for each age group and construction type:

(3) Table 4.1: Mean number (and standard deviation) of adult-like responses

Age Group	N	Mean age	*without*	*while*	*after*
Group 1	11	3;6	3.0 (1.0)	1.0 (1.0)	2.0 (2.0)
Group 2	12	5;0	4.0 (0.0)	1.6 (1.0)	3.3 (2.0)
Combined Results	23	4;4	3.6 (0.99)	1.4 (0.66)	2.8 (1.78)

[56] The difference in significance between these two comparisons is most likely due to the greater variation in standard deviation on *after* adjuncts.

Figure 1: Percent Adult-like Control by Age Group and Adjunct Type



These results are significant at the .05 level but not the .01 level. This might be due to the low number of subjects; we note that the 4- and 5-year-old children were grouped together in order to more closely match the number of subjects in the younger age group. The older group is comprised of seven 4-year-olds and five 5-year-olds. Experiment 2, conducted with a larger group of children, will serve to confirm these patterns.

4.3.5 Discussion

Prior to this investigation, it was unknown whether children ever showed adult-like knowledge of adjunct control. Now we have confirmation that children as young as 3;0 are able to implement the mechanism of control in *without* adjuncts.[57] In the older age group (mean age 5;0), there were no errors made on control in *without* adjuncts: all children consistently rejected external control. In the younger group (mean age 3;6), performance on control in *without* structures was well above chance (77% adult-like). In

[57] In this experiment, the youngest children were not all performing at an adult-like level (which I assume would be indicated by 90% or higher performance across the group). However, their performance is significantly more adult-like than in the temporal adjuncts, so it is the comparison between structures which is relevant here.

comparison, children in the youngest age group were significantly less adult-like on control in the temporal adjuncts (average of 56% adult-like). In the older group, adult-like performance increased to about 80%, suggesting that there is development on the temporal adjuncts across the 3;0 to 5;0 age range.

These findings fit the experimental hypotheses of the adjunct misanalysis account. Based on the theory of control that I argued for in chapter 2,we expected that children would be able to implement adjunct control at a young age, provided that they had learned the structure of the adjunct clause. It was hypothesized that children would learn the structure of *without* adjuncts at a younger age, and therefore show adult-like control at a younger age. This was in fact the case. As such, we have evidence supporting the notion that the mechanism of control itself was not the barrier to adult-like performance in adjuncts. Instead, it seems that there is some other feature common across the class of temporal adjuncts which causes children to treat them as non-obligatory control domains. The next experiment tests the hypothesis that adjunct misanalysis is the root of non-adult control in the temporal adjuncts.

Finally, we note that these findings are unexpected from the viewpoint of the nominalization hypothesis (Wexler 1992) which was discussed in Chapter 3. This account predicted that control into both *without* and *while* adjuncts would be adult-like from a young age, since these structures do not contain an empty temporal operator. By contrast, non-adult performance was only expected to occur in *before* and *after* adjuncts. However, the data above demonstrate that there is some problem common to both *after* and *while*; the difficulty that children have appears to be independent of the presence or absence of a temporal operator.

4.4 Experiment 2: Binding and control

4.4.1 Hypotheses and Predictions

Experiment 2 will build upon the results of experiment one and prior studies of adjunct control (Broihier and Wexler 1995; Cairns et al. 1994; Hsu et al. 1985). From these studies, it seems that control is delayed in all three temporal adjuncts (*before, after, while*) but not in *without* adjuncts. This experiment will ideally offer further support for the hypothesis that children can implement control in *without* adjuncts at a young age. In addition, it will test the hypothesis that adjunct misattachment is the root of the non-adult control patterns in the temporal adjuncts. We will look for correlations in performance on control and the interpretation of pronouns, both of which would be affected by adjunct misattachment.

According to the account I argue for, we predict that children who are non-adult on control will also be non-adult on Principle C-governed sentences like the one below:

(4) $\text{She}_{*i/j}$ ate a snack before the girl_i played with the dog.

Conversely, we do not expect to find any children who are adult-like on P(C) but non-adult on control, since the errors are predicted to derive from the same source. Based on previous studies of binding, we predict that children will generally not allow Principle C violations unless they have misattached the adjunct such that P(C) does not actually apply. However, several studies have found mixed results with respect to children's performance on P(C)-governed structures, so it is possible that there may be some additional barrier to adult-like performance. This could result in some children being adult-like on control, but non-adult on P(C). And naturally, we expect to find some

children who have reached the adult grammar. The table below summarizes these expectations:

(5) Table 4.2: Predicted response patterns under the adjunct misanalysis account:

	Non-adult Control	**Adult-like Control**
Non-adult Principle C	Predicted to **occur**: Errors due to adjunct misanalysis	Possible: Adjunct is properly embedded, but some issue remains with Principle C
Adult-like Principle C	Predicted to **not occur**	Adult grammar (predicted)

4.4.2 Subjects

30 children participated in this experiment. They were divided into three age groups with 10 subjects each. The average age of the groups were as follows: Group1: 3;7. Group 2: 4;5. Group 3: 5;5. Subjects were recruited from the Technology Children's Center at MIT; Cambridge Ellis School; the Children's Center at Northeastern University; and Lesley Ellis School in Arlington. The testing was conducted at the daycare locations, and each child participated in 2-3 testing sessions which took place within 1-2 weeks of each other.

The data from 9 children of the original 39 were not included in the final analysis. These children were excluded for various reasons, such as inattentiveness during testing or non-linguistic response patterns. For example, three children answered *yes* to every test question including fillers; one child answered *no* to every question. Two other children (aged 4;5 and 5;1) justified their *no* answers with non-linguistic explanations (such as "Kermit was wrong because he said the sentence twice"), making it difficult to

know how to score their responses. Importantly, none of the children who were excluded from the analysis fit the pattern that we predicted to not occur in the data (cf. table 4.1 above).

4.4.3 Materials and Procedures

The format of the stories and structure of the test sentences in this experiment were parallel to those in experiment one. The subjects were tested on three structure types: sentences with (1) a null subject in the adjunct, (2) a pronoun in the main clause and an r-expression in the adjunct, and (3) a fronted adjunct containing a pronoun. I will discuss each type in more detail.

The first type were null subject (i.e., control) adjuncts headed by *before*, *after*, *while* and *without*, as in the following examples:

(6) a. Woody washed his hands before PRO petting the skunk.

b. Mickey drank the tea after PRO eating some cookies.

c. The girl read a book while PRO eating lunch.

d. The farmer played hockey without PRO feeding the cow.

All children were tested on two items per preposition where the adult interpretation was false in the context, as described for experiment one. In addition, 15 children (5 per age group) were tested on one item per preposition in which the adult answer was *yes*. This was done to confirm the hypothesis that children would accept these structures.

The second structure type tested for Principle C violations, with a pronoun in the main clause and an r-expression in the following adjunct, as in (7) below. Adjuncts headed by *without* were not presented in this condition, since they are not grammatical

with a full sentence complement under any interpretation (e.g., **He found a feather without Tigger asked for help*):

(7) a. He brushed the horse before the boy went for a ride.

b. He found the feather after Tigger asked for help.

c. She ate a snack while the girl played with the dog.

These sentences constitute a Principle C violation on the reading where the pronoun and the name are coreferential; the adult grammar only licenses a deictic interpretation of the pronoun. In order to avoid making an *a priori* decision about whether children would accept or reject either reading, the sentences were presented both in contexts which made them true on the adult (deictic) reading and ones in which they were true on the illicit coreferential reading. If a child's grammar does not block the coreferential reading, such sentence types will actually be ambiguous. By the maxim of charity (Grice, 1975), we expect children to access whichever reading makes Kermit's sentence true in the context. As an example, the sentence in (7b) was used in the following story/context:

(8) *Experimenter (manipulates toys):* Winnie the Pooh and Tigger are having a contest to see who can find some hidden objects. There are two feathers and two rings. Tinkerbelle has hidden the objects for them. Pooh goes first – he finds one ring, and then one feather. Tigger goes next – he finds a ring, but he can't find anything else, so he asks for help. Tinkerbelle gives him a hint of where to look for the feather. Then he finds it.

Kermit: This was a story about a hide-and-seek context, and I know something that happened: **He found a feather after Tigger asked for help.**

In this context, Kermit's sentence is false for an adult: *he* can only refer deictically to Winnie the Pooh, and it is not true that Pooh found a feather after Tigger asked for help. However, the sentence is true on the ungrammatical reading in which *he* and *Tigger* are coreferential. Each of the three temporal prepositions were presented in a context like this. Additionally, they were tested in a context which made the deictic reading of the pronoun true.

The third structure type involved sentences with fronted temporal adjuncts. The adjuncts contained pronouns which are ambiguous in the adult grammar, that is, they can receive either a bound or deictic interpretation, as the following (adult) judgments indicate:

(9) a. Before $he_{i/j}$ lifted the car, the $dinosaur_i$ knocked over the sunflowers.

b. After $he_{i/j}$ went for a ride, the $king_i$ bought the magic carpet.

c. While $she_{i/j}$ was watching the bags, the little $girl_i$ saw a bunny.

The reason for including these structures is to confirm that the children are willing and able to accept backward anaphora (i.e., cases in which the pronoun precedes its referent). This would show that children who rejected coreference in the previous cases were doing so for a grammatical reason, rather than for a general dispreference for backward anaphora. In addition, these sentences are truly ambiguous for an adult, and can therefore be compared to the previous structures, which might be ambiguous under a child's non-adult grammar.

On the ambiguous pronouns and P(C) test items in this study, the pragmatic lead-in for the test sentences was systematically varied. Two conditions were compared: a biased context which supported the bound interpretation of the pronoun (i.e., by

mentioning only this referent), and a neutral context which did not mention either potential referent (see, e.g., (8) above). The purpose of using a biased context was to determine whether children would allow it to influence their interpretation of the pronoun, and furthermore, whether there would be a difference between the truly ambiguous sentences and the unambiguous ones in this respect.

The following table summarizes the testing materials:

(10) Table 4.3: Summary of testing materials, experiment 2

Structure type	**Sub-type**	**Number of trials; True/False for adult**	**Context type**[58]
Control: null PRO subject	*before*	2 F*	NA
	after	2 F*	NA
	while	2 F*	NA
	without	2 F*	NA
Principle C cases: only deictic interpretation available	*before*	1 F 1 T	neutral biased
	after	1 F 1 T	neutral biased
	while	1 F 1 T	biased biased
Fronted adjuncts: ambiguous pronouns	*before*	1 T on backward 1 T on deictic	neutral neutral
	after	1 T on backward 1 T on deictic	biased biased
	while	1 T on backward 1 T on deictic	neutral biased
Total number of items		20*	

*15 children were also tested on a 'true' trial, for a total of 24 test items

[58] Sentences with PRO were always introduced with a context mentioning both possible referents. The contexts for the other sentences were varied as shown because of the additional factor of whether the test item was true or false for an adult. Children's responses are sensitive to this difference (i.e., they often show higher adult-like performance when the adult answer is yes/true and lower performance when it is no/false). In order to compare the effect of the two contexts, we must vary only context type and compare two sentences that are both true or both false for the adult.

4.4.4 Results and Discussion

This experiment examined a number of structure types. The results will be presented in separate sections for ease of exposition.

4.4.4.1 Control Structures

I will first report the results from the 15 subjects who were tested on control structures which elicited a *yes* answer. These sentences were presented in a context that made control by the main clause subject true. As expected, the children accepted these sentences nearly 100% of the time. One child (age 3;8) gave an incorrect *no* answer on a trial with *after*, and one (age 4;8) gave a *no* answer on a trial testing *without*, yielding a 93% adult-like rate for these test items. Trials with *before* and *while* yielded 100% adult-like responses. This high level of success is a predicted result under the adjunct misanalysis account, because subject control is a possible interpretation under both the adult and non-adult grammar. We did not expect any child to systematically reject subject control.

Turning to the trials which elicited a *no* answer, we note that this experiment replicated and extended the findings of experiment one. The subjects were tested on control in adjuncts headed by *before* in addition to *after, while* and *without* adjuncts. The mean number and standard deviation of adult-like responses are given in the table below. The maximum possible for each adjunct type was 2:

(11) Table 4.4: Mean number (and standard deviation) of adult-like responses

Age Group	N	Mean age	*without*	*before*	*while*	*after*
Group 1	10	3;7	1.90 (0.32)	1.50 (0.71)	1.3 (0.67)	1.10 (0.88)
Group 2	10	4;5	2.0 (0.00)	1.60 (0.70)	1.40 (0.70)	1.40 (0.97)
Group 3	10	5;5	2.0 (0.00)	1.90 (0.32)	1.80 (0.42)	1.70 (0.48)
Combined Results	30	4;6	1.97 (0.18)	1.67 (0.61)	1.50 (0.63)	1.40 (0.81)

We find that performance on *without* is significantly better than performance on the temporal adjuncts in the 3- and 4-year-old age groups (repeated measures ANOVA, $p = .016$ and $p = .021$). This is an important point of comparison with the results of experiment 1, since the 30 children in this study are exhibiting adult-like performance 95-100% of the time, at a highly significant level. *Without* adjuncts also exhibited the lowest variation as measured by standard deviation in the number of adult-like responses. This suggests that the structure is mastered uniformly at a young age. In the 5-year-old age group, the differences between the different adjuncts have mostly disappeared (no significant difference, $p = .168$), suggesting that the children have largely recovered from any adjunct misanalysis by age 5-6. However, even in the older age group there is some variation in the responses to the temporal adjuncts. This suggests that a few children have not mastered the structure of the temporal adjuncts even at age 5;0 or older.

A repeated-measures ANOVA ($F(3,81) = 7.252$) demonstrates that there is a main effect of adjunct type ($p < .01$). A two-tailed t-test which examined the differences between the different adjuncts yielded the following results:

(12) Table 4.5: Difference in performance on different adjuncts (all age groups)

Pair	P-value
without – before	.010**
without – after	.001**
without – while	.000**
before – after	.018*
before – while	.202
after – while	.501

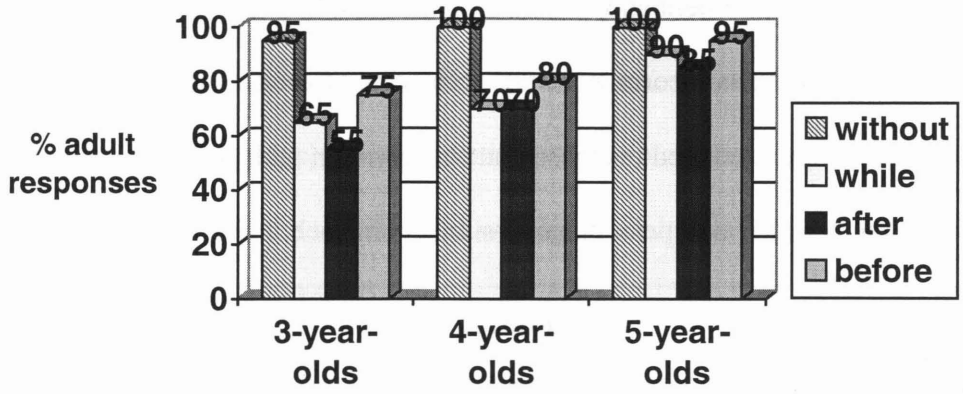
* = significant at .05 level
** = significant at .01 level

In all age groups, performance on adjuncts headed by *without* was significantly better than performance on the temporal adjuncts. This result was predicted under the adjunct misanalysis account that I argued for in Chapter 3: the structure of the temporal adjuncts but not those headed by *without* is delayed.

Perhaps surprisingly, the results of an ANOVA indicate that there was no main effect of age ($p = .10$) on the percentage of adult-like responses to the control structures; this held true even when the data on *without* were removed from the analysis and only the three temporal adjuncts were compared. Although the effect of age was not significant, the trends are in the expected direction, with the mean number of items correct increasing across the three age groups for every adjunct type. Each age group was composed of only 10 children, so it is possible that the number of subjects was too low for age to be identified as a significant factor.

The graph below gives the mean percent correct by age group and adjunct type:

Figure 2: Percent Adult-like Control by Age Group and Adjunct Type



As predicted by the misanalysis account, which argued that the temporal adjuncts but not *without* adjuncts would be misattached, structures headed by *without* are found to be significantly better than the temporal adjuncts across the board. Within the class of temporal adjuncts, children performed best on *before* in comparison to *after* and *while*. The differences between *before* and *while*, and *after* and *while* were not significant, although the difference between *before* and *after* was significant at the .05 level. This supports the conclusion that the temporal adjuncts are all similarly delayed; however, there may be some factor such as a difference in lexical acquisition which is responsible for the slightly better performance on *before*. This is an interesting result since it replicates the early claim that *before* was acquired earlier than *after* (Clark 1971). This result was challenged by Crain (1982) and Gorrell et al. (1989), who argued that the difficulty exhibited by children on sentences with *after* was due to a failure to satisfy the presuppositions of the test sentences. In the present study, however, all test sentences were presented in contexts which made their use felicitous; the stories used for *before* and *after* adjuncts did not differ in this respect. This suggests that there may be a real difference between these two lexical items in terms of age of mastery.

4.4.4.2 Principle C and Correlations with Control

The results from this experiment support the experimental hypothesis that performance on control and Principle C are correlated. The following table of actual response patterns can be compared to the predicted response patterns given in table 4.2 on page 175:

(13) Table 4.6: Number and percentage of subjects in each response category[59]

	Non-adult Control	**Adult-like Control**
Non-adult Principle C	10/30 (33%)	8/30 (27%)
Adult-like Principle C	0/30 (0%)	12/30 (40%)

As discussed above, the misattachment account predicted that children who were non-adult on control in temporal adjuncts would be non-adult on Principle C in these adjuncts as well. In fact, this was overwhelmingly found to be the case. The response pattern which was predicted to *not* occur (adult on P(C) but non-adult on control) in fact is missing from the data. This is expected if performance on Principle C and control is correlated. Based on the Pearson correlation coefficient, performance on these two aspects of grammar was 63% correlated; this correlation is highly significant ($p < .01$). Clearly, these findings present evidence in support of the main prediction of the misattachment account.

The sentences used to test for Principle C had a pronoun in subject position and a referring expression in the following adjunct, as in *He ate a snack after the clown went on a boat ride*. These sentences were tested in two types of contexts: one which made the deictic interpretation of the pronoun true, and one which made the illicit bound reading

[59] The threshold for a child to be considered adult-like was 5 out of 6 adult-like responses for both structure types. Children who scored 4 or less out of 6 were considered non-adult.

true. In the former type, the adult answer to the test question (*was Kermit right about what happened in the story?*) is *yes*; in the latter, the adult answer is *no*. Because children's performance is sensitive to this difference (i.e., the need to say *yes* vs. *no* to show grammatical knowledge), we will consider the two contexts separately.[60]

First I will discuss the test items in which the adult-like answer was *yes*. In these cases, we might expect near-100% acceptance of the test sentences, for a couple of reasons. These are situations in which the grammatical deictic interpretation of the pronoun is true in the context, and the ungrammatical bound reading is false. For adults, the sentences are not ambiguous, so there should not be competition between interpretations. Also, children tend to be charitable in the sense of accessing whichever interpretation makes the sentence true in the context (Grimshaw and Rosen 1990). For this reason, we would not expect children to reject the true, grammatical reading even if their grammar did not rule out the false, bound reading. However, this was not uniformly the case. Some children did reject these sentences, primarily ones in the youngest age group. The following table provides the mean and standard deviation of adult-like responses to the test item which elicited a *yes* answer; the maximum possible was 1. The data from each temporal preposition are grouped, as these differences were not significant:

(14) Table 4.7: Mean number adult-like on P(C) sentences when adult answer was *yes*:

	Group 1	Group 2	Group 3
Mean age	3;7	4;5	5;5
Mean number (and st.dev.) of adult-like responses	0.70 (0.47)	0.90 (0.31)	0.90 (0.31)

[60] The difference between the responses to *yes* and *no* items was significant ($p < .01$)

On these test items, the adult answer is *yes* and the non-adult answer is *no*, which means that the children were asked to justify their answers if they gave a non-adult response. The justifications from some of these children are revealing because they indicate that the children were in fact interpreting the pronoun and the r-expression as coreferential, and thereby interpreting the sentence as false. For instance, one of the test stories is about a pirate and a clown. The clown eats a snack, then goes on a boat ride. Once he is back, the pirate eats a snack. The test sentence was *He ate a snack after the clown went on a boat ride*. A few children who answered *no* to this item justified their answer by saying things like *He ate a snack before*. This indicates that they interpreted the pronoun as referring to the clown, which is not possible in the adult grammar.

On several test items in this experiment, children asked for clarification about the referent of the pronoun or PRO; that is, they asked Kermit which person he meant. In these cases, the experimenters avoided answering the question. The goal was to have the child reach a decision about the referent without input from the experimenters. Instead, Kermit would say something like, *Gosh I don't know, which one do you think?* (Having Kermit "play dumb" fit into the experimental set-up, since the children were told that he might say something silly or need help understanding whether he was right or wrong about what happened in the story). The fact that the children posed these questions at all seems to be evidence that they considered the sentences ambiguous and were entertaining both interpretations as possible meanings.

In the table below I present the mean number and standard deviation of adult-like responses when the adult response was *no*. This requires the child to reject the

interpretation of the sentence which was true in the context but ungrammatical due to a Principle C violation:

(15) Table 4.8: Mean number adult-like when adult answer was *no* (max. = 1):

	Group 1	Group 2	Group 3
Mean age	3;7	4;5	5;5
Mean number (and st.dev.) of adult-like responses	0.40 (0.50)	0.47 (0.51)	0.67 (0.48)

We see that children in Group 1 are below chance, and those in Group 2 are essentially at chance, in rejecting the illicit bound reading. This reflects lower performance than has been reported in the literature (see Chapter 3, section 3.4.5). However, it is important to note that we do have an explanation for more than half of the Principle C 'errors,' since they were made by children who also gave non-adult responses to control structures. Assuming that the misattachment account is correct, the subjects who were non-adult on both control and Principle C were not actually violating P(C) by allowing coreference; the sentences were not actually subject to Principle C for these children, since the adjunct was not c-commanded by the main clause subject. Only 20% of the test subjects were non-adult only on Principle C and not on control. But of course we don't know whether the children from previous studies of binding were adult-like on control or not, so we cannot know whether their non-adult answers were due to adjunct misattachment or actual delays with the binding principles. The data here seem to indicate a discrepancy with previous studies on binding.

Regarding the relatively high number of P(C) violations, recall that these test sentences were introduced with a special pragmatic context that was either neutral or supportive of the backward/bound interpretation; neither of these contexts were explicitly

supportive of the deictic interpretation. This could have influenced children's ability to link the pronoun deictically to the intended referent, possibly depressing the number of deictic responses. However, the same format of contextual lead-in was used with both P(C) sentences and truly ambiguous pronouns in fronted adjuncts, and it did not have any significant effect on children's interpretations in the ambiguous cases: as we will see below, children simply accessed whichever interpretation made the sentence true.

In the next section, I present the data from the sentences which are ambiguous in the adult grammar, i.e., cases in which the pronoun can receive either a bound or deictic interpretation. The results from this portion of the experiment may serve to enlighten the Principle C results.

4.4.4.3 Ambiguous vs. Unambiguous Pronouns

The children were tested on sentences with fronted adjuncts, as in *After he went for a ride, the king bought the magic carpet.* The subjects' responses indicate that they accepted both deictic and backward anaphora when it was grammatical to do so: to significant degree, they accessed whichever interpretation made the sentence true in the context. The following table provides the number of backward/bound responses according to whether the backward or the deictic interpretation of the pronoun made the test sentence true in the context. Note that the mean number of deictic interpretations can be found by subtracting the number of bound interpretations from the total number of test items – in this case, 3:[61]

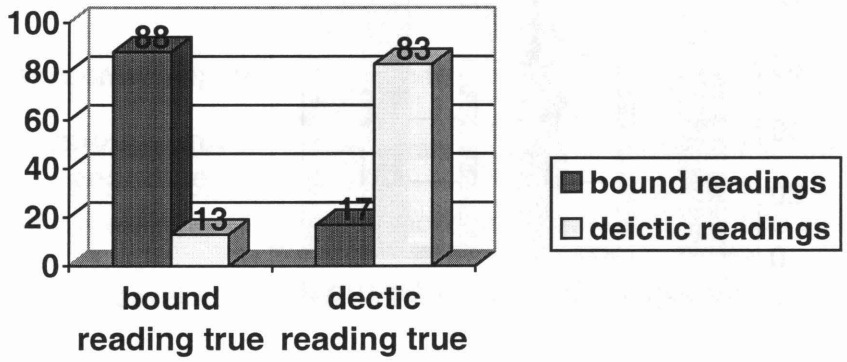
[61] Results are grouped across the three temporal prepositions, as no significant differences were found between them.

(16) Table 4.9: Mean number of backward/bound interpretations according to which interpretation was true in the context (max. = 3):

	Group 1	Group 2	Group 3
Mean age	3;7	4;5	5;5
Backward/bound interpretation true	2.8 (0.42)	2.6 (0.70)	2.5 (0.71)
Deictic interpretation true	0.4 (0.70)	0.4 (0.70)	0.7 (0.68)

The following chart provides the percent of bound readings and deictic readings for all subjects on all ambiguous sentences, according to whether the bound reading or the deictic reading was true in the context. The data from all subjects are grouped, as no significant age effects were found. The percentages in this figure correspond to the means given in table 4.9:

Figure 3: Percent of Bound vs. Deictic Interpretations in Ambiguous Sentences

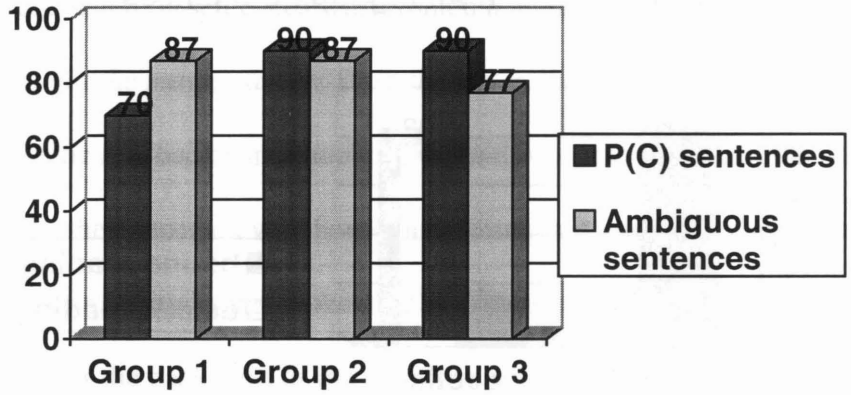


This pattern of results demonstrates that the children largely accessed whichever interpretation made the test sentence true in the context. There were no significant differences between the age groups, nor between the rate of acceptance of the deictic reading when it was true, and the rate of acceptance of the bound reading when it was true. From this, we can infer that the deictic interpretation of the pronoun was felicitous

and equally accessible as the bound interpretation. This suggests that the high number of Principle C violations reported in the previous section did not arise because the deictic interpretation was not accessible.

Next, I compare the rate at which children accepted the deictic interpretation in ambiguous and P(C) sentences when this reading was true in the context. The deictic interpretation is a grammatical option in both sentence types. The chart below provides the percentage of deictic interpretations in the P(C) condition and the ambiguous condition, for each age group. The percentages in the figure correspond to the averages given in tables 4.7 and 4.9. Recall that the mean ages were as follows: Group 1: 3;7. Group 2: 4;5. Group 3: 5;5:

Figure 4: Percent Acceptance of Deictic Interpretation by Age Group and Sentence Type



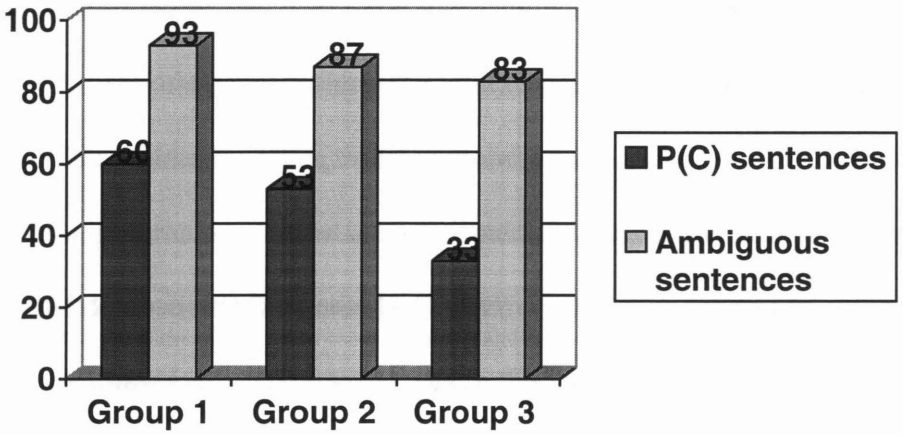
There was no main effect of adjunct type or age. The lack of a main effect of adjunct type suggests that, in both ambiguous and unambiguous sentences, the children were equally able to access the deictic interpretation when this reading was true in the context. Since the deictic interpretation is grammatical in both cases, this is not an unexpected result. However, there was a marginally significant interaction effect ($p = .048$) between these

two variables. The children in the 3;0 – 3;11 age group gave the fewest deictic interpretations in the P(C) adjunct condition, meaning that they accepted the ungrammatical backward/bound reading more often than the children in the older age groups. It is possible that the youngest children were susceptible to the influence of the pragmatic context used with the test sentences, more so than the older children. I discuss this further below.

Another question we wish to answer is whether children accessed the bound interpretation at the same rate in the two sentence types. The backward/bound reading is grammatical in the ambiguous cases but not in the P(C) cases. On the assumption that children have P(C) as part of their grammars, we expect them to reject the bound reading more often when it is ungrammatical than when it is allowed in the adult grammar. If the binding principle is not present or not active, both sentence types should be ambiguous; in this case we might expect them to access the bound interpretation equally in both structures.

In fact, the data robustly support the first expectation: children accept the bound interpretation of the pronoun at a different rate for P(C) sentences and ambiguous sentences. There was a main effect of adjunct type ($p < .001$). There was no main effect of age, although the developmental trend is in the expected direction, with acceptance of the ungrammatical bound reading decreasing as age increases. The chart below shows the results of this comparison. The percentages in the figure below correspond to the mean number of bound responses provided in tables 4.8 and 4.9:

Figure 5: Percent Acceptance of Bound Interpretation by Adjunct and Sentence Type



Children accepted the bound interpretation of the pronoun significantly less often when it was ruled out by P(C). This demonstrates that the children were not simply following a linear order strategy which ruled out backward anaphora.

In the 3-year-old age group, acceptance of backward anaphora in both ambiguous and P(C) contexts was especially high, as shown in the previous two charts. It seems that the youngest children were allowing the pragmatic context to influence their interpretations in both ambiguous and unambiguous sentences. This finding supports the hypotheses of Lust, Loveland and Kornet (1980) and Lust, Eisele and Mazuka (1992). These authors have argued that, at an early age, the use of a pragmatic lead which mentions a certain referent may influence children's responses regardless of whether the sentences are ambiguous or unambiguous for adults. This is a developmental stage which children pass through; in the adult state it is not possible for the pragmatic context to influence pronoun interpretation in unambiguous sentences. Crain and Thornton (1998), on the other hand, argue that non-grammatical factors like context can only influence the

interpretation of *ambiguous* sentences. It is only when a sentence has more than one possible interpretation according to grammatical constraints that issues such as pragmatic context and directionality of anaphora can significantly impact responses from either children or adults. They do not accept that this knowledge could differ from child to adult or develop over time. The data from this study seem to support the hypotheses of the former authors: in the youngest age group, children's interpretations were influenced by the context in both ambiguous and unambiguous sentences.

4.5 Experiment 3: Discourse control

4.5.1 Hypotheses and Predictions

This experiment looked at the way children interpret PRO in true discourse contexts. These are sentences in which PRO does not bear a syntactic relationship with its controller, but is instead interpreted as being coreferential with the topic of the sentence. This type of control was investigated as a point of comparison with the structural control adjuncts. Under the adjunct misanalysis account, we predict that a temporal adjunct which has not been properly embedded will fall into the domain of discourse control since, much like true discourse control contexts, the structural Agree relation would not be able to hold. So, we expect similarities between the interpretations that non-adult children give in structural cases and in discourse cases. I also hypothesized that most children would not have mastered the discourse properties necessary to correctly implement adult-like topic control, which is why non-adult behavior obtains in both the misattached temporal adjuncts and the true discourse control structures. It was also predicted that children would show adult-like behavior on the syntactic control relation

earlier than on the discourse structures, since the discourse properties must be learned over time. In contrast, adult-like structural control obtains as soon as children have properly embedded the adjunct. The following table summarizes these predictions:

(17) Table 4.10: Predicted response patterns to structural and discourse control:

	Non-adult Structural Control	**Adult-like Structural Control**
Non-adult Discourse Control	Predicted to **occur**: The two structures are equated because of misanalysis, and discourse control is delayed	Predicted to **occur**: Temporal adjuncts are properly embedded, but problems remain with discourse control
Adult-like Discourse Control	Predicted to **not occur**	Adult grammar (predicted)

4.5.2 Subjects

The children who participated in this experiment were the same 30 subjects from experiment 2. The mean ages of the three age group were as follows: Group 1: 3;7. Group 2: 4;5. Group 3: 5;5.

4.5.3 Materials and Procedures

The discourse control structures were tested in an additional session, intermixed with filler questions. Fillers were varied to counterbalance the *yes* and *no* answers that a child gave to sentences with PRO. Two types of discourse control contexts were tested: gerundive subjects (18a) and fronted absolutive adjuncts (18b):

(18) a. PRO Racing the unicorn made Shrek nervous.

b. PRO Lifting the table, Care Bear found the kitty.

15 children were tested on a single item per construction in which the context made the adult-like interpretation of the test sentence true; thus in these cases, the adult answer was *yes*. This was done to confirm that children would accept adult-like, grammatical discourse control. However, this interpretation is compatible with a grammar in which the referent of PRO need only be familiar in the discourse. As such, it is less informative to us in determining whether children will also allow overly liberal control. All 30 subjects were tested on two items per construction in which the context made the adult-like interpretation false, i.e., the adult answer was *no*. These contexts were designed such that the test sentences were true under the external or 'free' control reading, and false under the adult topic control requirement. An example of a context used to test the gerundive subject is given below:

(19) *Experimenter:* Shrek and Piglet are hanging out in the park, and see their friend the Unicorn. Unicorn says he is the fastest runner and the best jumper anywhere; he challenges them both to a race to prove it. They have to race and jump over a small bush. Shrek says, "That will be easy, no problem!" He races the unicorn and it's a tie, because they are both really fast. Then Piglet wants to try. But Shrek says, "I don't think that's a good idea. I am nervous about it because you are too small. You might trip and hurt yourself." But Piglet races Unicorn anyway. He trips over the bush and loses the race.

Kermit: This was a story about Shrek and Piglet, and I know something that happened: **Racing the Unicorn made Shrek nervous.**

The test sentence is true on the non-adult reading where PRO can be controlled by a discourse referent, since Shrek was nervous about Piglet racing the Unicorn. On the adult

interpretation in which PRO must refer to the sentence-internal referent *Shrek*, the sentence is false, since Shrek was not nervous when he himself raced the Unicorn.

4.5.4 Results and Discussion

Once again, we find a significant difference between the test items that elicited a *yes* vs. *no* answer ($p < .01$). The 15 children who were tested on a *yes* item were essentially adult-like: one child answered *no* to the test item with a fronted absolutive adjunct, yielding a 93% adult-like rate. Responses to the gerundive subject test item were 100% adult-like. This was an expected result, since the adult-like topic control rule is compatible with a grammar in which PRO can refer to any salient member of the discourse.

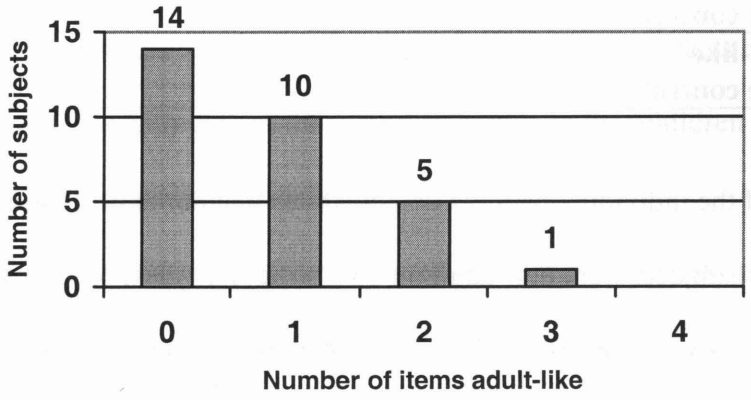
In contrast, the children were overwhelmingly *not* adult-like on test items which would elicit a *no* answer from adults. These data offer a more accurate estimation of the children's grammatical competence with respect to discourse control structures. Performance on these structures was remarkably low – the majority of children gave non-adult responses to all or nearly all of the test items. Perhaps surprisingly, there was no evidence of development across the ages tested. A repeated measures ANOVA confirms that age was not a significant factor ($p > .05$). The results of a two-tailed t-test indicate that the difference between the two structures was significant: $t(29) = 2.192$; $p = .037$. The mean number and (and standard deviation) of adult-like responses per age group is given below:

(20) Table 4.11: Mean number of adult-like responses by age group and structure:

	Gerundive subject	Absolutive adjunct
Group 1 (mean age: 3;7)	0.50 (0.70)	0.20 (0.63)
Group 2 (mean age 4;5)	0.60 (0.70)	0.30 (0.48)
Group 3 (mean age 5;5)	0.50 (0.53)	0.20 (0.42)
Combined results	0.53 (0.63)	0.23 (0.50)

I suspect that the difference between the two structures is due to a lack of mastery of the absolutive adjunct, which is not a commonly-used structure. Since children had to say *no* in order to show adult-like knowledge, it is possible that some children who said *yes*, and were therefore counted as being non-adult with respect to control, were just confused or unsure.[62] The figure below summarizes the group data and indicates the distribution of adult-like answers across the four test items when the adult answer was *no*:

Figure 6: Number of subjects who gave adult-like answers on discourse control tetst items



This figure indicates that the majority of children gave non-adult answers on three or four out of four test items.

[62] Although subjectively it was my impression that many of the children who answered *yes* were doing so confidently; they simply accepted the sentence as true in the context.

Let us take a closer look at the response patterns. One of the predictions of the adjunct misanalysis account is that children who show overly liberal control in temporal adjuncts will be similarly non-adult in true discourse contexts as well. This is because the children who are non-adult on structural control cases are thought to be erroneously treating the adjunct as a domain for discourse control. In addition, we established that the children are not correctly implementing the discourse rule. As a result, any child who is non-adult on structural control should be non-adult on discourse control too. Conversely, I hypothesized that discourse control might be delayed even beyond the age at which adjunct attachment is mastered. If this assumption is accurate, we might find children who are adult-like on structural control but non-adult on discourse control, but not vice versa. The following table of data can be compared to table 4.13, which listed the predicted responses on temporal adjuncts and discourse control:

(21) Table 4.12: Number of subjects in each response pattern type:[63]

	Non-adult control in temporal adjuncts	**Adult-like control in temporal adjuncts**
Non-adult discourse control	10/30 (33%)	19/30 (63%)
Adult-like discourse control	0/30 (0%)	1/30 (3%)

Examination of the individual patterns demonstrates that our expectations were robustly confirmed. Ten subjects were non-adult on both structure types, but **none** of the subjects were non-adult only on the temporal adjuncts. This is expected if the non-adult children are treating both structure types as discourse control domains. If some other factor was the root of the problem with temporal adjuncts, then we would not have observed this

[63] Children were considered adult-like on control in temporal adjuncts if they gave at least 5 out of 6 adult-like answers; adult-like on discourse control was 3 or more out of 4.

pattern: it would have been possible for a child to be non-adult on the temporal adjuncts and yet adult-like on the true discourse control structures.

The majority of children (19/30) were found to be adult-like to some degree on structural control and yet still non-adult on discourse control. This pattern was expected under the assumption that adjunct attachment height would be learned at an earlier age than the properties of discourse control. Only one child was adult-like on 3 out of 4 discourse control items; the rest of the subjects who were adult-like on structural control were performing at a 50% adult-like rate in the discourse condition.

We can compare these results to the findings from previous studies. Tavakolian (1977) reports that the children who participated in her act-out task chose internal coreference approximately 40% of the time on sentences like (22a):

(22) a. PRO to jump quickly over the fence scares the pirate.

b. PRO jumping quickly over the fence scares the pirate.

Goodluck (1987) tested both gerundive (a) and infinitival (b) subjects. The 24 children in her study gave on average 27% internal-coreference responses when acting out these sentences. This is remarkably similar to the results on gerundive subjects found in the current investigation. Taken together, these findings indicate that children have not mastered the properties of adult discourse control.

Goodluck (1987) focused on the difference between PRO and pronouns in this position (e.g., (22a) versus *For him to jump quickly over the fence scares the pirate*). She expected to find a higher rate of internal coreference with PRO than with pronouns, since the adult grammar proscribes external reference in the control structure only. However, under the assumptions made here, the actual finding is not a surprising result. Although

PRO in these structures is typically limited to a sentence-internal referent, controller choice is based on properties of the discourse rather than the structurally-determined control relation. I have argued that children in this age group might be insensitive to the pragmatic knowledge necessary to correctly implement the discourse control rule. As such, we expect them to allow a range of interpretations of PRO that is similar to overt pronouns, in which the referent need only be familiar and salient in the discourse.

4.6 Summary and Conclusions

In conclusion, three experiments were presented in this chapter. The first one established that control into adjuncts is not uniformly delayed, as children were found to appropriately rule out external control in *without* adjuncts even in the youngest age group tested. This was a predicted result under the control theory that I presented, since we expected that children would be able to implement the control relation in at least some adjuncts. I predicted that adjunct control ability would be contingent upon adjunct type and structure, and this was found to be the case.

The second experiment was a test of the adjunct misanalysis account, which led to the hypothesis that children's responses to control and Principle C-governed sentences would be correlated. In fact, a significant correlation was found between non-adult adjunct control and non-adult coreference judgments, as expected. I argued that the misattachment of the adjunct clause was the root of the non-adult responses on both PRO and overt pronouns. By the oldest age group (5;0 – 5;11), children were largely adult-like on control in the temporal adjuncts, suggesting that the misattachment was resolved by this point.

In the third experiment, children were tested on discourse control structures. The goal of this was to confirm and extend previous findings on discourse control structures, and to compare individual children's responses on structural and discourse control. The results confirmed the patterns observed in earlier act-out tasks: children in the 3-6 age range allow overly liberal control in these structures about 60-70% of the time. At the individual level, we observed that only children who were adult-like on structural control gave adult answers on two or more of the discourse control test items. The children who were non-adult on structural control were overwhelmingly non-adult on discourse control as well; they allowed external control of PRO in both cases. This supports the hypothesis that both structures were being treated as discourse control domains, and both were similarly delayed prior to adult-like embedding of the temporal adjunct. In this experiment, no evidence was found for development in discourse control across the age groups. This is not too surprising, since the structures require pragmatic knowledge which children under 6 may lack. In contrast, performance on all structural control adjuncts reached 90 to 100% correct in the oldest age group.

In conclusion, the experimental results offer strong evidence in support of the predictions and hypotheses set forth in Chapter 3. These predictions emerged from a theory of grammatical development which in turn was based on current linguistic theory on the adult grammar of control. Drawing upon this theoretical work provided insight into the root of the delays that are exhibited by young children.

Chapter 5: Conclusion

The overarching objective of this dissertation was to examine how innate and learned aspects of grammar come together in the acquisition of control. Throughout the thesis, I emphasized the importance of combining the insights of experimental and theoretical research in order to achieve this goal. For this reason, I began with a review of existing theories of control in the adult grammar, and built upon them to establish a comprehensive theory of adjunct control. I argued that the account of Landau (2000), in which the control relation is characterized as a syntactic Agree relation, is the most comprehensive theory of control to date. In fact, I provided evidence that this account should be extended to capture control into certain adjuncts in addition to control in complements. Because of the nature of the Agree relation, only adjuncts which attach sufficiently low in the structure are penetrable to control of this sort. Control in high-attaching adjuncts, on the other hand, was argued to be governed by a discourse mechanism rather than a syntactic relation. I argued that the relevant discourse feature in this case was topicality: the null subject is oriented toward the topic of the sentence.

Having argued for this particular approach to control, the next goal was to examine the predictions it made for the acquisition process. For instance, an important part of this process was determining which aspects of the grammar are thought to be innately specified and which are subject to learning based on language input. Following in the long tradition of generative psycholinguistics, I argued that the principles of obligatory (or structural) control are available through UG. Along with Merge and Move, in the Minimalist program the Agree relation is a fundamental part human grammar. As

such, it seems that we have a strong basis in claiming that this aspect of control is innate. Given this, we predicted that adult-like judgments in structural control contexts would emerge early in childhood. Since the theory of control grouped low-attaching adjuncts with verb complements in the domain of structural control, we predicted that adult-like control in these structures would emerge around the same age. In contrast, control into discourse-governed structures was predicted to show a different developmental pattern, most likely subject to gradual learning.

A review of the existing data on the acquisition of control showed that these predictions were not completely supported. As expected, control in verbal complements has been found to develop early – around age 3;0. However, we lacked evidence that children are able to implement adult-like control in adjunct structures. Temporal adjuncts headed by *before* and *after* are thought to attach low in the structure, thereby permitting structural control, and yet children as old as 5;6 have exhibited non-adult control in such cases. In order to understand the discrepancy in the child data between control in complements and adjuncts, I once again turned to the theory of control for answers. As described above, the control-as-Agree theory argued that the attachment height of an adjunct is crucial to knowing whether structural or discourse control will obtain. So, although the structural control principles are innate, they depend upon the successful embedding of adjunct clauses in order to be implemented correctly.

This issue brought us back to the question of innate versus learned properties of grammar. Although I argued that the control principles are innate, in general I have sought to avoid attributing unnecessary complexity to the innate grammar. A reasonable assumption arising from this approach to acquisition is that features of grammar which

are learnable on the basis of experience need not be innately specified; if the language input provides the tools for a child to learn a certain contrast, there is no *a priori* conceptual motivation for claiming it is encoded in UG.[64] In the case of control, proper adjunct attachment is a necessary component to implementing control, but it is not necessarily an innate component. Based on the fact that adjunct attachment can vary both within and across languages, I hypothesized that this could reasonably be a feature of the grammar which must be learned from the input.

These ideas suggested that a revision of our predictions was in order. Although structural control is innate, and certain adjuncts fall under the domain of structural control for adults, a child's ability to implement adjunct control will depend on the structure that she assigns to the adjunct clause. I therefore predicted that children as young as 3;0 would show evidence of adult-like control in adjuncts, but that this would be contingent upon the particular adjunct in question.

Naturally, the next step was to define our expectations regarding the development of adjunct attachment: which structures are likely to be erroneously attached? Which ones will be correctly attached from a young age? I argued for a model of acquisition in which children rely upon the argument structure of a lexical item as evidence for its syntactic structure, including attachment level. For some prepositions, however, this evidence is not definitive, because it is compatible with more than one structural analysis. I argued that this was the case for the temporal prepositions (*before, after, while*). Because they readily appear with a full, tensed sentence as a complement, they seem similar to a preposition which actually conjoins two phrases rather than subordinating one to another

[64] I maintain the assumption that negative evidence is unavailable to the child during the acquisition process. As a result, any aspect of grammar which could only be learned through negative evidence remains a good candidate for innate specification.

(such as *and, or, but*). On the other hand, we find adjuncts headed by *without*: these are limited to taking DP complements and therefore never have the appearance of IP-level conjunction. This means that temporal adjuncts might be erroneously assigned the syntax of coordination initially, but an adjunct headed by *without* will not be subject to such a misanalysis. Of course, it is important to confirm that there is in fact positive evidence that will lead children to the adult-like structural analysis of temporal adjuncts. I pointed out that such evidence is in fact available in the input: coordinated and subordinated clauses differ in their behavior in clefted structures, yes-no questions, raising structures and wh-questions. However, not all these sources of evidence will be available to the child in the initial stages of acquisition – raising structures, for instance, are subject to maturational constraints. This provides additional reason to think that the distinction between subordination and coordination will be subject to gradual learning and development.

Based on this account, I formed more specific predictions regarding control in adjuncts. Adjuncts headed by *without* will be correctly embedded, and therefore exhibit adult-like control properties, at a young age. In contrast, the temporal adjuncts may be subject to a misanalysis in which they are attached very high in the structure, and will therefore exhibit overly liberal control patterns.

The final element of this study was the experimental evidence in support of the theoretical analysis. Three experiments were conducted to test the predictions laid out above. The first experiment was conducted with 23 children (mean age 4;4). It sought to confirm that children are adult-like on control in *without* adjuncts, as predicted under the adjunct misanalysis account that I argued for. This experiment also tested children on

while adjuncts, to determine whether they patterned with the other temporal ones or with those headed by *without*. An alternative account of the child errors (Wexler, 1992) predicted a different pattern – i.e., that control into *while* adjuncts would pattern with *without* in not being delayed. In fact, the results support the first expectation: as a group the children showed a mean of 91% adult-like responses on without adjuncts, but only 70% adult-like on *while* and *after*. In the youngest age group (3;0 – 3;11), performance on *without* adjuncts was significantly better than performance on the other two structures. From this, we have evidence that children as young as 3;0 are able to implement control in adjuncts. This is an important finding, since previously it was unknown whether children ever succeeded on control in adjuncts at a young age. Future research efforts could certainly be devoted to studying control into other adjunct types, and determining whether the adjunct misanalysis account accurately predicts the breakdown of adult and non-adult control patterns.

The second experiment tested 30 children overall, with 10 children in three age groups from 3;0 to 5;11. This experiment looked for positive evidence of adjunct misattachment in a domain other than control: namely, pronoun interpretation. Children were presented with sentences containing pronouns that, because of Principle C of binding theory, can only receive a deictic interpretation in the adult grammar – for example, *He$_{*i/j}$ ate a snack after the clown$_i$ went on a boat ride*. I hypothesized that a child who had misattached the adjunct clause would allow the illicit backward/bound reading, since the lack of c-command between the main clause and adjunct would mean that Principle C would not actually be violated. This account predicted that such Principle C violations would be correlated with non-adult control if the two 'errors' derived from

the same source, namely, adjunct misattachment. In fact, the results strongly support this conclusion. None of the 30 children showed the pattern which was predicted not to occur – adult-like Principle C and non-adult control – even though the other patterns of responses which were predicted to occur were in fact present in the data. This suggests that adjunct misattachment was a significant factor in children's performance on both control and binding. Future research in this area could be directed toward finding additional indicators of adjunct misattachment, for instance, based on extraction differences which normally exist between subordinated and coordinated clauses.

The final experiment, conducted with the same 30 children, elicited data on control in true discourse contexts to compare to the previous results on control in temporal adjuncts. This is because it was hypothesized that the adjunct misattachment put the temporal adjuncts into the domain of discourse control. So, I sought to confirm that children's responses were similar in each context – more specifically, that children who were non-adult on control in temporal adjuncts were similarly non-adult on control in discourse contexts. Again there was a pattern of responses that was predicted not to occur: if the two structure types were truly conflated, then children would not show non-adult control in temporal adjuncts and adult-like control in discourse contexts. As in experiment 2, no subjects were found to have this grammar type, offering support for the hypothesis that control in the two contexts was equated.

This experiment also confirmed the hypothesis that discourse control would exhibit delays beyond structural control. However, because the children in the oldest age group still exhibited non-adult control in discourse contexts, this study was not able to establish an age of acquisition for the adult discourse control principles. One goal of

future research could be to test older groups of children on these structures. In addition, this experiment was not able to test my hypothesis regarding the root of the delay in discourse control. It was suggested that adult-like discourse control would depend upon learning the distinction between sentence-level and discourse-level topics. The differences between these two types of topics are evinced in the way that speakers deal with violations of their use in terms of conversational implicature. Thus, it was hypothesized that adult-like discourse control would emerge around the age at which adult-like treatment of conversational pragmatics emerges. This is a relatively recent area of research in acquisition, and should prove a fruitful ground for future study.

Overall, this study demonstrated the importance of utilizing theories of the adult grammar to explain and understand the patterns we find in child language. The experiments which were presented here offered strong support for the predictions and hypotheses of the account that I argued for. The data indicated that the principles of structural control are innately specified, whereas the principles of discourse control are subject to gradual development. Additionally, we found evidence that children analyze the language input for regularities and patterns in argument structure in order to learn the attachment height of adjuncts. These results suggest that the model of acquisition assumed herein was an accurate characterization of language development.

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Appendix 1: Experiment 1 Materials

Adult interpretation is FALSE in the context

after story 1:

Donald Duck and Spiderman want to buy some trucks. First Spiderman goes to the 'dealership' and buys a truck. Donald wants a truck too, but he doesn't have any money. So, he goes to the piggybank and gets out a coin. Then he also goes to buy a truck.

Test sentence: Donald Duck opened the piggybank after buying a truck.

after story 2:

Shrek and Scooby Doo are at home. Scooby goes to the market to get some food, and Shrek stays home. Scooby buys the food and then comes home. Shrek decides that it's time to take a bath, so he does. Then he goes to the market and buys some food too.

Test sentence: Shrek took a bath after going to the market.

after story 3:

Tigger and his friend the dinosaur are having a jumping contest to see who can jump the best. Dinosaur goes first. He jumps over a tree, and then he jumps over a fence. Then it's Tigger's turn. Tigger jumps over the tree and then the fence. They agree that they are both really good jumpers.

Test sentence: Tigger jumped over the tree after jumping over the fence.

after story 4:

Shaggy and his friend the blue girl are showing how brave they are. There are two things to try: a Ferris wheel and a dinosaur. First Shaggy gets on the dinosaur and rides around. He is a little bit scared but he does not fall off. Then the blue girl tries out the Ferris wheel. She doesn't fall off, so she says she is really brave. In fact, she is so brave that she rides the dinosaur too.

Test sentence: The blue girl rode the Ferris wheel after riding the dinosaur.

while story 1:

Mickey Mouse is at home, and his friend the pirate invites him to go to the zoo. They go and look at some animals together. Then Mickey decides to go home and finish the puzzle he was working on. He is almost done with the puzzle but he gets sleepy, so he takes a nap. The pirate is still at the zoo.

Test sentence: Mickey Mouse fell asleep while visiting the zoo.

while story 2:

Caillou is working in the garden with his friend the girl. They need to water the flowers and rake up the fallen leaves. Caillou waters some of the flowers, but then the girl says that she wants to do this job. So the girl waters the flowers and Caillou rakes up the leaves instead. In the pile of leaves, he finds a beautiful, shiny rock. He decides to keep it for his collection.

Test sentence: Caillou found a rock while watering the flowers.

without story 1:

A farmer and a fisherman are going to play hockey on a field. A horse lives on the field and she says, you have to feed me if you want to play here. The farmer gives her some carrots and she is happy. The fisherman offers to give the horse a fish but she says, horses don't like fish! But he has no other food to give. She lets them play anyway.

Test sentence: The farmer played hockey without feeding the horse.

without story 2:

A girl and a boy are playing in the snow. They are having a great time. They are dressed in warm clothes, because it's really cold outside. Finally they get tired and go inside to eat a snack. The girl takes off her scarf and boots and snow pants, because it is warm inside. She puts on her shorts and sandals. But the boy is really hungry, so he doesn't stop to change his clothes.

Test sentence: The girl ate a snack without changing clothes.

without story 3:

There is a big boy and little boy who are doing skateboard tricks. The little boy goes first – he tries to do a really special trick but he can't make it. He falls down. The big boy goes next. He is really good on the skateboard and he does the trick perfectly.

Test sentence: The little boy did a trick without falling down.

without story 4:

There is a pirate and a magician who are out for a walk. They see a girl who is selling gumballs, and they want to buy some. The magician gives his coin to the girl and takes a gumball. Then the pirate comes up. He has a really special coin from his treasure, and he doesn't want to give it away. So, he takes a gumball and does not give the girl any money.

Test sentence: The magician took a gumball without paying.

Appendix 2: Experiment 2 Materials

A2.1 Control Structures

A2.1.1 Adult interpretation is FALSE in the context

before story 1:

Shaggy and Scooby-Doo are hanging out. Along comes Bart Simpson, who is a troublemaker, riding his skateboard. He shows them a trick on his board, and wants to see if they will do some tricks too. First Shaggy shows how he can stand on a ball and not fall off. Then he climbs all the way to the top of a tree. Scooby thinks it's easy to climb the tree so he skips that. He stands on the ball and balances for a long time. Shaggy and Scooby agree that they are both very brave.

Test sentence: Shaggy climbed the tree before standing on the ball.

before story 2:

Woody and Minnie Mouse go to a special petting zoo with a skunk, lizard, and giant bugs. Minnie is too scared to pet the animals. Woody pets the skunk, then he goes to wash his hands off, in case the skunk was stinky. Once he gets back, Minnie works up the courage to pet the skunk.

Test sentence: Woody washed his hands before petting the skunk.

after story 1:

Donald Duck and Spiderman want to buy some trucks. First Spiderman goes to the 'dealership' and buys a truck. Donald doesn't have any money, so he goes to the piggybank and gets out a coin. Then he also goes to buy a truck.

Test sentence: Donald Duck went to the bank after buying a truck.

after story 2:

Mickey Mouse is out taking his dog for a walk, and they come to his friend's house. She is getting ready to have tea and cookies. They are really thirsty, so they ask for tea. She says wait, I have been waiting all day to eat some cookies. They just came out of the oven. So she eats the cookies first and then pours some tea for them. They drink the tea, and then Mickey eats some cookies too.

Test sentence: Mickey drank the tea after eating some cookies.

while story 1:

Mickey Mouse is at home, and his friend the pirate invites him to go to the zoo. They look at some animals together, then Mickey decides to go home and finish the puzzle he was working on. He is almost done with the puzzle but he gets sleepy, so he takes a nap. The pirate is still at the zoo.

Test sentence: Mickey Mouse fell asleep while visiting the zoo.

while story 2:

This girl has a cat who is very hungry for his lunch. She gives him some cat food and then walks inside to eat her own lunch. But the cat says, I am afraid that the neighbor's dog will try to steal my food. Will you stay outside with me? So the girl sits down and reads her book, and the cat eats his lunch. Then they both go inside and the girl eats her lunch (book is next to her but she does not read).

Test sentence: The girl read a book while eating lunch.

without story 1:

A farmer and a fisherman are going to play hockey on a field. A cow lives on the field and she says, you have to feed me if you want to play here. The farmer gives her some carrots and she is happy. The fisherman offers to give the cow a fish but she says, cows don't like fish! But he has no other food to give. She lets them play anyway.

Test sentence: The farmer played hockey without feeding the cow.

without story 2:

Donkey and Winnie the Pooh want to go swimming in the lake. When they get to the lake, they see a little cat stuck in a tree. Pooh tries to get him down, but he is too short to reach the cat. So he leaves the cat and goes swimming. Donkey is taller, so he is able to get the cat down. The cat leaves to go home. Then Donkey goes swimming too.

Test sentence: Donkey went swimming without helping the cat.

A2.1.2 Adult interpretation is TRUE in the context

before story:

There is a little boy who gets picked up from school by his mom. They go home and Mom is really hungry, so she eats a snack right away. Then the little boy goes out to ride his skateboard, and his mom watches him. Then the boy says he is hungry, so they go back inside and boy eats a snack..

Test sentence: The boy rode the skateboard before eating a snack.

after story:

Shrek and Scooby Doo are at home. Shrek goes to the market to get some food. When he gets home, he realizes that it's time to take a bath, so he does. Then Scooby goes to the market and buys some food too.

Test sentence: Shrek took a bath after going to the market.

while story:

Piglet and his friend the woman are working in their garden. Piglet waters some of the plants, but the woman really wants to do that job. So the woman waters the plants and Piglet rakes up the fallen leaves. In the leaf pile, Piglet finds a beautiful rock.

Test sentence: Piglet found a rock while raking the leaves.

without story:

Tigger and his friend the girl decide to go for a walk. They see a woman selling flowers. The girl takes some flowers, and gives the woman a coin. Tigger wants flowers too, but he doesn't have any money. The woman lets him take the flowers and he promises to bring some money later.

Test sentence: Tigger took some flowers without paying.

A2.2 Principle C Structures

A2.2.1 Adult interpretation is FALSE in the context

before story:

Tigger and Batman's friend has an idea: she will hide some objects, and they will look for them. The girl hides two rings and a heart. First Tigger finds a ring, then he finds the heart. Then Batman finds the other ring. Tigger gets a prize for being so fast and finding two things.

Test sentence: He found the ring before Tigger found the heart.

after story:

Winnie the Pooh and Tigger are having a contest to see who can find the hidden prizes. Tinkerbelle the fairy is the helper and judge. Pooh goes first – he finds a ring and a feather. Tigger goes next – he finds a ring, but he can't find anything else, so he asks for help. Tinkerbelle gives him a hint of where to look for the feather. Then he finds it.

Test sentence: He found a feather after Tigger asked for help.

while story:

This farmer calls up his friend the Indian to help him out. His pig ran away and he needs the Indian to watch the other animals so he can go look for the pig. The Indian stays with the other animals. The farmer climbs up a tree so he can look around. He sees the pig hiding behind some sunflowers.

Test sentence: He found the pig while the farmer was up in the tree.

A2.2.2 Adult interpretation is TRUE in the context

before story:

There is a cowboy who has a horse. A little boy comes to ride the horse. The cowboy is brushing the horse, and explains that they have to brush him every day. The boy goes for a ride first, and brushes the horse when he comes back.

Test sentence: He brushed the horse before the boy went for a ride.

after story:

There's this clown, and his friend the pirate invites him to go for a ride on his new boat. Clown says yes, but he is really hungry so he eats a snack first. Then they walk down to the boats. The pirate gets the boat ready, and the clown goes for a ride. He gets back and says thank you to the pirate. Then the pirate rests and eats a snack.

Test sentence: He ate a snack after the clown went on a boat ride.

while story:

This girl is with her mom, having a snack in the house. The girl wants to play with the dog, but Mom isn't done with snack yet. Girl suggests that mom eat a snack outside, and Mom says OK. Both go outside. The girl plays with the dog, and Mom eats a snack.

Test sentence: She ate a snack while the girl played with the dog.

A2.3 Ambiguous Pronouns (fronted adjuncts)

A2.3.1 Backward/bound interpretation is FALSE in the context

before story:

A dinosaur and a horse are having a contest. They have to lift up a car and jump over some tall sunflowers. The judge will give a prize to the winner. The dinosaur goes first – he uses his tail to lift up the car. Then he tries to jump over the sunflowers, but he is too big and heavy, so he knocks them over. Then it's the horse's turn – he lifts the car with his head. Then he jumps over the sunflowers just fine. The judge says that the horse is the winner.

Test sentence: Before he lifted the car, the dinosaur knocked over the sunflowers.

after story:

Monkey invites his friend the duck over to his house for dinner. He has made a great salad with fish for Ducky – Monkey doesn't like fish but it's special for Ducky. The duck eats up the whole salad. Then Monkey brings out dessert – some cakes with bananas. Ducky doesn't like bananas but Monkey eats some. They are both very full and happy.

Test sentence: After he ate the salad, Monkey ate dessert.

while story:

A girl and her grandma are camping, and it is really cold outside. Grandma is very cold, so she goes to find firewood, and the girl stays behind to watch the bags. Grandma finds a little bit of wood. The girl goes to find more. She looks behind a bush and sees a cute little bunny, and she also finds more firewood.

Test sentence: While she was watching the bags, the girl saw a bunny.

A2.3.2 Backward/bound interpretation is TRUE in the context

before story:

There is a big boy who has a lamb for a pet, and a little boy who has a bunny. The animals need some food. The big boy feeds the lamb. The little boy is really excited to do a trick on his skateboard, he can't wait so he does this first. He and big boy go outside and little boy does a trick. Then they come back and little boy feeds his bunny.

Test sentence: Before he fed his pet, the little boy did a skateboard trick.

after story:

This king goes to visit the wizard. He wants to find a way to get around his kingdom, instead of walking everywhere. The wizard shows him the magic carpet. The king takes it for a test drive, to see if he likes it. Then he decides to buy the magic carpet. Wizard says he will ride the horse instead, and he goes off for a ride.

Test sentence: After he went for a ride, the king bought the magic carpet.

while story:

Princess invites Ariel for a ride in her boat. They sail to a small island. They both get out and go for a walk. Then Princess goes back inside boat but Ariel stays on the island. She says that she is not ready to leave, but it's OK because she can swim back. The Princess leaves in the boat, and on her way home she sees a little turtle swimming next to the boat.

Test sentence: While she was riding in the boat, the princess found a turtle.

Appendix 3: Experiment 3 Materials

A3.1 Adult interpretation is FALSE in the context

Gerundive subject story 1:

Shrek and Piglet go for a walk, and see their friend the Unicorn. Unicorn says he is the fastest runner and the best jumper; he challenges them both to a race to prove it. They have to race and jump over a plant. Shrek says, that will be easy! He races the unicorn and it's a tie. Then Piglet wants to try. But Shrek says, I don't think that's a good idea. I am nervous about it because you are too small and you might trip and hurt yourself. But Piglet goes anyway. Piglet loses the race; he can't jump over the plant. He says, I guess you were right, Shrek.

Test sentence: Racing the Unicorn made Shrek nervous.

Gerundive subject story 2:

Harry Potter is at magic school with Mrs. Wizard, his teacher. Mrs. Wizard gives him an assignment: he must turn a picture of a dinosaur into a real dinosaur. He thinks for a while and then he remembers the magic word – Abracadabra! He does the spell right and the picture turns into a real dinosaur. Mrs. Wizard is very happy, she tells Harry that he got an A on the assignment.

Test sentence: Doing the mage spell right made Mrs. Wizard happy.

Absolutive adjunct story 1:

Care Bear lost his kitty, and he asks the police officer for help. First Care Bear lifts up the table, but there's no cat. The police officer looks behind the plant, but no kitty. Then, the cat runs in and hides under the table. CB and the policeman don't see him come in but the policeman says, let's look under the table one more time just in case. He lifts the table, and CB sees the kitty and picks him up, and says thank you to the policeman.

Test sentence: Lifting the table, Care Bear found the kitty.

Absolutive adjunct story 2:

Ninja Turtle asks Superman to go to a pet store with him to help him choose a new pet. There is a turtle, and some cats. Ninja Turtle chooses the turtle, and buys him. Then Superman pets the cats.

Test sentence: Having bought the little turtle, Superman pet the cat.

A3.2 Adult interpretation is TRUE in the context

Gerundive subject story:

Two brothers get out of school and see that it snowed during the day. They are really excited and instead of going straight home, they play outside for a long time. Finally, they get tired and go home. Their dad is waiting, and he is upset. He got worried because they were so late. He tells them that dinner is waiting for them. They say sorry and go inside to eat.

Test sentence: Playing in the snow made the boys late for dinner.

Absolutive adjunct story:

There is a little boy who is on his way home from school. He is walking past the park and he sees some big boys playing. He stops to play with them. They are all having a good time, but then the little boy sees a snake slithering through the grass. He gets scared, and runs home. The big boys stay at the park.

Test sentence: Playing at the park, the little boy saw a snake.