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Reconstruction Effects in Child Language

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ABSTRACT

Reconstruction Effects in Child Language

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A central question of theoretical linguistics is how children develop a grammar consisting of abstract syntactic representations and computations. Especially problematic are grammatical operations not apparent in the surface form of children's input, like *reconstruction*, the mechanism by which a syntactically moved constituent is interpreted in its pre-movement position. Reconstruction effects vary across syntactic environments, creating a complex system for language-learners to acquire. Nevertheless, the current study reveals that four-year-old children have adult-like knowledge of reconstruction, despite lacking direct evidence for it. Moreover, in cases where children appear to differ from adults, their differences are best attributed to distinct parsing mechanisms, and not disparities in competence.

This study uses the Truth Value Judgment (Crain & Thornton, 1998) and Questions After Stories Tasks (de Villiers & Roeper, 1996) to compare children's and adults' knowledge of reconstruction where movement interacts with binding theory (Chomsky, 1981, 1986). For example, 'himself' in (1a) is bound by 'John,' which is possible only when interpreted in its reconstructed position. Similarly, coreference

between ‘he’ and ‘John’ is ungrammatical in (1b), as reconstruction results in a Principle C violation:

(1) a. Bill_i knew [how proud of $\text{himself}_{*i/j}]_k$ John_j was t_k.

b. Bill_i knew [how proud of $\text{John}_j]_k$ $\text{he}_{i/*j}$ was t_k.

While obligatory for moved predicates, reconstruction for moved arguments appears to behave differently for Principles A versus C. Reconstruction is optional for Principle A (2a), but is apparently obligatory for Principle C (2b):

(2) a. Bill_i knew [which picture of $\text{himself}_{i/j}]_k$ John_j liked t_k.

b. Bill_i knew [which picture of $\text{John}_j]_k$ $\text{he}_{i/*j}$ liked t_k.

A series of experiments explores these asymmetries, revealing that children’s grammars do include reconstruction. Like adults, children obligatorily reconstruct moved predicates. They likewise demonstrate a predicate/argument asymmetry, consistently failing to reconstruct moved arguments in both Principles A and C environments (adults actually reconstruct optionally in both). Children persist with a surface interpretation because they have difficulty revising their initial parse (Trueswell, Sekerina, Hill, & Logrip, 1999): the parser thus obscures children’s knowledge. However, despite the lack of sentences revealing it in child-directed speech, we find four-year-olds to have successfully acquired complex knowledge of reconstruction.

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CHAPTER 1

One of the central questions in the study of language acquisition is how children so rapidly develop a complex grammar that encompasses knowledge of sentence types they may never have been previously exposed to. That children are able to interpret such sentences leads to the widely held conclusion that children at the youngest ages have an abstract symbolic system, or grammar, that goes beyond their experience in many ways. In other words, some portion of the child's grammatical knowledge must be innately specified, and therefore does not have to be gleaned from the language they hear used around them. Of course, accepting this claim opens the question of just how children project a symbolic system from their experience, and what the contribution of the child is in directing that projection. The input they receive clearly plays a crucial role, as children do eventually learn the language of the speech community that surrounds them. Nevertheless, the fact that the input is almost certainly incomplete with respect to the full range of structures licensed by the adult grammar leaves a significant challenge for language-learners: how do they come to have command over structures they have never been exposed to? Likewise, while the input children do receive is clearly important, they must also be equipped to project a symbolic system and analyze the input in a way that will allow them to build the grammar of their language. In other words, just being

exposed to certain input is no guarantee children will use it to generate the constraints appropriate to their language. So the question becomes: how might children master abstract rules of grammar not explicitly revealed in their input?

Related to this question and crucial to the current study is how children come to have adult-like command over abstract grammatical operations that are not apparent given the surface form of the sentence, even if the children have been exposed to sentences requiring such operations. In other words, much of the grammatical knowledge adults have been shown to have relies on abstract representations and manipulations of these representations. Therefore, even for learners equipped with a rich representational system, such abstract knowledge presents learners with the distinct challenge of attaining competence with respect to unobservable operations. This dissertation explores children's knowledge of one type of abstract syntactic operation, and whether their competence varies with the different grammatical environments requiring it. It includes an analysis of the input children receive that might be taken as evidence for this operation, and addresses how children might acquire the competence they demonstrate. The adult grammar is likewise explored, and evaluated along with child grammars with respect to various theoretical proposals designed to account for this phenomenon. The results of the current study in turn shed light on issues in theoretical syntax and sentence processing, as well as questions concerning the acquisition pattern for abstract grammatical operations.

1.1. Introduction and Background

In this dissertation, children's knowledge of the abstract grammatical operation *reconstruction* will be compared to adults' through a series of experiments. Reconstruction refers to the phenomenon where structures containing a constituent that has undergone syntactic movement are interpreted with respect to scopal relations or binding theory as though this movement had not taken place. As its name suggests, the term "reconstruction" derives from analyses where the movement operation is literally undone, and the moved item is moved back or "reconstructed" to its base position. Although this analysis has generally been abandoned in favor of more current accounts, the term "reconstruction" nevertheless persists. In an attempt to place distance between the phenomenon and its analysis, a more theoretically neutral term, "connectivity," which generally refers to the relationship between a moved referring expression or pronominal and its original position, can be found in the literature as well. However, as "reconstruction" is used most commonly, that is the term I will use throughout this dissertation, although this choice reflects no particular theoretical position.

An example will help illustrate reconstruction. In general terms, consider a structure where we know that the meaning of *x* interacts with the meaning of *y*. The reconstructed interpretation of *x*, where *x* is interpreted in its original (non- surface) position, is represented as follows:

(1) $[\ldots x_{pronounced} \ldots y \ldots x_{interpreted} \ldots]$

Thus we can detect whether reconstruction has occurred by observing how *x* is interpreted with respect to *y*. A concrete example is given in (2), where the interaction of the quantificational noun phrase "every horse" with negation results in ambiguity:

(2) Every horse didn't jump over the fence.

(i) None of the horses jumped over the fence. (EVERY > NOT)

(ii) Not every horse jumped over the fence. (NOT > EVERY)

The interpretation in (i) can be generated from the surface form of the sentence. In this case, "every horse" is interpreted as having scope over negation, and this is the configuration reflected in the pronounced form of the sentence, where the negative clitic is in the c-command domain of the subject[1]. In contrast, the interpretation in (ii) requires "every horse" to be interpreted within the scope of negation. Despite the surface positions of the subject and negation, this reading may be straightforwardly generated via reconstruction, where the moved constituent is interpreted in its pre-movement position. Note that independent evidence suggests that in a sentence like (2), the subject "every horse" originates in the subject position of the main verb, and subsequently moves to its surface position (see McCloskey, 1997 for a review of proposals)[2]:

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[1] Scopal relations depend on the c-command relation: an item takes scope over all of the elements in its c-command domain. C-command is defined as follows: *a* c-commands *b* if and only if neither *a* nor *b* dominates the other, and the lowest branching node that dominates *a* also dominates *b*.

[2] McCloskey reviews evidence from many independent analyses supporting the Internal Subject Hypothesis (the hypothesis that subjects originate within VP and subsequently move to a higher position). One argument comes from Sportiche (1988) who notes that Quantifier Float is straightforwardly explained if the subject originates in a position lower than its surface position. For example, in (i), the quantifier "all" may appear in any of the positions in parentheses:

(i) They (all) must (all) have (all) been (all) drinking wine.

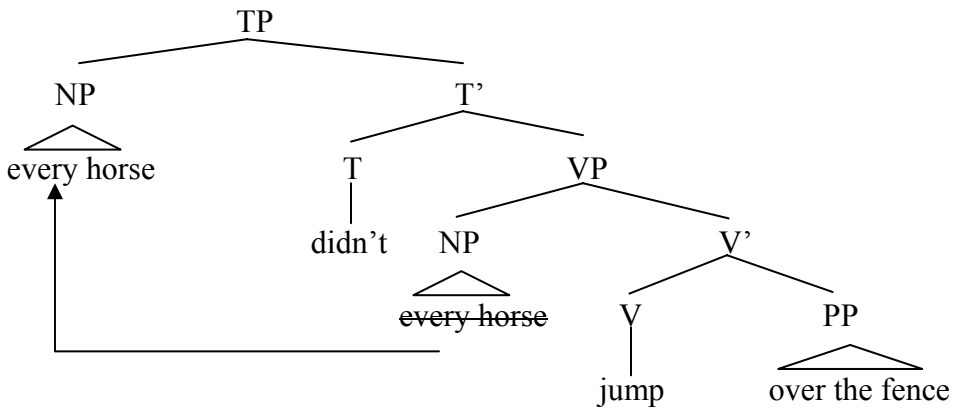
Assuming "they all" begins as a syntactic constituent, the distribution of "all" may be explained as arising from movement of the subject "they all" to various landing points along the path of extraction. Quantifier Float results because "they" may move on its own and fail to pied-pipe the quantifier.

A second relevant argument comes from Ladusaw (1988), who notes that the scope of negation (and other sentence-level adverbs, as well as modals) is determined from its position in the surface structure of the sentence. For example, the sentences below are unambiguous, with negation taking scope only over items in its c-command domain:

(ii) a. A Fiat isn't necessarily reliable. (NOT > necessarily reliable)

b. A Fiat necessarily isn't reliable. (NOT > reliable)

(2)



The ambiguity in (2) thus occurs due to the movement of "every horse," and where it is interpreted with respect to negation. Under the reading in (i), it is interpreted in its surface position, where it c-commands (and therefore takes scope over) negation. However, to generate reading (ii), it must be interpreted via reconstruction in its original position within the scope of negation.

Previous studies have shown that pre-school aged children fail to consistently access both interpretations of certain scopally ambiguous sentences that require reconstruction (Lidz & Musolino, 2002; Musolino, 1998; Musolino, Crain & Thornton, 2000; Musolino & Lidz, 2003). Specifically, for sentences like (2), children consistently interpret the sentence as having the meaning in (i), while rejecting the meaning in (ii). Adults, on the other hand, readily accept both meanings given the appropriate context. One possible explanation of these results is that children simply lack the grammatical

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If negation does not participate in covert movement operations available to other scope-bearing elements (remaining in situ), then the Internal Subject Hypothesis provides a straightforward means of capturing the scopal interaction between negation and other quantificational elements. In order for the subject to have narrower scope than negation, as in (2ii) above, it must at some point in the derivation have occupied a position below negation, like [Spec, VP].

operation that generates this meaning; in other words, they lack reconstruction. As few systematic studies of children's knowledge of reconstruction have previously been conducted, the current study aims to fill this gap in the literature by testing children on a variety of structures that involve reconstruction. Children's interpretations of such sentences will be compared to adults' through a series of experiments using the truth value judgment task (TVJT) (Crain & McKee, 1985; Crain & Thornton, 1998) and questions after stories task (de Villiers & Roeper, 1996). These results, in addition to revealing the acquisition pattern for this abstract grammatical operation, will also shed light on theoretical analyses of reconstruction and syntactic movement more generally. They will demonstrate that children have adult-like knowledge of the full range of constraints on sentences involving reconstruction, although their parser interferes with their ability to show this knowledge in certain structural environments. As there is very little work that attempts to model an LF parser, examining children's parsing strategies may allow for some initial steps to be taken towards a more general theory of LF parsing.

1.2. Analyses of Reconstruction

As noted above, reconstruction refers to the mechanism by which a moved element behaves for interpretive purposes as if it occupies a position lower than its surface position. The example in (2) illustrates how reconstruction may be observed with respect to scope-taking elements, in that case, universal quantification and negation[3]. As

[3] Some analyses propose a distinct mechanism to account for scope ambiguities like those in (2): semantic reconstruction (Cecchetto, 2001; Cresti, 1995; Lechner, 1998; Rullman, 1995; Sharvit, 1998, 1999;

shown, one way to derive the ambiguity in (2) is to appeal to where the quantified NP "every horse" and negation are interpreted with respect to one another: either in the order they appear in the surface form of the sentence (generating the interpretation in (2i)), or with this order reversed (where the quantified NP is interpreted within the scope of negation, generating the reconstructed interpretation in (2ii)).

In addition to being observable through scope ambiguities like those in (2), evidence for reconstruction may also be found in structures that are subject to binding theory (Chomsky, 1981, 1986). Binding theory is a set of constraints governing the interpretation of noun phrases (including anaphors, pronouns, and referring expressions). While the technical implementation of the binding theory has evolved over the years, these specifics are not crucial for present purposes: none of the structures considered in this dissertation are controversial with respect to details of its formulation. Therefore, the following general formulation is assumed:

(3) Binding Theory[4,5]

a. Principle A: A reflexive must be locally bound.

b. Principle B: A pronoun must be locally free.

c. Principle C: An R-expression (referring expression) must be free.

Sternefeld, 2001). On these accounts, the ambiguity is derived through semantic means and without appealing to syntactic position. These analyses will be discussed further in section 1.2.2.

[4] The definition of "local" is what typically distinguishes formulations of the binding theory. For simplicity's sake, and because such details are irrelevant to the structures considered here, it is assumed the local domain is the clause.

[5] "Binding" is defined by the c-command relation: *a* binds *b* if and only if *a* c-commands *b* and *a* and *b* are coindexed.

A few examples will help illustrate the principles of binding theory. In (4a), "himself" is bound by "John," and the sentence is grammatical. In contrast, in (4b) no antecedent is available to bind "himself," so the sentence violates Principle A, and is ungrammatical.

(4) a. John$_i$ saw himself$_i$.

b. *Himself$_i$ saw John$_i$.

The example in (5) illustrates Principle B. In this case, the pronoun "him" is bound by the co-indexed antecedent "John," which violates Principle B, rendering the sentence ungrammatical:

(5) *John$_i$ saw him$_i$.

Finally, (6) violates Principle C as the R-expression "John" is c-commanded by the co-indexed "he:"

(6) *He$_i$ saw John$_i$.

Binding theory thus successfully describes the grammaticality pattern for a wide variety of data. When applied to structures containing constituents that have undergone syntactic movement, however, the picture becomes more complicated.

In particular, the sentences in (7) present a potential problem for binding theory. For example, in (7a) the antecedent "John" fails to c-command the reflexive "himself," which according to binding theory should result in a Principle A violation. Nevertheless, the sentence is as grammatical as its corresponding statement given in (4a). Likewise, (7b) and (7c) are ungrammatical, despite the fact that the pronoun and R-expression (respectively) are free in the surface structure of these sentences:

(7) a. How proud of himself$_i$ was John$_i$?

b. *How proud of him$_i$ was John$_i$?

c. *How proud of John$_i$ was he$_i$?

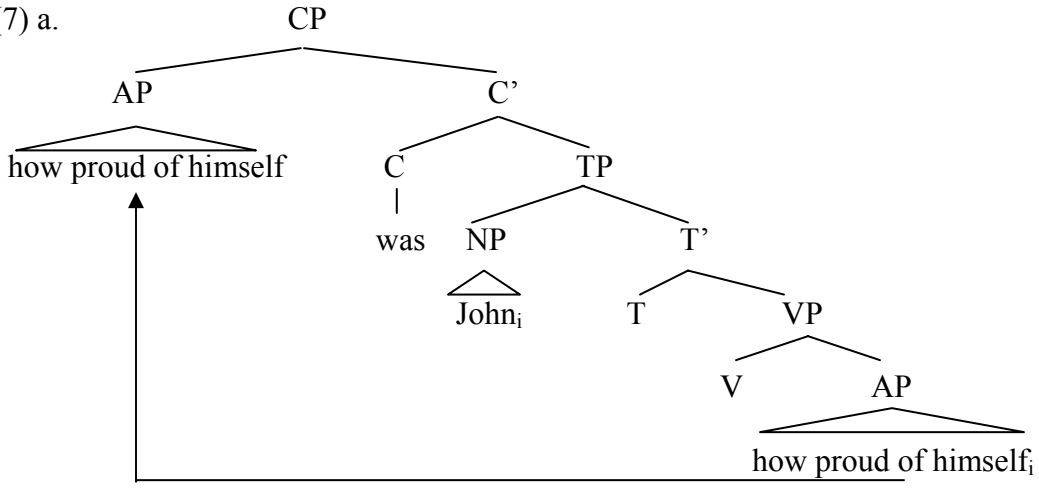
In short, the grammaticality pattern in (7) suggests that binding theory does not always apply to surface structure representations; at the very least, movement appears to interact with binding theory in a way that is not straightforwardly captured by appealing to surface structure. A brief history of theorizing on the interaction between movement and binding theory (both empirically and theoretically) is outlined in the next section, leading up to the current state of the art with respect to reconstruction. The array of facts presented leads to an interesting acquisition puzzle: how might children develop this complex system?

1.2.1. History of Reconstruction

As noted above, the sentences in (7) represent an apparent counterexample to binding theory. Their surface representations fail to meet the structural description for the binding theory principles, yet their grammaticality mirrors their non-movement counterparts whose grammaticality is clearly captured by binding theory. Such apparent exceptions to binding theory in movement structures are known as "reconstruction effects." As the term suggests, early syntactic approaches to this phenomenon were based on literal reconstruction, or syntactic lowering of the moved phrase (or part of the moved phrase) back into its original position at an abstract level of structure after movement had occurred (Cinque, 1982, 1990; Clark, 1992, Gueron, 1984; Hornstein, 1984; Langendoen & Battistella, 1982; Longobardi, 1987). For example, in (7a), if the

wh-phrase is put back in its original position after movement, the anaphor is in a position to be bound by "John," thus satisfying Principle A:

(7) a.



On this view, binding theory still applies to the final output of the derivation, which in this case is a level of representation that does not correspond to surface structure, but rather corresponds to logical form (LF).

An alternative approach to reconstruction appeals instead to the surface structure of the sentence, using traces to derive reconstruction effects (Barss, 1986, 1988; Cinque, 1982; Hornstein, 1984). This approach reformulates the binding theory principles in terms of "binding paths," which are defined as the path connecting an antecedent, anaphor/pronoun/R-expression, and any of its traces. Constraints on where items may stand with respect to one another in the syntactic structure of these paths derive reconstruction effects. However, the empirical coverage of these proposals has been called into question (Heycock, 1995; Huang, 1993; among others), and the loss of conceptual cohesiveness that comes with reformulating binding theory in terms of two

logically independent notions (chain membership and hierarchical domination) has cast further doubt on this type of analysis (Barss, 2001).

A simpler approach to reconstruction effects posits that binding theory actually applies at D-structure, or the structure of the sentence *before* movement occurs. Instead of the wh-phrase "how proud of himself" in (7a) being put back in its original position after movement (and binding theory applying at LF), or binding resulting from a relationship between "John" and the trace of the wh-phrase, this approach simply applies binding theory to the pre-movement structure where the anaphor is in a position to be bound. On this view, binding theory always applies before any movement operation. However, the sentence below suggests that binding theory may apply *after* movement in certain cases:

(8) $[John_i]_j$ seems to himself$_i$ t_j to be handsome[6].

In this example, "John" is not in a position to bind the anaphor until after movement has occurred. Therefore the questions in (7) demonstrate that binding theory does not necessarily apply at surface structure, and the statement in (8) shows that it also does not necessarily apply at D-structure.

Van Riemsdijk & Williams (1981) propose a new level of representation to account for the above facts. On this analysis, "NP-structure" is described as the structure derived from A-movement, and used as the input for A-bar movement. In other words, all A-movement (e.g., the subject raising in (8)) occurs before all A-bar movement (e.g.,

[6] The notation of using an indexed *t* to indicate a moved element's original position is not intended to reflect a particular theoretical stance. As discussed below, the copy theory of movement will be assumed in this dissertation, where a full copy of the moved item remains in the pre-movement position. The *t* is simply used in certain cases for notational simplicity.

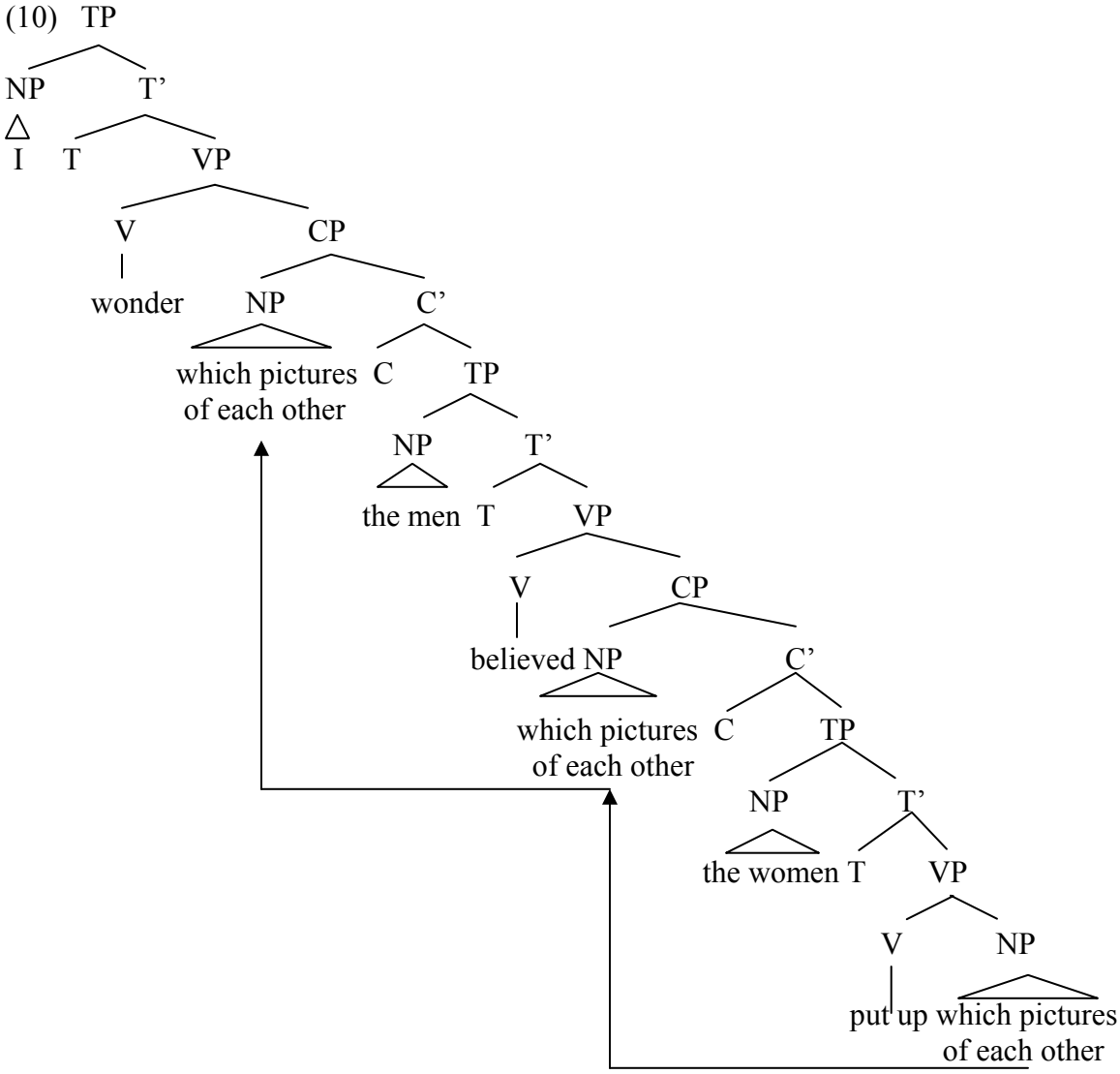
wh-movement), and NP-structure is the level of structure between the two. It is also said to be the level where binding theory applies. This predicts binding theory to apply after A-movement, but before A-bar movement, thus capturing the grammaticality patterns in both (7) and (8).

However, strictly ordering the application of binding theory and A-bar movement fails to capture the ambiguity of (9) (from Barss, 2001):

(9) I wonder which portraits of each other$_{i/j}$ the men$_i$ believed the women$_j$ placed in a scrapbook.

In this example, Principle A may be satisfied before A-bar movement (allowing "the women" to bind the anaphor) or *after* the first A-bar move (allowing "the men" to bind the anaphor):

(10)



Thus while the NP-structure hypothesis predicts that binding theory should only apply before A-bar movement, the example above shows that binding theory in certain cases actually applies after A-bar movement has occurred. Therefore it seems that binding theory and movement should not stand in the strict ordering relation proposed in this analysis.

Given the shortcomings of the above approaches, a more recent approach to reconstruction effects dispenses with reference to D-structure, NP-structure, and surface structure altogether. In Chomsky's minimalist framework (Chomsky, 1993, 1995), binding theory applies to the structure that is to be interpreted; in other words, it applies at LF. To derive reconstruction effects, movement is characterized by the copy theory. Under this theory, when an item moves, a copy of that item remains in its original position, and every position it occupies in the path of extraction. Therefore reconstruction is a logical by-product of movement: anytime movement occurs, a lower copy of the moved item remains and therefore may be interpreted. Of course, because only one copy is pronounced, the other must be deleted at PF. What is less clear is what happens to both copies for the purposes of interpretation. Chomsky assumes that in order for the derivation to converge, only one copy may be interpreted, so deletion applies to ensure only one copy of each item in the moved constituent remains at LF. An alternative analysis proposed by Fox (1999, 2002) claims that both copies remain available for interpretation at LF. A review of the minimalist analysis of movement will help illustrate these two accounts.

Movement is defined under minimalism as the result of applying the operations Copy and Merge. Merge introduces lexical items from the numeration (a selection of lexical elements to be included in the derivation) into the derivation. Copy allows for a linguistic expression to be repeated in the derivation. Therefore movement essentially amounts to copying an expression and re-merging it. This process is motivated by the goal of convergence: a derivation only converges when all of its uninterpretable features

have been checked and deleted. In the case of wh-movement, the complementizer has an uninterpretable wh-feature, which is checked when the wh-element (which has an interpretable wh-feature) is in a local relation with the complementizer (thus allowing the features to be deleted). Although only the interpretable wh-feature itself is required to check and delete the uninterpretable one, the entire wh-phrase is pied-piped, or copied and re-merged, along with it. The result is two copies of the wh-phrase in the derivation. As mentioned above, one of these copies is deleted at PF. The question then becomes what happens at LF.

With respect to wh-questions, it is standardly assumed that the material in [Spec, CP] is interpreted as a quantificational operator, while the material in the lower copy is interpreted as a variable. Chomsky proposes that just as the chain must reduce at PF, leaving only one copy to be pronounced, it likewise reduces at LF, leaving just one copy of each item in the moved constituent. The Preference Principle is introduced to account for what is deleted where, stating that there is a preference to minimize operator restrictions. In other words, it is preferable to reduce the material in [Spec, CP] to just the operator itself. Therefore the wh-operator is left for interpretation in [Spec, CP], and the rest of the material in the restrictor of the wh-operator is deleted, remaining available for interpretation in the lower copy.

An example will help illustrate how reconstruction effects are generated in this framework. It was noted above that the wh-element must be interpreted in the higher copy remaining in [Spec, CP], in order to establish the appropriate operator-variable

frame[7]. The non-quantificational material in the restrictor of the wh-phrase is preferentially interpreted in the lower copy, thus deriving a reconstructed interpretation, as in the LF below:

(10) $[_{CP}$[Which ~~picture of himself~~]$_j$ did $[_{TP}$ John$_i$ like [~~which~~ picture of himself$_i$]$_j$]]

Note that in this example, the only way the anaphor may be bound is if it is interpreted in the lower copy where it is c-commanded by "John." Principle A requires that all anaphors be locally bound. So the grammaticality of the above sentence is straightforwardly explained by the availability of the lower copy of the anaphor.

The analysis of the copy theory of movement proposed by Fox (1999, 2002) differs from Chomsky's approach in dispensing with the deletion process and leaving both copies available for interpretation. Fox proposes that deletion of a copy is usually unavailable, because it is less economical than interpreting both copies. That is, deletion is an extra operation that under minimalist goals of minimizing computations is non-optimal. Therefore, both copies remain for interpretation at LF: the higher copy is interpreted as an operator, and the lower copy as a variable. Any other material in the wh-phrase is interpreted as a restrictor, either as a restriction on the quantifier (the higher copy) or a restriction on the variable (the lower copy). In a sense, therefore, the material in the lower copy is redundant. Thus what separates Chomsky's and Fox's proposals is

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[7] In fact, there are examples of overt movement of the wh-element where the non-quantificational material is left behind, as in French (Kayne, 1989; Rizzi, 1990):

(i) Combien$_i$ a-t-il consultés [t$_i$ de livres]?
How-many has-he consulted of books
How many books did he consult?

See Hornstein, Nunes, & Grohmann (2005) for an overview of analyses of split constructions like these in French and German.

what material remains for interpretation at LF. This theoretical debate is slightly orthogonal to the current study, and Chomsky's approach will generally be assumed. However, the implications of each analysis for the current results will be explored in detail in Chapter 3.

The possibility of interpretation in any position along a moved element's path of extraction allows the copy theory of movement to account for a wide range of data that the earlier approaches fail to cover. However, restrictions on which copy(ies) are interpreted are clearly crucial to avoiding overgeneration. The economy principles described above predict that the lower copy is preferentially interpreted. But economy appears to be violable in certain instances. For example, while interpretation of the lower copy is forced in (11b), it appears either copy may be interpreted in (11a):

(11) a. Bill_i knew [which picture of $\text{himself}_{i/j}]_k$ John_j liked t_k.

b. Bill_i knew [how proud of $\text{himself}_{*i/j}]_k$ John_j was t_k.

In (11a), the anaphor may be interpreted either in its surface position, where it is bound by "Bill," or in its reconstructed position, where it is bound by "John." The ambiguity of this sentence provides evidence that reconstruction here is optional. In contrast, the anaphor in (11b) must be interpreted in its lower position, where it is bound by "John," it may not be interpreted in its surface position where it is bound by "Bill." This sentence thus behaves as expected: the lower copy is interpreted over the higher one. What distinguishes these two examples is the nature of the moved element: (11a) features a moved argument of the verb "like," and (11b) features a moved predicate. Thus it

appears reconstruction is obligatory for moved predicates, but optional for moved arguments[8].

However, examining this asymmetry in embedded questions subject to Principle C, as opposed to the above items subject to Principle A, leads to a different conclusion:

(12) a. $Bill_i$ knew [which picture of $John_j]_k$ $he_{i/*j}$ liked t_k.

b. $Bill_i$ knew [how proud of $John_j]_k$ $he_{i/*j}$ was t_k.

In (12), coreference between "John" and "he" is apparently ungrammatical in both sentences. Crucially, this reading is only ruled out if "John" is interpreted in its original position, where it gives rise to a Principle C violation, thus ensuring coreference with "Bill." Therefore, for moved arguments, reconstruction appears to be obligatory for Principle C, but optional for Principle A. For moved predicates, reconstruction is always obligatory.

This asymmetry between moved arguments and moved predicates has been widely reported in the reconstruction literature (Barss, 1986, 1988; Cinque, 1982, 1984; Heycock, 1995; Huang, 1993; among others). It is often discussed in conjunction with a distinction between reconstruction constraints on moved constituents containing arguments versus adjuncts (Lebeaux, 1988, 1990, 1991). Specifically, it has been observed that adjuncts contained in moved phrases may avoid reconstruction, while arguments may not. Therefore the asymmetry between moved arguments versus moved

[8] It is not immediately clear how this might be accounted for under Chomsky's analysis, which would have to stipulate that the Preference Principle obligatorily holds in the case of moved predicates, but is not obligatory for moved arguments. Heycock's (1995) referentiality-based proposal, which explains the obligatory reconstruction of moved predicates as resulting from their nonreferential status (nonreferential items being interpreted with narrow scope), nicely captures this asymmetry. Both analyses will be explored in further detail in Chapter 3.

predicates may be reducible to the argument/adjunct distinction; on this view, anaphors, pronouns, and R-expressions contained in moved predicates are obligatorily interpreted in their reconstructed position because they are contained in an *argument* of the predicate, and therefore must reconstruct. Anaphors, pronouns, and R-expressions contained in moved arguments like the so-called "picture-NP's" above (e.g., "picture of X," "painting of X," etc.), on the other hand, may avoid reconstruction if the PP contained in the picture-NP is analyzed an *adjunct*, since adjuncts may avoid reconstruction[9]. Analyses of the predicate/argument and argument/adjunct distinction, along with how these asymmetries may relate to one another, are discussed in detail in the chapters that follow.

Regardless of the source of these asymmetries, this complex system presents a distinct challenge for language learners. Not only must children be aware of the possibility of interpreting a moved item in its pre-movement position in general, they must be able to distinguish moved arguments from moved predicates, and obligatorily interpret the lower copy of moved predicates. They must also distinguish structures subject to Principle C versus Principle A, and calculate the varied reconstruction possibilities for moved arguments across these two binding theoretic environments. The current study tests children's knowledge of reconstruction with respect to these various asymmetries. Adults are likewise tested, to establish through controlled experiments their grammaticality judgments of a wide variety of movement structures, as such

[9] The status of PP's contained within picture-NP's is controversial, as they are not clearly arguments or adjuncts. This lack of consensus on their analysis and its implications will be discussed in detail in Chapter 3.

judgments are often debated in the theoretical literature. These experimental studies will be discussed in further detail in Chapters 2-3.

In summary, in contrast to earlier analyses of the interaction between movement and binding theory, the copy theory of movement has the advantage of seamlessly incorporating reconstruction into a more general theory of movement: reconstruction on this view is part of the movement operation, and is available wherever movement applies. Various levels of representation are dispensed with, and binding theory is evaluated with respect to the structure that will be interpreted, or at LF. Due to its empirical coverage and conceptual elegance, most recent analyses of syntactic reconstruction accept the basic ideas of this proposal (Barss, 2001; Fox, 1999, 2002; Fox & Nissenbaum, 2004; Sauerland, 2000, 2004; Sportiche, 2001; among others). Therefore, it will be the framework assumed in this dissertation as well. While both Chomsky's (1993) and Fox's (1999, 2002) approaches to the copy theory will be shown to be compatible with the results of the current study, Chomsky's account will generally be assumed. These two analyses will be discussed in further detail in Chapter 3, where analyses of the reconstruction asymmetries mentioned above are likewise explored.

1.2.2. Semantic Reconstruction

The proposals discussed above analyze reconstruction in terms of hierarchical relations between elements in the sentence, relying on syntactic structure to generate reconstruction effects. They belong to a class of accounts that use a single mechanism, syntactic reconstruction, to account for scope ambiguities like those in (2), as well as the binding theory examples discussed in the previous section (Barss, 1986, 1988, 2001;

Cinque, 1990; Clark, 1992; Fox, 1999, 2002; Fox & Nissenbuam, 2004; Gueron, 1984; Heycock, 1995; Huang, 1993; Langendoen & Battistella, 1982; Lebeaux, 1988, 1990, 1991; Longobardi, 1987; Romero, 1998a,b; Sauerland, 2000, 2004, Sportiche, 2001; van Riemsdijk & Williams, 1981, 1986). In contrast, a second class of proposals claims that the surface structure of a sentence is interpreted directly, with reconstruction effects being derived through semantic means (Sharvit, 1998, 1999; Sternefeld, 2001). Along with these "semantic reconstruction" accounts, some adopt a split approach, appealing to semantic reconstruction to account for scope ambiguities, and syntactic reconstruction to account for binding relations (Cecchetto, 2001; Cresti, 1995; Lechner, 1998; Rullman, 1995). The debate over when syntactic versus semantic reconstruction applies, and if such a distinction is even necessary, is far from finished. As this debate is largely theoretical in nature, it is often difficult to find evidence that distinguishes the two approaches, and it is not immediately apparent how data from acquisition may help distinguish them either. Furthermore, since this dissertation focuses on reconstruction with respect to binding theory (considered the domain of syntactic reconstruction by many), this debate is slightly orthogonal to the current study. However, in the interest of being complete, I will briefly outline the basic features of semantic reconstruction before turning to the empirical questions at hand.

As mentioned above, semantic reconstruction accounts largely focus on scope reconstruction (reconstruction for the purposes of deriving scope ambiguities), and several accept some syntactic reconstruction analysis (typically LF lowering or the copy theory of movement) to explain reconstruction effects with respect to binding theory

(Cecchetto, 2001; Cresti, 1995; Lechner, 1998; Rullman, 1995). Those who propose a single semantic mechanism to account for all reconstruction effects typically advocate a revised binding theory based on semantics/pragmatics as well. With respect to the approaches that propose distinct analyses for semantic (scope) versus syntactic (binding theory) reconstruction, evidence from reconstruction effects in the presence of weak islands is typically taken as support for their account. Specifically, Cinque (1990) notes that while scope reconstruction is sensitive to weak islands, reconstruction for the purposes of binding theory is not. For example, the scope of the how-many phrase in (13) (from Romero, 1998b) is not able to be reconstructed within the wh-island, but reconstruction for the purposes of binding theory is allowed across such islands, as in (14) (examples from Cinque, 1990):

(13) How many students do you wonder [whether I should talk to]?

a. For what number n: there are n-many students x such that you wonder whether I should talk to x.

b. *For what number n: you wonder whether it is necessary that there are n-many students x such that I talk to x.

(14) a. It is to herself$_i$ that I don't know [whether she$_i$ wrote].

b. *It is to her$_i$ that I don't know [whether Mary$_i$ wrote].

c. *It is to Mary$_i$ that I don't know [whether she$_i$ wrote].

In short, the reconstructed interpretation is disallowed for scope reconstruction in (13), but is forced for the binding theory examples in (14).

To account for scope reconstruction, semantic reconstruction analyses propose that the semantic type of the trace of movement determines the scope of the moved item. On this view, there are two distinct semantic types of trace: traces of individual type *e* (represented by lower case *t*) and traces of a generalized quantifier type <<*e*,<*st*>>,<*st*>> (represented by capital *T*). If a moved constituent leaves a trace of type *t*, it receives a non-reconstructed interpretation, taking scope in its landing site. If it leaves a *T* trace, it is interpreted as taking scope in its original position, therefore generating a reconstructed reading. Thus for scope reconstruction, it is the semantic type of the trace that determines whether the surface or reconstructed interpretation is generated, and for syntactic reconstruction, it is the syntactic position of the moved constituent at LF. While the necessity of two distinct mechanisms to account for scope reconstruction and reconstruction for binding theory has been questioned (Fox & Nissenbaum, 2004; Romero, 1998a,b), the debate continues. As this dissertation focuses on reconstruction for the purposes of binding theory, which is largely considered the domain of syntactic reconstruction, I will continue to assume a syntactic reconstruction framework based on the copy theory of movement.

1.3. Acquisition of Binding Theory

As discussed above, one type of structure that requires reconstruction for interpretation involves wh-questions with reflexives, pronouns, or names in the moved wh-phrase, as in (7), repeated below:

(7) a. [How proud of himself$_i$] was John$_i$?

b. *[How proud of him$_i$] was John$_i$?

c. *[How proud of John$_i$] was he$_i$?

The sentence in (7a) is grammatical because the anaphor is interpreted in a position where "John" c-commands the reflexive, thus satisfying Principle A. Likewise (7b) and (7c) are ungrammatical because the pronoun or name is interpreted in its original position where it is no longer free within its clause, thus violating Principles B or C respectively. Crucially, these judgments rely on knowledge of binding theory. Therefore in order to test whether children have reconstruction with respect to sentences like those in (7), it is necessary to first establish their knowledge of binding theory.

There is a large literature on children's acquisition of binding theory, which I briefly review here. The main point for present purposes is that taken together, this group of studies strongly suggests that the principles of binding theory are in place in children at the youngest age they are able to be tested on such structures. Certainly this is true for children's knowledge of Principles A and C (Principle B is a special case which will be discussed below). Therefore, sentences like those in (7) provide an appropriate means to test for children's knowledge of reconstruction.

Many studies have demonstrated young children's knowledge of Principle A (Chien & Wexler, 1990; Deutch, Koster, & Koster, 1986; Grodzinsky & Kave, 1993/1994; Jakubowicz, 1984; Solan, 1987; Wexler & Chien, 1985; among others). In an early study, Wexler & Chien (1985) had children act out commands given by a puppet ("Kitty") to probe their knowledge of binding theory. For example, in responding to a

sentence like (15), by age 4 and a half children reliably interpret Amy as the antecedent for the anaphor over Kitty:

(15) Kitty_i says that Amy_j should point to $\text{herself}_{*i/j}$.

Solan (1987) obtained similar results in a task where children manipulated stuffed animals and pictures of these animals in an act-out task (mean age 4;10 for the younger group tested)[10]. This evidence suggests that by age 5, children know that reflexives must be bound within their clause, and cannot be bound by an antecedent outside of it.

Grodzinsky & Kave (1993/1994) likewise demonstrated children's knowledge of Principle A in an experiment using a version of the TVJT where the child is asked to judge whether the puppet is accurately describing a picture being shown. The study aimed to establish whether children's success in previous experiments could be explained by an experimental artifact; namely, that children do not use Principle A to interpret reflexives, but rather, upon hearing the reflexive, automatically assign a reflexive interpretation, regardless of the antecedent binding the anaphor (Grimshaw & Rosen, 1990). On this account, children appear to have adult-like knowledge of Principle A, but only because there is always some self-action occurring in the context where children are judging the statement. This analysis therefore predicts that children should accept a statement like (16) even when the picture depicts a character other than Danny washing himself:

[10] Chien & Wexler (1990) found children younger than age 5 to have difficulty ruling out binding by a non-local antecedent for reflexives in a study using the TVJT methodology (this pattern was even more robust for cases where the local antecedent was quantificational). Thornton & Wexler (1999) suggest that this result arose due to younger children having trouble with the task. In any event, children aged 5 and older demonstrated adult-like knowledge of Principle A for both quantificational and non-quantificational antecedents.

(16) Danny is washing himself.

Grodzinsky & Kave tested Hebrew-speaking preschoolers on items like (16) with an overt reflexive, as well as items where the verb had morphological reflexive marking (and no separate overt reflexive), which are very common in Hebrew. In both cases, children appropriately rejected the statement when the picture showed a character other than the subject of the test sentence performing the self-action as often as they rejected it when the picture showed one character performing the action on another. Thus children must not be using the strategy suggested by Grimshaw & Rosen to interpret reflexives: they know to interpret reflexives as being bound by their local antecedent.

Several studies have likewise shown children to have adult-like knowledge of Principle C (Crain, 1991; Crain & McKee, 1985; Crain & Thornton, 1998; Guasti & Chierchia, 1999/2000; Kazanina, 2005; Thornton, 1990). For example, Crain and McKee (1985) used the TVJT to test 4-year-olds on sentences that contained an R-expression that was not free (violating Principle C) versus sentences that had free R-expressions. The results showed that 4-year-old children appropriately rule out coreference between an R-expression and pronoun when their configuration violates Principle C (when the pronoun c-commands the R-expression), but not otherwise. In other words, children rejected the sentence in (17a), but accepted (17b):

(17) a. *He$_i$ ate the hamburger when the Smurf$_i$ was inside the fence.

b. While he$_i$ was dancing, the Ninja Turtle$_i$ ate pizza.

Unlike (17a), in (17b) the pronoun “he” does not c-command “the Ninja Turtle,” so no Principle C violation occurs, and children correctly accept the coreferential reading. This

finding was replicated by Guasti & Chierchia (1999/2000), who demonstrated the same effect in Italian-speaking preschoolers.

Most of the literature on children's acquisition of binding theory concentrates on the finding that preschool-aged children fail to consistently demonstrate knowledge of Principle B, in contrast to Principles A and C (Avrutin & Thornton, 1994; Chien & Wexler, 1990; Deutch, Koster, & Koster, 1986; Jakubowicz, 1984; McDaniel, Cairns & Hsu, 1990; McDaniel & Maxfield, 1992; Solan, 1987; Thornton, 1990; Thornton & Wexler, 1999; Wexler & Chien, 1985; among others). For example, Chien and Wexler (1990) found that children systematically accept a sentence like (18) on an interpretation where Mama Bear is washing herself, in apparent violation of Principle B:

(18) Mama Bear is washing her.

This "delayed Principle B effect" has likewise been shown cross-linguistically (Avrutin & Wexler, 1992 for Russian; Koster, 1994; Philip & Coopmans, 1996; Zuckerman, Vasic & Avrutin, 2002 for Dutch; Sigurjónsdóttir & Coopmans, 1996 for Icelandic). However, most of these studies have also gone on to replicate Chien and Wexler's (1990) result that children only fail to demonstrate knowledge of Principle B in the presence of a non-quantificational antecedent; when the antecedent is quantificational, they appropriately reject sentences that violate Principle B. In short, while children often accept coreference in (18), they reject (19) on a reading where every bear is washing herself[11]:

(19) Every bear is washing her.

[11] A recent survey of the acquisition of Principle B literature (Elbourne, 2005) suggests that this reported asymmetry between children's performance when faced with quantificational versus non-quantificational antecedents may be an experimental artifact. This analysis will be discussed further in Chapter 2.

While many proposals have been developed to account for this asymmetry between quantificational and non-quantificational antecedents with respect to Principle B, most consider these results evidence that children in fact have Principle B, and some other (likely pragmatic) factor accounts for their non-adult-like performance on sentences like (16) (Avrutin, 1994; Chien & Wexler, 1990; Grodzinsky & Reinhart, 1993; Thornton & Wexler, 1999). The reasoning is that the only way to get coreference between a quantificational antecedent and a pronoun is for the antecedent to bind that pronoun; children correctly recognize that such binding would violate Principle B and do not allow it. However, for a sentence like (18), there may be means other than binding to establish coreference between "Mama Bear" and "her" (e.g. each receives a different index that happens to be assigned to the same entity), and children have not yet acquired the pragmatic machinery that typically rules out such sentences. In other words, (18) may not be ruled out strictly by Principle B (even for adults), while (19) uncontroversially is. Regardless of the particular account assumed, the crucial point for present purposes is that the preponderance of evidence strongly suggests children have all three principles of binding theory in place at a young age, including Principle B (when tested in unambiguous environments).

1.4. Acquisition of Reconstruction

Having established children's command of binding theory, it is now possible to examine what children know about reconstruction. As mentioned previously, few studies have systematically tested children on sentences requiring reconstruction. However,

there are some studies of children's interpretations of sentences involving reconstruction to compute scopal relations, as well as a few examining children's knowledge of reconstruction in structures subject to binding theory. Taken together, they suggest child grammars do include reconstruction.

1.4.1. Reconstruction and Scopally Ambiguous Sentences

As mentioned earlier, several studies testing children's knowledge of reconstruction in sentences with quantifier scope ambiguities show that in contrast to adults, children fail to consistently access the reconstructed, inverse scope interpretation for sentences like (2) (repeated below) (Lidz & Musolino, 2002; Musolino, 1998; Musolino, Crain, & Thornton, 2000; Musolino & Lidz, 2003):

(2) Every horse didn't jump over the fence.

(i) None of the horses jumped over the fence. (**surface scope**) (EVERY > NOT)

(ii) Not every horse jumped over the fence. (**inverse scope**) (NOT > EVERY)

The fact that children fail to access the inverse scope interpretation of sentences like (2) initially called into question whether children's grammars include reconstruction (at least for sentences with quantifier-scope ambiguities). However, subsequent studies demonstrated that children *can* access the reconstructed interpretation of such sentences given a context that sets an expectation for this reading (Musolino & Lidz, 2004). Likewise adults, while able to access both scopal interpretations, have been shown to actually prefer the surface scope interpretation for certain structures, as children do (Musolino & Lidz, 2003). These results suggest that the difference between children and

adults with respect to their interpretations of scopally ambiguous sentences lies not in their grammars (both groups, given the right context, will accept both interpretations) but rather in their preference for one reading over the other. In short, children are simply not able to override their preference for surface scope as easily as adults are.

1.4.2. Reconstruction and Binding Theory

The most comprehensive study involving children's knowledge of reconstruction with respect to binding theory focused on Principle C in contexts that either required reconstruction for interpretation or not. Guasti and Chierchia (1999/2000) tested Italian-speaking preschool-aged children in a series of studies using both elicited imitation and TVJT methodologies. They found that as soon as children demonstrated knowledge of Principle C in non-reconstruction environments, they also demonstrated it in environments requiring reconstruction. In other words, once children ruled out a sentence like (20a) they also ruled out (20b)[12]:

(20) a. *He$_i$ put a gun in every pirate's$_i$ barrel. (**non-reconstruction**)

b. *In every pirate's$_i$ barrel, he$_i$ put a gun. (**reconstruction**)

Guasti and Chierchia take these results as evidence supporting an analysis of reconstruction under the copy theory of movement (Chomsky 1993, Fox 1999). On this view, the LF structure for (20a) and the reconstructed LF for (20b) are virtually identical, therefore one would predict that a ruling out of the two should be uniform, as Guasti &

[12] Guasti and Chierchia present data from sentences involving PP-preposing and scope ambiguities (from Chierchia, 1995) as evidence that sentences like (18b) involve reconstruction.

Chierchia found. Assuming PP-preposing involves movement, these results provide evidence that children have reconstruction as part of their grammar.

Similar results emerged from an early set of studies on children's acquisition of anaphora (Lust & Clifford, 1982, 1986; Lust, Loveland & Kornet, 1980). Without explicitly intending to test the acquisition of reconstruction, these studies used elicited imitation and act-out tasks to determine how children (ages 3-9 years) would interpret pronouns in a variety of syntactic environments. While the elicited imitation tasks showed children to have an easier time imitating grammatical instances of forwards anaphora (21a) as opposed to backwards anaphora (21b), the act-out task demonstrated that children appropriately ruled out coreference in configurations that would violate Principle C regardless of the surface order of the pronoun and R-expression (22):

(21) a. Oscar$_i$ bumped the wall when he$_i$ found the penny.

b. When he$_i$ closed the box, Cookie Monster$_i$ lay down.

(22) a. *He$_i$ rolled over when Big Bird$_i$ opened the box.

b. *On top of Ernie$_i$'s head, he$_i$ rubbed the tissue.

c. *Under Cookie Monster$_i$, he$_i$ threw the donut.

Again assuming a movement analysis of PP-preposing (which is not uncontroversial with respect to PP-adjuncts like those in (22)), the fact that children rejected the coreferential interpretations of the sentences in (22b) and (22c) suggests they have reconstruction as part of their grammar. Children demonstrated knowledge of Principle C in rejecting (22a), and demonstrated knowledge of reconstruction by likewise ruling out (22b) and (22c) (where a Principle C violation only arises on the reconstructed reading). Taken

together with the Guasti & Chierchia study, these results provide evidence for children's command of reconstruction. The current study aims to add to the literature on the acquisition of reconstruction by testing children on sentences that uncontroversially involve syntactic movement, and that children are highly familiar with, namely, wh-questions.

As with many movement structures, wh-questions provide an interesting challenge for language learners because their interpretation involves two structural positions. Wh-phrases are simultaneously associated with their surface position, where the wh-operator takes scope over the rest of the sentence, and their underlying position, where they are interpreted as an argument of the verb they are associated with (in the case of wh-arguments). As demonstrated earlier, reconstruction thus requires children to put together knowledge from two separate domains: knowledge of syntactic movement, and knowledge of binding theory. Previous studies have shown children to have knowledge of binding theory at a young age. Therefore the focus of the current study will be on children's knowledge of movement, and specifically their knowledge of whether a moved item may be interpreted in its original, reconstructed position.

1.4.3. The Current Study

As mentioned earlier, scopally ambiguous sentences are subject to some controversy with respect to the mechanism that derives their ambiguity (semantic versus syntactic reconstruction). In order to first establish children's knowledge in a less controversial domain (where syntactic reconstruction is largely assumed to apply), this dissertation focuses on reconstruction with respect to binding theory. As mentioned above, it also

focuses on wh-questions, as these are the prototypical examples of syntactic movement, and are structures children are highly familiar with. For the current study, a series of experiments using a combination of the truth value judgment task (Crain & McKee, 1985; Crain & Thornton, 1998) and the questions after stories task (de Villiers & Roeper, 1996) was conducted to test children's knowledge of reconstruction and compare it to that of adults. Both groups were tested on statements subject to binding theory (to establish knowledge of the binding principles) and on corresponding questions (to establish knowledge of reconstruction). In addition, performance on items with moved predicates (where reconstruction appears to be obligatory) was compared to items with moved arguments (where reconstruction does not appear to be obligatory). To examine the apparent asymmetry between reconstruction in Principle A versus Principle C environments for moved arguments, a variety of binding theoretic environments were tested. Experiments 1-4 provide an initial characterization of children's knowledge of reconstruction in structures subject to Principles A, B and C. Based on their results, Experiments 5-6 were designed to more precisely characterize both children's and adults' preferences when reconstruction is not obligatory. In the end, both the child and adult data shed light on theoretical analyses of movement and reconstruction, as well as more general parsing strategies.

1.5. Summary

The results of this series of experiments show that preschool-aged children do have reconstruction as part of their grammar. They are adult-like in consistently

accessing the reconstructed interpretation of sentences where reconstruction is obligatory, as in cases where it is required to satisfy binding theory, or required because the moved element is a predicate. However, when reconstruction is not obligatory, children's and adults' preferences differ. These experiments show that there actually is no asymmetry between Principles A versus C for moved arguments: adults optionally reconstruct in both environments. For children, reconstruction of moved arguments was not only optional, it was actually dispreferred: they consistently fail to access the reconstructed interpretation when a non-reconstructed reading is available, going so far as to reject sentences as false when the context makes only the reconstructed interpretation true. Adults, on the other hand, are shown to have conflicting preferences across two of the studies, preferring the reconstructed interpretation of matrix questions subject to Principle C, but the surface interpretation of sentences with embedded questions subject to Principle A. Thus children and adults differ in their preferences for reconstruction of moved arguments in the Principle C experiment, but have similar preferences in the Principle A embedded question experiment. While both groups show an argument/predicate asymmetry (obligatorily assigning the reconstructed reading to moved predicates), it is their interpretation of moved arguments that provides an interesting means for evaluating the competing grammatical and processing constraints they use to generate these readings.

Various theoretical analyses of movement and reconstruction are considered as possible accounts of the current data. In the end, several are adopted. Specifically, the analysis in Heycock (1995), that predicts reconstruction to be obligatory for

nonreferential moved constituents (like moved predicates), is most explanatory with respect to the observed predicate/argument asymmetry. For moved arguments, where reconstruction was shown to be optional, adults' preference for reconstruction in Principle C environments seems best explained by an economy consideration along the lines of Chomsky (1993), which assumes under the copy theory of movement that that the restrictor of the wh-phrase is preferentially interpreted in the lower copy. In contrast, adults' preference for the surface interpretation of Principle A embedded questions is shown to be best accounted for by a processing account; here their apparent preference for the surface interpretation is actually a preference for resolving the anaphor's antecedent as quickly as possible.

Children's preference for surface structure in all cases where a surface reading is licensed is also attributed to parsing strategy. As in the studies of children's interpretations of scopally ambiguous sentences mentioned above, children have a strong preference for the surface reading, even though they clearly have access to the operation that generates the reconstructed interpretation. That children persist with the surface reading over a competing non-reconstructed interpretation is in line with previous psycholinguistic studies that show children to have a difficult time revising their initial parse of a sentence. It seems plausible that children's initial parse would correspond as directly as possible to the input, and therefore reflect surface structure. Thus children's preference for the surface interpretation is not a reflection of their grammatical knowledge, but rather is a result of their parsing strategy. In effect, their parsing

preference for the surface structure interpretation when it is licensed, and their inability to revise this parse, masks their adult-like knowledge of reconstruction.

After weighing various proposals and establishing a theoretical account of the results obtained in Experiments 1-6, questions of learnability are addressed. Specifically, possibilities for how children come to have knowledge of reconstruction and the various restrictions associated with it are outlined. The results of a corpus study examining the input children receive that might reveal reconstruction are reported, which show children to receive virtually no input that might lead them to posit the knowledge they have acquired. A proposal for how children might use knowledge of simpler syntactic structures combined with knowledge of Universal Grammar to arrive at this complex system follows, showing children's adult-like command of reconstruction to fall out naturally as a result. That children are shown to differ from adults in consistently favoring a surface interpretation when licensed is again the result of their parsing preference for surface structure and limited ability to revise their initial parse of a sentence. As children's processing capacity expands with maturation, so does their ability to revise this initial parse. Therefore as they grow older, children's parsing strategies interfere less with their ability to demonstrate knowledge of reconstruction in a full range of structural environments.

This dissertation will be organized as follows. Chapter 2 reports on the design, execution, and results from Experiments 1-4, which test reconstruction with respect to Principles A, B, and C in monoclausal structures. Chapter 3 discusses Experiments 5-6,

which explore preferences with respect to reconstruction in structures where it is not obligatory. This discussion is followed by a theoretical analysis of all experiments. Chapter 4 reports results from a corpus study, and also addresses questions of learnability: in short, how children might learn the system they have acquired with respect to reconstruction. Chapter 5 concludes the dissertation, outlining open questions.

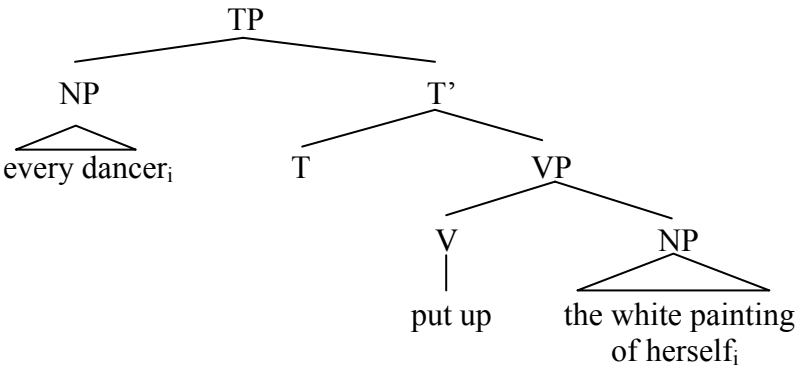
CHAPTER 2

Children's knowledge of reconstruction is examined below through a series of experiments featuring items subject to binding theory. Adults' and children's interpretations of statements subject to either Principles A, B or C are compared to their interpretation of corresponding questions involving reconstruction. The statements are included to verify knowledge of the binding theory principles, while the questions are used to establish knowledge of reconstruction. Both groups are tested on items with moved predicates, where reconstruction is said to be obligatory, as well as moved arguments (picture-NP's), where reconstruction may be optional. The results show that children, like adults, have reconstruction as part of their grammar. The predicted asymmetry between moved predicates and moved arguments likewise emerges, as both groups consistently assign the reconstructed interpretation to items with moved predicates, but allow for the non-reconstructed interpretation for moved arguments. However, while adults appear to prefer the reconstructed interpretation for wh-arguments, children are shown to actually prefer the non-reconstructed interpretation when reconstruction is not obligatory. In other words, children disprefer the reconstructed reading when an alternative non-reconstructed interpretation is available. Analyses of children's and adults' preferences with respect to optional reconstruction are further discussed in Chapter 3.

2.1. Experiment 1

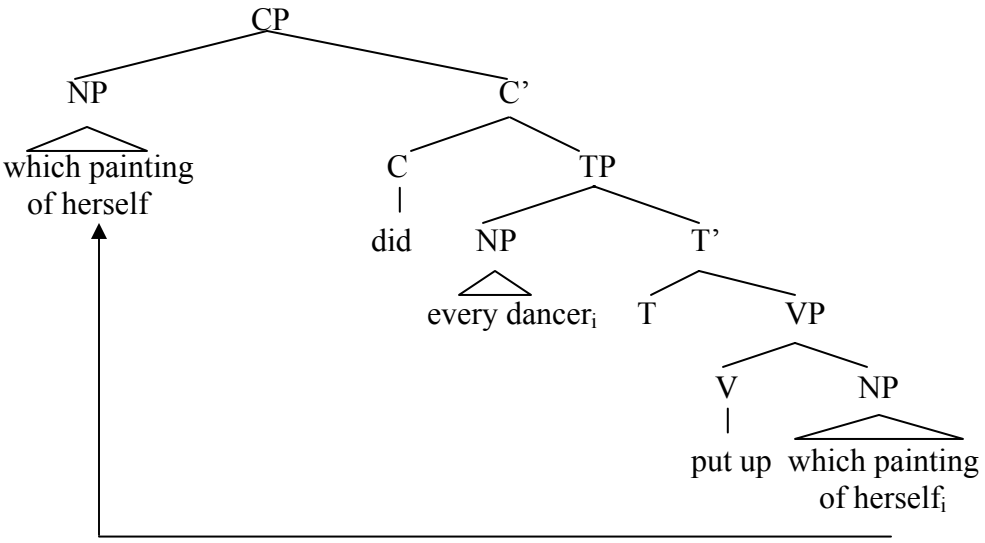
The first experiment in this series examines children's knowledge of reconstruction with respect to Principle A of the binding theory, which observes that a reflexive pronoun must be bound (c-commanded by and coindexed with) an antecedent within its clause. As mentioned above, previous studies testing children on sentences that do not require reconstruction show children to have knowledge of Principle A. The current study aims to replicate those results by testing statements subject to Principle A, as in (23).

(23) Every dancer$_i$ put up the white painting of herself$_i$.



In (23), "every dancer" c-commands the reflexive "herself," and the sentence is grammatical. As mentioned in Chapter 1, however, the corresponding question in (24) is likewise grammatical, which is only predicted if the anaphor is interpreted in its reconstructed position:

(24) Which painting of herself$_i$ did every dancer$_i$ put up?



The question in (24) is just as grammatical as the statement in (22), despite the fact that the antecedent "every dancer" does not c-command "herself" in the surface form of the sentence. The Principle A violation is avoided via reconstruction, which allows the anaphor to be interpreted in its original position, where it can be bound by "every dancer." Experiment 1 seeks to establish children's knowledge of Principle A by testing their performance in non-movement environments like (23), and having established this knowledge, tests their knowledge of reconstruction with wh-questions that require reconstruction for interpretation, like (24).

It is worth noting that the status of Principle A is not uncontroversial. Some researchers claim that certain instances of anaphors are exempt with respect to binding theory (Goldwater & Runner, 2004; Pollard & Sag, 1992; Reinhart & Reuland, 1993; Runner, 1998). In particular, anaphors occurring in picture-NP's (e.g., "picture of himself," "painting of herself," "article about himself," etc.) are said to be capable of

violating binding theory, and do not necessarily require a c-commanding antecedent. These anaphors, like pronouns, may either receive a bound interpretation (in which case they require a c-commanding antecedent), or a coreferential interpretation with their antecedent (which crucially does not require c-command). Nevertheless, outside of these "binding theory exempt" (Pollard & Sag, 1992) or "logophoric" (Reinhart & Reuland, 1993) uses, all other uses of anaphora are said to be subject to the structural constraint given in Principle A.

In order to avoid the potential confounds associated with exempt anaphora, the current experiment was designed to elicit only the bound interpretation of reflexives. By using quantificational antecedents, which are not candidates for a coreferential interpretation, this potential problem was averted. Furthermore, given the debate surrounding picture-NP's, the experiment was designed to include structures whose structure is less controversial with respect to Principle A, like the predicate structures below:

(25) Every hippo$_i$ was very proud of herself$_i$.

(26) How proud of herself$_i$ was every hippo$_i$?

Predicate questions were also included in Experiment 1 because as mentioned above, it has been claimed that reconstruction is obligatory for moved predicates (as in (26)) (Barss, 1986, 1988; Cinque, 1984; Heycock, 1995; Huang, 1993; among others). It should be noted, however, that the reported argument/predicate asymmetry does not apply in the case of mono-clausal questions subject to Principle A, as in (24) and (26). Because the anaphor contained in the wh-phrase requires binding by a local antecedent to

satisfy Principle A, reconstruction is forced for both predicates and arguments in this structural environment. Nevertheless, in order to provide a full characterization of each participant's knowledge, all participants in Experiment 1 were tested on both question (reconstruction) and statement (non-reconstruction) structures for both argument and predicate embedding contexts.

2.1.1. Method and Design

Both child and adult participants in this experiment were tested using the truth value judgment task (TVJT) and questions after stories task. In this method, participants are asked to watch a story that is acted out by one experimenter using toys as props. Another experimenter controls a puppet (Elmo, in this case), who watches the story too. The puppet provides a means of establishing the task as a game for child participants, and to put them more at ease in the testing environment. Participants are told the puppet is learning, and sometimes needs help understanding things, therefore it is the participant's job to help the puppet understand the story. After each story, the puppet makes a statement (typically the target sentence being tested) about what he thinks happened, which the participant is asked to accept or refute. The task is set up so the participant rewards the puppet with one item (in this case, a plastic cookie) if he is right, and a different item (in this case, a cardboard carton of milk) if he is wrong. Participants are periodically asked to justify their answers (and are always asked when saying the puppet is wrong) in order to ensure they understood the story and target sentence as expected, as well as to keep them engaged in the task. Use of the puppet allows children who may be

reluctant to correct an adult experimenter to instead correct the "silly" puppet, therefore minimizing the chance that children will simply accept all of the test items.

In order to best gauge the participant's knowledge of the grammatical principle at hand, the stories are constructed so that on one logically possible interpretation of the target sentence it should be judged true, but given another possible interpretation it should be judged false, thus satisfying the TVJT's condition of falsification. Furthermore, the characters in the stories always entertain the possibility of acting in accordance with both interpretations, but crucially only end up choosing one of these paths of action. This contemplation of a decision between two possibilities satisfies the TVJT's requirement of plausible dissent. An example story will help illustrate. Note that the stories in this experiment always featured a set of 3 similar characters (the group) and a single distinct character (the lone character) of the same gender. For the stories corresponding to argument test sentences, like those in (23-24) (repeated below), there were also two pictures, articles, videos, or in this case, paintings (one red, one white) corresponding to each member of the group (here, three dancers) and six corresponding to the lone character (Miss Cruella):

(23) Every dancer put up the white painting of herself.

(24) Which painting of herself did every dancer put up?

In this story, Miss Cruella is a dance teacher, and announces to the dancers they have been elected the best dancers in their dancing school. As a reward, they each get to put up a painting with their picture in it. All are faced with a choice between two possible paintings, one red and one white; they each may only put up one of the two paintings.

But Miss Cruella also wants to make sure people don't forget who their teacher is, so she requires the dancers to each pick out one painting with Miss Cruella's picture in it, and put that up next to their own (there are 3 red paintings with Miss Cruella, and 3 white). Each dancer then proceeds to pick out two paintings: one with their own picture in it, and one with Miss Cruella's. After deliberating a bit, each dancer takes a turn putting up the white painting of herself, and a red painting of Miss Cruella (crucially, each possibility is entertained, satisfying the TVJT's requirement of plausible dissent). The puppet then utters the test sentence in (23). If the participant has interpreted "herself" as bound by "every dancer" (as expected), she will accept that sentence as true, since every dancer did put up the white painting of herself. If, however, the participant takes "herself" to mean something like "her," referring instead to Miss Cruella, she should judge the sentence false (since every dancer put up the red painting of Miss Cruella). Crucially, on one interpretation the sentence is true, and on the alternative interpretation the sentence is false, satisfying the condition of falsification.

The stories for the predicate-type target sentences resemble those designed for the argument items, in that each features a set of 3 characters with another lone character of the same gender. For the sentences in (25-26), the story featured three (female) hippos and their friend Miss Cow:

(25) Every hippo was very proud of herself.

(26) How proud of herself was every hippo?

In this scenario, Miss Cow challenges the hippos to participate in a rock-pushing contest, to see if they can each push a rock past a designated finish line. The hippos think the

rocks look very heavy, and are not sure they would be able to push them past the finish line, but agree to try. Miss Cow volunteers to go first and show them how rock-pushing is done. The hippos reiterate how heavy the rocks look, and say they would be very proud about anyone who pushed their rock all the way past the finish line, and they would even be a little bit proud about anyone who just managed to push their rock a little bit. Miss Cow goes first, struggles, and finally pushes the rock past the finish line. The hippos say they are very proud Miss Cow was able to push the rock past the line. Then the hippos push the rocks, but only push them a little ways (they do not make it past the line). The hippos are disappointed, but finally agree they are a little proud about what they did; after all, they did manage to push the rocks a little ways. The puppet then utters the sentence in (25). If the participant has interpreted "herself" as being bound by "every hippo," this sentence should be judged false (since every hippo was only a little proud of herself). However, if the participant lacks Principle A and interprets "herself" as referring to Miss Cow, then the sentence should be judged true (since every hippo was very proud of Miss Cow).

Because the current study concerns reconstruction effects in wh-question contexts, it was necessary to modify the TVJT to be able to test questions in addition to statements. Questions are inappropriate for the TVJT because they require an answer, and cannot be simply judged true or false. Thus to accommodate questions, the TVJT was combined with the questions after stories task (de Villiers & Roeper, 1996). Participants were told that after hearing each story, the puppet could first ask them one question about what happened. The participant was to answer that question, after which

the puppet would say what he thought happened, and the regular TVJT method would be followed with rewarding the puppet, asking for justification for the participant's answer, etc. Crucially, only one of the post-story sentences, either the question or the statement, was a test item of the type given in (23-26). The other item was considered a filler. Fillers were designed to test whether the participant was paying attention and understood the story correctly, and whether the participant understood the quantifier "every." Statement fillers were varied so that if a participant answered that the statement for the previous item was true, the version of the filler statement the puppet uttered would be false, thus ensuring a roughly equal mix of true and false statements throughout the session. Participants who incorrectly answered two fillers or more were excluded from the study results. A complete list of test sentences and fillers is given in Appendix A.

At the beginning of each session, the participant would receive two warm-up items. These were designed to familiarize the participant with the task and ensure against any "yes" or "no" bias by giving the participant an opportunity to reject one of the puppet's statements and accept another in relatively simple contexts. For the test items, as mentioned above, participants responded to both questions and statements, for both arguments and predicates. In other words, both sentence type (question versus statement) and the type of phrase the reflexive was embedded in (predicate versus argument) were within subjects factors: each participant received two predicate questions, two argument questions, two predicate statements, and two argument statements for a total of eight test items. Test items were varied so that half of the participants responded to the question version of a particular item (as in (24) and (26)) and half of the participants judged the

statement version of an item (as in (23) and (25)). Statement items were also varied so that a given participant heard two statements predicted to be judged true, and two statements predicted to be judged false. This was done to ensure participants' knowledge of Principle A, which is only verifiable when participants both accept statements that obey Principle A and reject those that do not. Finally, the order in which the items were presented was varied across subjects, with half receiving the items in one order, and half receiving them in the reverse order, to control for any ordering effects.

Directly before each test item, whether it was a question or statement, the puppet would recap the story by naming all of the characters (e.g. "That was a story about the three hippos and Miss Cow. And now here's my question/here's what I think happened…"). Because it is the participants' interpretation of the reflexive that is in question, it was crucial to make sure all of the logically possible antecedents were made linguistically salient prior to hearing the test item. The puppet always named the character who was predicted *not* to be chosen as the antecedent last, so as to increase that character's salience. This way any bias for choosing an antecedent based on extraneous factors was weighted against the expected interpretation, ensuring the participant's answer reflected their grammatical knowledge, and was not an artifact of the experiment. Child participants responded orally to all items, with their answers recorded by the puppet experimenter. During the rare times a child failed to initially provide a response to a question item, the experimenter would prompt him by giving both possible answers as a choice (e.g. after hearing "How proud of herself was every hippo?" the experimenter would follow up with "a little bit proud, or very proud?"). Before repeating any test item,

due to either a participant's request or because the participant failed to initially answer, the experimenter would repeat the recap sentence naming the characters. Adult participants, who were often run more than one at a time, responded to the test items in written form. There was no separate puppet experimenter for the adult participants; a single experimenter both told the stories and afterward controlled the puppets reaction and comments. Adults were asked to provide written justifications for their answers on an answer sheet.

2.1.2. Results

Twenty-six preschool-aged children (15 female, 11 male; mean age 4;6) and 24 Northwestern undergraduates participated in this study. Two children were excluded from the final analysis for incorrectly judging the truth or falsity of more than one filler item. As expected, the adults were at ceiling in accepting the bound interpretation of the reflexive across all conditions: they correctly assigned the bound interpretation to the reflexive 100% for argument statements, 98% of the time for argument questions, 98% of the time for predicate statements, and 100% of the time for predicate questions. Due to the small number of observations in each condition (only two per participant for argument statements, argument questions, predicate statements, and predicate questions), a continuous normal distribution could not be assumed, and non-parametric statistical analysis was used. Using the Wilcoxon signed-ranks test, no significant differences were found between adult performance on questions versus statements for argument items ($Z = 1$, $p = .317$) or for predicate items ($Z = 1$, $p = .317$). Adults did, however, outperform children overall ($Z = 3.861$, $p < .001$), as would be expected.

Children patterned with adults in consistently accessing the bound interpretation of the reflexive equally across all conditions, even if their performance was not quite as perfect. They assigned the bound interpretation 73% of the time in the argument statement condition, 71% of the time in the argument question condition, 79% of the time in the predicate statement condition, and 73% of the time in the predicate question condition. Thus children accessed the bound interpretation as often for questions as they did for statements: no significant differences were found for their performance on questions versus statements for argument items ($Z = .258$, $p = .796$) or for predicate items ($Z = .758$, $p = .448$).

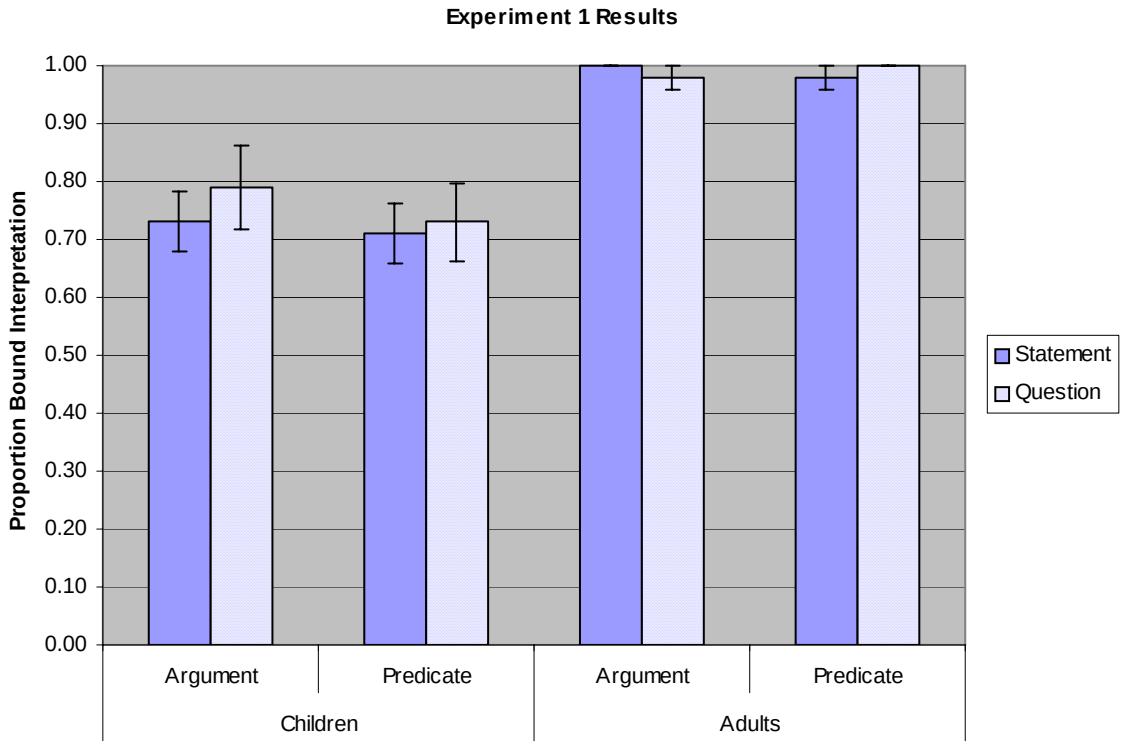


Figure 1. Mean proportion bound interpretation responses for child (n = 24) and adult (n = 24) groups for statements and questions subject to Principle A in argument and predicate conditions.

Thus like adults, children performed equally well on both statements and questions in both embedding contexts.

2.1.3. Discussion

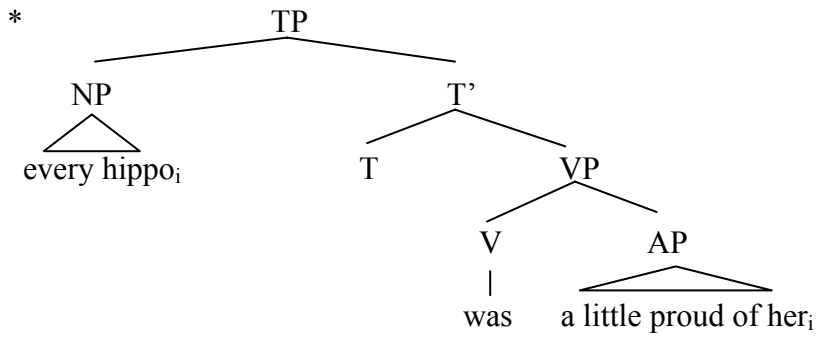
Children's performance in Experiment 1 supports the claim that they have reconstruction as part of their grammars. As expected, their performance on statements establishes their command of Principle A. Given this knowledge, the fact that children also access the bound interpretation of the reflexive in the question items at an equal rate can be taken as

evidence that they have reconstruction. Recall that the only way to generate a bound interpretation of the anaphor in this experiment, as children consistently did, is to interpret the anaphor in its pre-movement position. Therefore the fact that children assigned the bound interpretation equally to both statements and questions provides evidence that they have reconstruction as part of their grammar. While children's overall accuracy was consistently lower than the adults', such a result is not entirely unexpected given the complexity of the stories and target items, as well as the added burden of having to both answer questions and judge the truth/falsity of statements in this task. Indeed after a total of ten stories, most children were approaching the limit of their attention span. Nevertheless, children succeeded in demonstrating adult-like knowledge of reconstruction in Experiment 1.

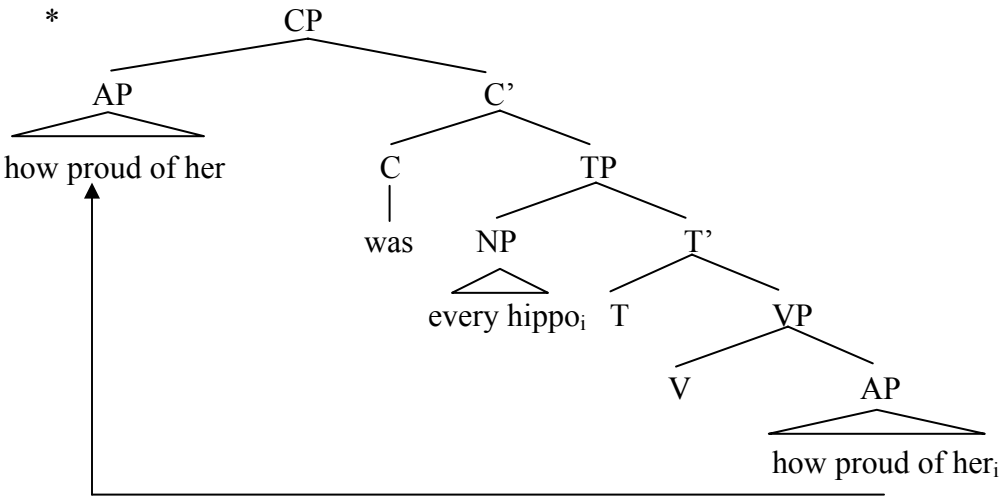
2.2. Experiment 2

In Experiment 2, children's and adults' knowledge of reconstruction was tested in sentences subject to Principle B. Recall that Principle B observes that a pronoun must be free within a local domain; in other words, it may not be bound by a co-indexed antecedent. The sentences in (27-28) illustrate:

(27) *Every hippo$_i$ was a little proud of her$_i$.



(28) *How proud of her$_i$ was every hippo$_i$?



In (27), "every hippo" c-commands "her," ruling the sentence out by Principle B. The question in (28) is likewise ungrammatical, despite the fact that "every hippo" does not c-command the pronoun in the surface structure of the sentence. Again, this ungrammaticality may be explained by appealing to reconstruction: "every hippo" does c-command "her" when the pronoun is in its base position, resulting in a Principle B violation. Of course, (28) is also ungrammatical even on the surface, non-reconstructed interpretation, since "every hippo" fails to c-command the pronoun in its surface position,

and therefore cannot bind it. This confound is one reason why questions subject to Principle B are generally dispreferred as diagnostics for reconstruction (this will be further discussed in section 2.2.3.). Nevertheless, Experiment 2 was included in this series for two primary reasons: first, doing so provides the most general coverage of reconstruction in structures subject to each of the principles of binding theory. Second, it allows this study to serve as a point of comparison for Experiment 1, as it employs the same materials and method as the previous experiment, only substituting the pronoun for the anaphor in the test items. Demonstrating that participants access the free interpretation in Experiment 2, as opposed to the bound interpretation in Experiment 1, provides explicit evidence that the form of the pronominal matters to adults as well as children, and that their interpretations are not being guided by extraneous experimental artifacts, but rather by their grammar.

2.2.1. Design

As discussed above, it is well established that preschool-aged most reliably demonstrate knowledge of Principle B in the presence of a quantificational antecedent; that is, they rule out sentences like (19) on an interpretation where every bear is washing herself, but often accept an interpretation where Mama Bear is washing herself for (18):

(18) Mama Bear is washing her.

(19) Every bear is washing her.

In short, in contexts where the antecedent is a name, children quite often appear to violate Principle B. While debate continues over the explanation for this effect, many studies have established that in cases where the antecedent is quantificational, children perform

like adults in obeying Principle B. Thus to avoid presenting participants with items that may obscure their knowledge of Principle B, quantificational antecedents were used in Experiment 2.

The design of Experiment 2 closely follows the design of Experiment 1. The TVJT/questions after stories task was again used, where participants answered one question and judged the truth/falsity of one statement after each story. Participants received 8 test items, both questions and statements, and with pronouns embedded in both arguments and predicates. Items were varied so half of the participants heard the question version of a particular item, and half heard the statement version. Statement items were varied so participants would both have an opportunity to demonstrate knowledge of Principle B by rejecting statements that violated Principle B and accepting statements that did not. The stories closely mirrored the contexts used in Experiment 1. For the argument items, the stories were in fact identical to those used in the previous experiment. Thus for the target sentences in (29-30), the story again featured 3 dancers and Miss Cruella.

(29) Every dancer put up the white painting of her.

(30) Which painting of her did every dancer put up?

In this story, the three dancers each put up the white painting of themselves, and a red painting of Miss Cruella. Therefore, when presented with the statement in (29), if the participant knows Principle B, she will rule out the bound interpretation of "her" and judge the sentence to be false (since "her" cannot refer to every dancer by Principle B, and every dancer put up a red painting of Miss Cruella). If the participant does not have

Principle B, nothing rules out a bound interpretation, so participants may be expected to accesses a bound interpretation of "her" and judge the sentence to be true (since every dancer put up the white painting of herself). For the question version of this item, if the participant has reconstruction (assuming she also has Principle B), she should answer "the red one," since "her" must be interpreted as referring to Miss Cruella. If the participant does not have reconstruction, however, she should answer the same: while a bound interpretation of the pronoun is not ruled out by Principle B, it is still ruled out because "every dancer" fails to c-command "her" in the surface structure of the sentence. Thus with or without reconstruction, participants are expected to assign a free interpretation to the pronoun, as mentioned above.

Stories for the predicate items also closely mirrored those used in the first experiment. Thus for items like those in (27-28) (repeated below), the story once again featured Miss Cow and the three (female) hippos:

(27) Every hippo was a little proud of her.

(28) How proud of her was every hippo?

Recall in the Experiment 1 version of this story, Miss Cow challenges the three hippos to a rock-pushing contest. The hippos agree, and say they would be very proud if anyone succeeded in pushing such a heavy rock past the finish line, and they would even be a little bit proud about anyone who just managed to push their rock a little bit. In the Experiment 1 version, Miss Cow makes it past the finish line, so the hippos are very proud of her, but the hippos fail to push the rocks past the line, so they are just a little bit proud of themselves. When piloting this study with adults, using the story as it was

designed for Experiment 1 along with the test sentence in (27), a problem became apparent due to the scalar implicature evoked by the test item. Thus when the puppet said after hearing the story, "every hippo was a little proud of her," even if participants interpreted "her" as referring to Miss Cow (as expected), they did not necessarily judge the statement to be false. If a participant thought that being very proud of Miss Cow entailed that the hippos were also a little bit proud, they judged the sentence to be true (e.g., reasoning that it was true that every hippo *was* a little proud of Miss Cow, in fact, they were *very* proud).

To eliminate this potential confound, the stories were modified so that the lone character always failed in the task at hand, making the three characters a little proud, pleased, etc. with the lone character, and the three characters always succeeded, making them very proud, pleased, etc. with themselves. In this way, the sentence in (27) would be expected to be judged true if the participant has Principle B (since every hippo was a little proud of Miss Cow), and false if not (since every hippo was very proud of herself). In the version of the statement the participant is predicted to reject if she has Principle B, the adverb is simply changed from "very" to "a little," as in (27'):

(27') Every hippo was very proud of her.

Participants should judge this sentence false if they have Principle B (since the free interpretation is the only licit one, and every hippo was only a little proud of Miss Cow) and true if not (because nothing rules out the bound interpretation, and every hippo was a little proud of herself). For the question version of this item participants are expected to answer "a little proud" to the question in (28) if they have reconstruction (assuming they

have Principle B, the bound interpretation is ruled out if the reconstructed reading is assigned, and on the free interpretation, every hippo was a little proud of Miss Cow). If they do not have reconstruction they should likewise answer "a little proud," since "every hippo" is not in a position to bind "her" in the surface structure and therefore generate a bound interpretation (and under the free interpretation, every hippo was a little proud of Miss Cow).

Again in Experiment 2 participants heard both a question and statement after each story, with only one being a test item; the non-test item was treated as a filler (a complete list of test items and fillers is given in Appendix B). The puppet always gave a recap sentence, naming the characters, before uttering the test item. In this recap the three characters were always mentioned last, to weight the experiment in favor of their being chosen as the antecedent in violation of Principle B. Experimenters who controlled the puppet were instructed not to prosodically highlight the pronoun in any way when uttering the test sentence, since it has been claimed such emphasis can promote local coreference (e.g., even for adults, "Mama Bear washed HER" may be interpreted as meaning Mama Bear washed herself) (Grimshaw & Rosen, 1990; Heim, 1998; McDaniel & Maxfield, 1992; among others)[13]. In all other respects, the design and methodology followed that described for Experiment 1.

[13] The idea that contrastive stress on the pronoun licenses a coreferential interpretation in environments where adults would typically rule it out (e.g. Principle B and C configurations) is somewhat controversial. Certain listeners report the intuition that placing contrastive stress on the subject and de-stressing the pronoun more readily supports the coreferential interpretation. To avoid this controversy, experimenters in the current study were instructed to use neutral intonation when uttering the test sentence.

2.2.2. Results

In contrast to Experiment 1, the results for Experiment 2 are less conclusive with respect to children's command of reconstruction. Twenty-six 4-year-old children (10 female, 16 male; mean age 4;6) and 24 Northwestern undergraduates participated in this study (two children were excluded from the final analysis for missing more than one filler item). Once again adults generally performed better than children ($Z = 3.257$, $p = .001$), as expected given the demands of the task. In the question conditions, adults reliably assigned interpretations consistent with reconstruction, choosing the free interpretation of the pronoun 96% of the time for argument questions, and 94% of the time for predicate questions. They likewise consistently assigned the free interpretation in the predicate statement condition, choosing it 96% of the time. Using the Wilcoxon signed-ranks test, there was no significant difference between performance on questions and statements for predicate items ($Z = .378$, $p = .705$). However, adults' performance on statements in the argument embedding context was quite surprising. In this condition, they only assigned a free interpretation to the pronoun 73% of the time (as compared to 96% for the corresponding questions ($Z = 3.051$, $p = .002$)). Closer examination of adults' performance on the argument statements revealed little consistency among those who sometimes accepted a bound interpretation of the pronoun: of 24 participants, 14 always assigned the expected free interpretation, while only 3 consistently assigned the bound interpretation for both argument statement items. The other 7 participants assigned the bound interpretation for one item and the free interpretation for the other, and there was no consistency across which item was assigned which interpretation. In other words, it

was not the case that certain adults consistently violated Principle B for argument items and others did not. This result is further explored further in a follow-up experiment discussed below.

Children also produced some unexpected results in Experiment 2. In the argument condition, they were as successful as they were in Experiment 1, assigning the free interpretation to the pronoun equally in both statements and questions (77% of the time for both statements and questions ($Z = 0$, $p = 1$)). But there was a significant difference between children's performance on predicate questions versus statements ($Z = 2.961$, $p = .003$), and with respect to the predicate questions, children were at chance (the free interpretation assigned only 46% of the time.

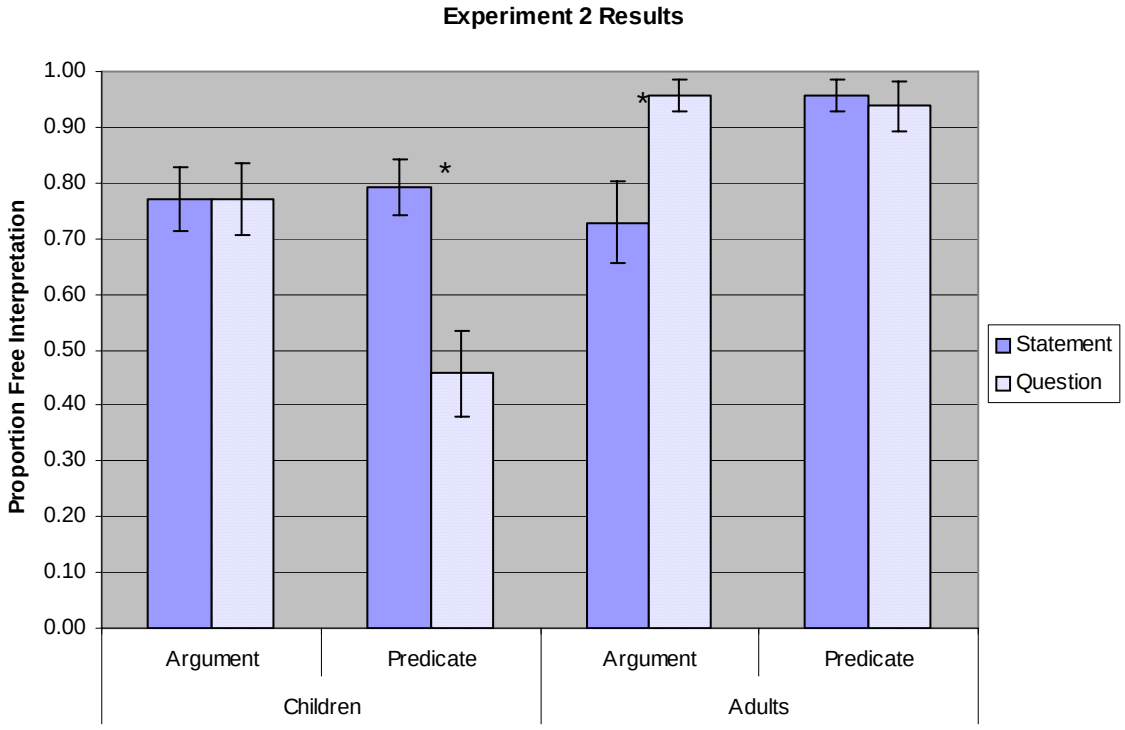


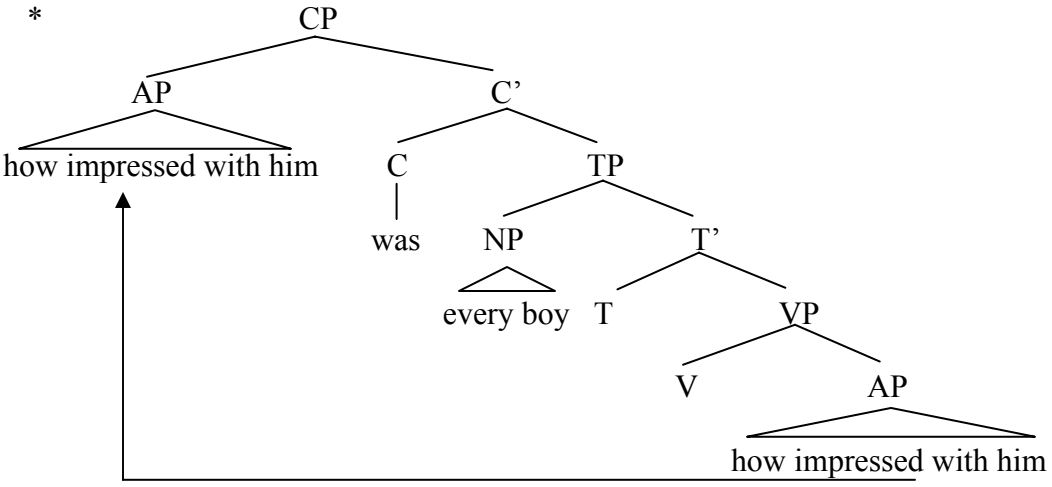
Figure 2. Mean proportion free interpretation responses for child (n = 24) and adult (n = 24) groups for statements and questions subject to Principle B in argument and predicate conditions.

While children's performance in Experiment 1 and on the argument items in Experiment 2 suggests they have reconstruction, their performance on the predicate questions in this experiment requires further investigation. The adult results likewise require an explanation for why they overwhelmingly preferred the free interpretation of the pronoun for questions in both embedding contexts and for predicate statements, but had a weakened preference for the free interpretation in argument statements. Both of these open questions are addressed in the sections below.

2.2.3. Discussion

As mentioned above, one disadvantage of using Principle B as a diagnostic for reconstruction is that it is impossible to determine the source of the ungrammaticality for a sentence like (31):

(31) *How impressed with him$_i$ was every boy$_i$?



On one analysis, (31) is ruled out by Principle B via reconstruction: when the pronoun is interpreted in its base position, "him" is c-commanded by "every boy," which violates Principle B. However, it may be the case that this interpretation is blocked because on the surface, "every boy" fails to c-command "him, and c-command is required for a bound interpretation. In other words, if the pronoun is interpreted in its reconstructed position, the participant is expected to generate a free interpretation of the pronoun (because of Principle B), and if it is interpreted in its surface position, the participant is also expected to generate a free interpretation (because of the failure of the antecedent to c-command the pronoun). If the participant ostensibly comes up with the "correct"

answer for (31), it is impossible to be sure if that answer was given because the participant has reconstruction: with or without reconstruction, the subject should assign the free interpretation. Given this confound, sentences like those in (31) are generally not as well suited for testing knowledge of reconstruction as are sentences that are subject to Principles A and C. Nevertheless, Experiment 2 was included in an effort to test for reconstruction in the full range of environments subject to binding theory, and to provide a basis of comparison for interpreting the Experiment 1 results. Taken together with the results from Principles A and C, it was intended to add to a complete picture of children's knowledge of reconstruction.

Despite the fact that the structure of the question items biases the desired interpretation in Experiment 2, results were less conclusive for both adults and children than they were in Experiment 1. Starting with the adults, it was shown that they curiously performed relatively poorly on argument statements, as in (32), for which a bound interpretation should clearly be ruled out by Principle B:

(32) Every dinosaur saved the short article about him.

While adults still assigned the free interpretation to the pronoun 77% of the time, this was far less than their free interpretation rate in the other categories, which was at ceiling. On closer examination of the stories, a possible explanation for this asymmetry emerges.

Recall that in the argument stories, among the group of three characters (in this case, dinosaurs) each has one short article and one long article about himself. There are also three identical short and three identical long articles about the lone character, in this case Mr. Giraffe. The dinosaurs each save the short articles about himself, and save a

long article about Mr. Giraffe. The puppet then utters the statement in (32), which participants are predicted to reject, although they do not consistently do so. Given the story, however, the use of the definite determiner "the" may be construed as infelicitous. Specifically, it is well known that use of the definite in "the picture of him" presupposes the existence of the picture, and also, crucially, that the picture is unique. In this case, the newspaper articles about Mr. Giraffe do exist, but there are three of them: the uniqueness presupposition associated with the definite article is not met as long as the pronoun is interpreted as referring to Mr. Giraffe. However, the uniqueness presupposition *is* met if the pronoun is given the bound interpretation, since there is only one unique short article about each dinosaur. Thus a potential confound arises when using the definite article in the test sentences, as it may bias towards the bound interpretation. No such confound should arise if an indefinite picture-NP is instead used, as the indefinite presupposes only existence, not uniqueness.

Along these same lines, Chomsky (1973) notes an asymmetry between use of the definite versus indefinite picture-NP's, with the use of the definite slightly degraded as compared to an indefinite NP (e.g., some find "Who did you see pictures of?" better than "Who did you see the pictures of?"). The potential violation of the uniqueness presupposition associated with the use of the definite article, along with Chomsky's observation, provides a possible explanation of adults' unexpected results in the argument statement condition.

A short follow-up experiment was conducted to test whether adults would perform better if the argument sentences, instead of using the definite determiner "the,"

used the indefinite "a" (which does not have a uniqueness requirement). In this updated version of the experiment, in which 6 Northwestern undergraduates participated, adults' performance on the argument statements rose to 92% free interpretation responses, the same as their free interpretation rate on argument questions, and comparable to adults' performance in the other conditions of the original experiment. Thus the apparent asymmetry in the adults' original responses apparently does not reflect their grammatical knowledge (the results show they do in fact have Principle B, as expected), but rather is an artifact of the wording of the target sentences. Once this was corrected, adults performed at rates comparable to their performance in the other conditions.

The puzzle over children's interpretations of predicate question items is less easily explained. While their performance on the argument items supports children having reconstruction in the grammar, the fact that they are at chance when answering the predicate questions (as in (31), repeated below) is unexpected:

(31) How impressed with him was every boy?

Furthermore, it is unclear how children ever get a bound interpretation of "him" in the first place: if the child assigns a reconstructed reading, the bound interpretation should be ruled out by Principle B (and performance in previous studies with quantificational antecedents, as well as their performance in all other conditions of Experiment 2, suggests they do have Principle B), but if the child assigns a surface reading, the bound interpretation should still be ruled out since "every boy" fails to c-command the pronoun (previous studies show children know c-command is required for binding (Lidz, et al. 2003)). Either way the child should arrive at the free interpretation. Nevertheless,

children assign the bound interpretation about half of the time. They must somehow think the puppet intends to ask "how impressed with him*self* was every boy?" when in fact the puppet utters the question in (31).

Again one possibility for this confusion may lie in the story context. The predicate stories for Experiment 2, like those for Experiment 1, involve the lone character challenging the group of three characters to perform some task. In the case of (31), Mr. Monkey wants to see if his friends the three boys can jump over his new couch. The boys discuss how hard it will be, saying they would be very impressed about anyone who jumped all the way over the couch, and even a little impressed with anyone who just jumped onto it. Mr. Monkey offers to go first and show the boys how it is done. He just jumps onto the couch, and the boys say they are a little impressed he was able to do that. Then the boys jump over the couch, and say how very impressed they are they made it all the way over the couch. Afterward, the puppet asks the target question in (31).

One potential problem with this setup is that the story events always occur in the same order: the lone character performs the task, then the group does. If the child only remembers the second event, or if the second event is simply more salient because it is the final one, then participants may be biased towards choosing the three characters as the pronoun's antecedent (the bound interpretation). To examine this possibility, 4 children were tested using stories where the order of events was reversed. Despite the reverse ordering, however, these children were still exactly at chance (50%) in assigning the free interpretation to the pronoun.

While the order of events does not appear to have affected the children's responses, the stories may still have an additional bias towards the bound interpretation due to which characters are rendered most salient (Elbourne, 2005). Recall that the story is set up so the main issue at hand is how the group can perform on a certain task: the lone character simply suggests the task and offers to show the others how it is done. This emphasis on the group of three characters, in addition to their doing most of the talking in the story (setting up criteria for being impressed, proud, etc. and then reiterating how impressed, proud, etc. they are after the fact), may be enough to cause confusion in the children when hearing the test question. After all, if the whole story has mainly been about how the boys performed on the couch-jumping task and how proud they are as a result, it is understandable that the child may expect the question to be about how impressed with himself every boy was. Furthermore, all of the questions and sentences uttered by the puppet in this experiment have "every X" in subject position, which strengthens the focus on the three characters as opposed to the lone one. While adults are able to overcome this bias and interpret the items as we would expect, it is not unlikely that children, burdened by coming up with an answer to the question in the first place, are persuaded to the bound interpretation by these extraneous factors. Crucially these factors do not come into play for the argument stories, where the articles, paintings, etc. of each character are given equal emphasis, and each character's choice of their own article is interspersed with their choice of the lone character's (obviating any order effects). Experiment 3, discussed below, re-tests the predicate items from Experiments 1 and 2, using redesigned stories to eliminate this bias toward the group of three characters.

2.3. Experiment 3

Experiment 3 seeks to address some of the potential confounds discussed with respect to Experiment 2 above. Specifically, it aims to address the result from Experiment 2 where children were shown to perform at chance on predicate questions like (33), while preferring the free interpretation of the pronoun (as adults do) for predicate statements and all argument items:

(33) How confident in him was every whale?

Given the fact that the free interpretation should be preferred whether the pronoun is interpreted in its reconstructed position or not, an explanation was sought for why children access this interpretation only half of the time. One possibility is that the structure of the story prompts the bound interpretation, confusing children by conflicting with the interpretation generated by their grammar, and resulting in their chance performance. Indeed, the stories are construed to focus on the characters corresponding to the bound reading, and do little to make the alternative referent for the pronoun very salient.

A review of the acquisition of Principle B literature by Elbourne (2005) lends support to the idea that the antecedents made salient by the story and target sentence may affect children's interpretations of pronouns. As noted above, several studies have shown children to access interpretations consistent with Principle B when the antecedent is quantificational, but to often violate Principle B when the antecedent is non-quantificational (Avrutin & Thornton, 1994; Boster, 1991; Chien & Wexler, 1990;

Thornton, 1990; Thornton & Wexler, 1999). While explanations of this asymmetry vary, a widely accepted view appeals to a revision of binding theory along the lines of Reinhart (1983), who claims Principle B applies only to pronouns interpreted as bound variables. Children may therefore know Principle B, but have problems when a referential interpretation of the pronoun is available, as when the antecedent is non-quantificational. In these cases, according to Reinhart, a pragmatic principle known as Rule I determines whether the pronoun will receive a referential or bound interpretation. In general terms, Rule I states that an LF with a bound variable interpretation is preferred over a minimally distinct LF with a coreferential interpretation; in other words, if there is a way to generate a bound variable interpretation, that is the optimal path to coreference. Children's failure to demonstrate knowledge of Principle B only when the antecedent is non-quantificational may thus be attributed to difficulty applying Rule I (Grodzinsky & Reinhart, 1993; Thornton & Wexler, 1999). In environments where Rule I is obviated, as with quantificational antecedents, children are able to demonstrate knowledge of Principle B. The Rule I hypothesis thus predicts the observed asymmetry between quantificational and non-quantificational antecedents.

Elbourne examines previous studies showing an asymmetry in children's knowledge of Principle B in contexts with quantificational versus non-quantificational antecedents. He concludes that the reported asymmetry actually does not exist: certain less widely discussed studies actually fail to show any asymmetry (Boster, 1991; Lombardi & Sarma, 1989), and those that do report an asymmetry are shown to have experimental artifacts that may just as plausibly be its root cause as problems with Rule I.

Specifically, Elbourne analyzes each previous experiment in light of a new hypothesis, the Salience Hypothesis, which states that "children interpret pronouns according to the most salient choice made relevant by the story and the question." (Elbourne, 2005, p. 338). After analyzing the stimuli used in these experiments, the Salience Hypothesis is shown to account for the results obtained, both in experiments that show an asymmetry between quantificational and non-quantificational antecedents and those that do not. Elbourne concludes that preschool-aged children simply do not have Principle B, and that in cases where they appear to, their responses may be explained by the Salience Hypothesis.

It is important to note that while salience is quite plausibly one factor in determining children's performance on the TVJT or questions after stories task, it may not be the only factor. For example, in the argument embedding context in Experiment 2, the stories appear to be roughly balanced for salience: the three characters all pick out one picture, painting, etc. of themselves, and one of the lone character. Each character chooses in turn, deliberating over the choices, which are both equally important to the narrative. If anything, it seems the story type makes the three characters more salient as potential antecedents, since after all, there are three of them. Despite this potential salience bias, however, children in this experiment consistently interpreted the pronoun as referring to the lone character, in both the statement and question contexts, lending support to the view that they do indeed have Principle B in their grammars[14].

[14] One may counter that the use of the singular pronoun in the test sentence ("Every dinosaur saved the short article about him"/"Which article about him did every dinosaur save?") makes the lone character more salient as an antecedent than the group of three characters. The fact that the story seems, if anything,

Furthermore, even in the predicate statement condition, where the stories clearly make the three characters more salient, children were adult-like in consistently interpreting the pronoun as referring to the lone character. Of course, judging a statement to be true or false is clearly less burdensome for the participant than having to come up with an answer to an open-ended question about a character's level of pride, confidence, etc. This may be what causes children's poor performance on the predicate questions: the salience of the three characters in the stories leads them to prefer a bound interpretation, which is in fact ruled out by their grammar. Given the demands of the task when asked to respond to a question, and the confusion caused by these conflicting antecedent preferences, they end up responding at chance. In short, children's performance in Experiment 2 suggests that they may actually override any effect of salience when faced with a simple yes/no judgment, but they become more susceptible to salience effects when faced with a more difficult task.

Experiment 3 aims to establish whether salience was a factor in children's performance on predicate questions in Experiment 2, as well as in Experiment 1, which used stories almost identical to the Principle B experiment. Recall that the results from Experiment 1 showed children to be adult-like in arriving at a bound interpretation for questions like (26):

(26) How proud of herself was every hippo?

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to favor the three characters as an antecedent may balance out this salience effect, rendering the test scenario relatively neutral. This discussion serves to highlight the difficulty in determining just what counts as making something salient, and how to balance the competing effects of various sources of salience. Making this definition more precise is crucial for the Salience Hypothesis, but orthogonal to the present discussion.

This result was taken as evidence that children have reconstruction. However, the stories used in the experiment may have actually biased participants in favor of the desired bound interpretation by making the three characters more salient as potential antecedents. Experiment 3 therefore aims to manipulate the structure of the stories to more effectively balance out how much the various characters are highlighted and eliminate any effects of salience.

2.3.1. Method and Design

Because the argument stories from Experiments 1 and 2 seem to be more balanced in terms of salience, and because performance on these for both children and adults reflected the expected pattern (free interpretation for pronouns and bound interpretation for anaphors, with respect to the same stories), only predicate items were re-tested in Experiment 3. Likewise, since unexpected results emerged only from the predicate question condition, all of the predicate items from the previous experiments were re-tested in Experiment 3 in question form. Two new predicate items were also added and tested in statement form. Since results on the predicate statements in Experiments 1 and 2 showed children and adults to appropriately assign the bound interpretation to anaphors and the free interpretation to pronouns, it was unlikely performance would differ in Experiment 3. Nevertheless, the statement items were included as fillers to ensure all participants had Principles A and B in place. Each participant therefore received a total of 6 items: 4 predicate questions, and 2 predicate statements.

The stories in Experiment 3 were amended from those used in Experiments 1 and 2 to place roughly equal emphasis on all characters. Specifically, each story was

expanded to include a neutral character of the opposite gender (which ruled out this character being considered as an antecedent for the anaphor/pronoun) who challenges both the group of three characters and the lone character to some task. The three characters and lone character discuss how difficult the task will be, and the three characters go on to say how very proud/pleased/confident/impressed they would be if any of the characters completely succeeded at the task, and in fact, they would be a little bit proud, pleased, etc. if any of them even was able to succeed at the task a little bit. The test stories were varied so that half the time the lone character completely succeeds (making the three characters very proud, pleased, etc. with him/her) and the three characters succeed only a little bit (making them a little proud, pleased, etc. with themselves); and half of the time the situation is reversed. This variation was included to make the stories more interesting (this way the outcome is truly in doubt for the participant), and because the scalar implicature problem from Experiments 1 and 2 (where some interpret a character who is very proud as also being a little bit proud) does not seem to arise with questions (e.g. it is unlikely a participant would answer that the hippos were a little proud if they were in fact very proud in the story). The between subjects factor for this experiment was Principle A versus B; the Principle B questions were re-tested for the reasons given above, and the Principle A questions were re-tested since the previous stories may have actually been biased in favor of the bound interpretation, thus potentially inflating performance on those items in Experiment 1. A list of test sentences and filler for Experiment 3 can be found in Appendix C.

2.3.2. Results

Twenty-eight 4-year-olds (12 females, 16 males; mean age 4;6) and 24 Northwestern undergraduates participated in Experiment 3. Four children were excluded from the final results for having a either a yes or no bias (judging all statements either all true or all false), or not being able to correctly judge the truth of filler statements that did not test any knowledge of binding conditions. Adults in this experiment again performed as expected. For the filler statements designed to test knowledge of Principles A and B, adults were at 100% in assigning the bound interpretation to the reflexives in the Principle A condition, and only assigned the bound interpretation 5% of the time in the Principle B condition (appropriately assigning the free interpretation 95% of the time). With respect to the test questions, for Principle A, adults accurately assigned the bound interpretation to the reflexive 98% of the time. For the Principle B questions, they consistently chose the free interpretation of the pronoun, assigning a bound interpretation only 5% of the time.

Children in Experiment 3 likewise performed as expected, suggesting story type did influence their behavior in Experiment 2. As in Experiments 1 and 2, children's performance on the filler statements designed to test Principles A and B was quite accurate; they appropriately assigned the bound interpretation to the reflexive in the Principle A condition 75% of the time, but assigned the bound interpretation to the pronoun only 25% of the time in the Principle B condition (appropriately assigning the free interpretation 75% of the time). With respect to the question test items, for Principle A, children once again consistently assigned a bound interpretation to the reflexive (83%

bound interpretation). However, in contrast to Experiment 2, children consistently assigned a free interpretation to the pronoun for the Principle B questions, and only assigned a bound interpretation 25% of the time (in contrast to 54% in Experiment 2). Again using the Wilcoxon signed-ranks test, a significant difference was found between children's acceptance of the bound interpretation for Principle A versus Principle B questions ($Z = 3.071$, $p = .002$), and likewise for adults ($Z = 3.176$, $p = .001$).

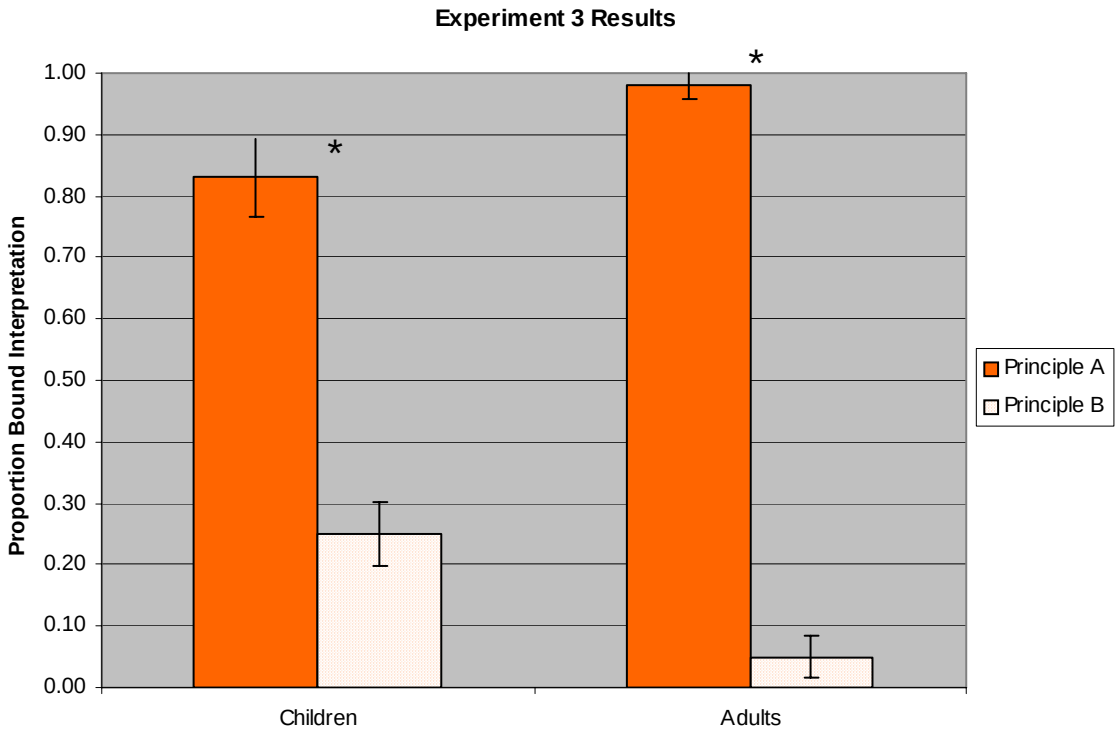


Figure 3. Mean proportion bound interpretation responses for child (n = 24) and adult (n = 24) groups for predicate questions subject to either Principle A or Principle B.

Children's performance on both the Principle A and Principle B questions in this experiment, mirroring that of the adults, and is thus consistent with the other evidence that they have reconstruction in their grammar.

2.3.3. Discussion

Experiment 3 illustrates the importance of constructing stories for the TVJT and questions after stories task that are as neutral as possible when it comes to biasing interpretations. The stories' focus on the three characters who were always the subject of the test sentences in Experiments 1 and 2 was apparently enough to bias children's responses when faced with a predicate question, as in (26) and (28):

(26) How proud of herself was every hippo?

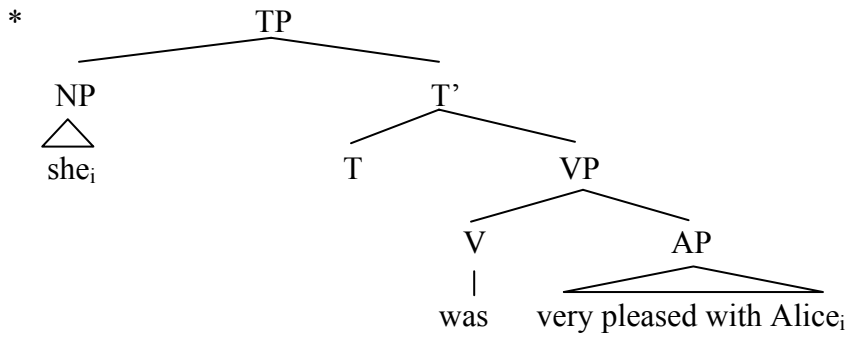
(28) How proud of her was every hippo?

Such questions may be expected to be difficult for children even under ideal circumstances, as they are quite abstract in questioning the characters' degree of pride, confidence, etc. While the children were able to overcome this bias in the predicate statements in the earlier experiments, such a result may be expected since it is arguably less demanding to judge a statement true or false than it is to answer a question like (26) or (28). That children performed as well on the statement items in Experiment 4 as they did in the earlier experiments confirms their knowledge of Principles A and B. Furthermore, their performance on the Principle B questions in this experiment answers the questions raised by their performance in Experiment 2: once the stories were constructed to be more neutral, evidence supporting children's knowledge of reconstruction emerged.

2.4. Experiment 4

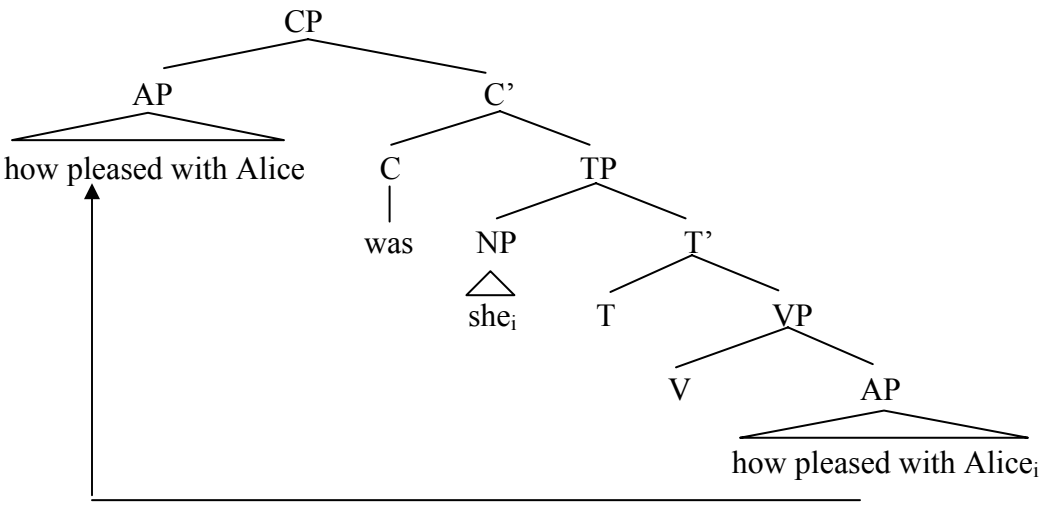
Experiment 4 completes the testing of reconstruction with respect to binding theory, examining knowledge of reconstruction using sentences subject to Principle C. Principle C is the most common diagnostic for reconstruction: it has none of the confounds associated with Principle B, and its status in applying to sentences across the board is relatively uncontroversial, unlike Principle A. Recall that Principle C observes that a referring expression (such as a name, definite description, etc.) must be free. Therefore, (34) is ruled out by Principle C because the coindexed pronoun "she" c-commands the name "Alice:"

(34) *She$_i$ was very pleased with Alice$_i$.



Likewise, (35) is ungrammatical because "Alice" is c-commanded by "she" when interpreted in its reconstructed, base position.

(35) *How pleased with Alice$_i$ was she$_i$?



Experiment 4 seeks to establish participants' knowledge of reconstruction by testing their interpretations of sentences like (34-35).

2.4.1. Method and Design

The design for Experiment 4 closely follows the previous two experiments. It is somewhat simplified due to the use of non-quantificational NP's; while some previous studies suggest children perform better at ruling out co-indexation of a pronoun and a quantified NP in Principle C environments (Carden, 1986; Lust, Loveland, & Kornet, 1980) children have also been shown to consistently rule out interpretations barred by Principle C with non-quantificational NP's in several more recent studies (Crain & McKee, 1985; Crain & Thornton, 1998; Thornton, 1990). Given this recent evidence, along with the complexity that the multiplicity of characters required for the quantificational antecedent added to the stories in the earlier experiments, non-quantificational NP's were determined to be appropriate for the current study.

The TVJT and questions after stories tasks were again used in this experiment. Participants responded to a mix of question and statement test items, in both predicate and argument embedding contexts. Before saying each test sentence, the puppet again provided a recap statement naming the potential antecedents; the order in which the antecedents were named controlled to bias in favor of assigning the pronoun an interpretation that would violate Principle C. Again the puppet experimenter was instructed not to place any prosodic emphasis on the pronoun, to avoid possibly fostering a coreferential interpretation. A complete list of test sentences and fillers can be found in Appendix D.

The stories used in Experiment 4 were similar to those used in the previous two experiments, except given the revised test items, the stories in the current experiment only had two characters. For example, for the argument items below, the corresponding story featured Miss Cruella and her student, Janie:

(36) She put up the red painting of Miss Cruella.

(37) Which painting of Miss Cruella did she put up?

In the story, Miss Cruella explains that she wants Janie's help decorating their new dance studio. She has three paintings, one white, one red, one purple, and each features Miss Cruella's picture. But Miss Cruella only wants to put up two paintings, so she suggests each of them should pick out their favorite one and put it up. Miss Cruella deliberates, and finally puts up the red painting of herself. Then Janie deliberates and puts up the

white painting with Miss Cruella in it[15]. Afterwards, the puppet makes the statement in (36). If the participant has Principle C, he should reject this sentence, since Principle C rules out coreference between "she" and "Miss Cruella" and forces the pronoun to refer to Janie (and Janie put up the white painting of Miss Cruella). This sentence should only be judged true if the participant does not have Principle C, and therefore allows coreference between the pronoun and Miss Cruella. For the question test item, participants are predicted to interpret "she" as Janie and answer "the white one" if they do have reconstruction; the interpretation of "she" as Miss Cruella is blocked if the name is interpreted in its base position, where "she" c-commands "Miss Cruella." If the participant doesn't have reconstruction, there is nothing blocking such an interpretation, and the participant would be predicted to answer "the red one" (since Miss Cruella put up the red painting of herself) a significant amount of the time.

For the predicate items, the stories were again similar to those used in the previous experiments. The story corresponding to the items in (34-35) (repeated below) featured Miss Butterfly and Alice:

(34) She was very pleased with Alice.

(35) How pleased with Alice was she?

In this story, Alice wants to show Miss Butterfly her new car. Miss Butterfly is impressed and asks Alice to demonstrate to her how fast it goes; she suggests Alice drive all the way across the yard, past a boulder that is in the middle of it, and to the fence at

[15] The order in which the choosing events occur is varied across the argument items, to control for any ordering effects.

the end. But Alice says she is just learning to drive, and doubts she could drive that far. Miss Butterfly responds that Alice is always good at everything she does, and she thinks Alice is probably a great driver. She tells Alice to give it a try and see how pleased she can make Miss Butterfly by seeing how far she can drive. Alice responds that she will try her best, but she is not sure she will make it all the way to the fence. She agrees to try hard though, and says she will see how pleased she can make herself too. Alice drives a little ways, past the boulder, but not to the fence. Miss Butterfly consoles her saying that even though she didn't get all the way to the fence, she did drive a little bit, so Miss Butterfly is a little pleased. Alice responds that driving is so hard, just making past the boulder was a real accomplishment, so she is very pleased about how she did[16]. After the story, the puppet makes the statement in (34). If the participant has Principle C, he should reject this statement, since Principle C rules out interpreting "she" as "Alice," and the only other available referent, Miss Butterfly, was only a little pleased with Alice. The participant should only accept this statement if she does not have Principle C, and therefore allows coreference between the pronoun and Alice. In the question condition, participants should answer the question in (35) "a little bit," if they have reconstruction (since Miss Butterfly was a little pleased with Alice); interpreting "she" as Alice is ruled out if the R-expression is interpreted in its original position, where "she" c-commands it. Without reconstruction, nothing rules out such an interpretation, and participants could be

[16] The order in which the characters say how pleased, proud, etc. they are is varied across items to control for any additional salience that might be given to the final character's utterance.

expected to answer “very pleased” (since Alice was very pleased with herself) a significant proportion of the time.

2.4.2. Results

Twenty-six 4-year old children (14 females, 12 males; mean age 4;4) and 24 Northwestern undergraduates participated in this study (two children were again excluded from the final analysis for incorrectly responding to more than one filler item). The Wilcoxon signed-ranks test was again used to analyze the results. Both adults and children performed equally well on predicate questions versus statements ($Z = 1$, $p = .317$ for adults; $Z = .246$, $p = .806$ for children) with adults at ceiling and children assigning the expected disjoint interpretation 75% of the time in both structural contexts, comparable to their performance in the previous experiments. An asymmetry was observed in the argument results, however, for both children and adults. In this condition, a significant difference was found between performance on questions and statements for both groups ($Z = 2.070$, $p = .038$ for adults; $Z = 3.001$, $p = .003$ for children).

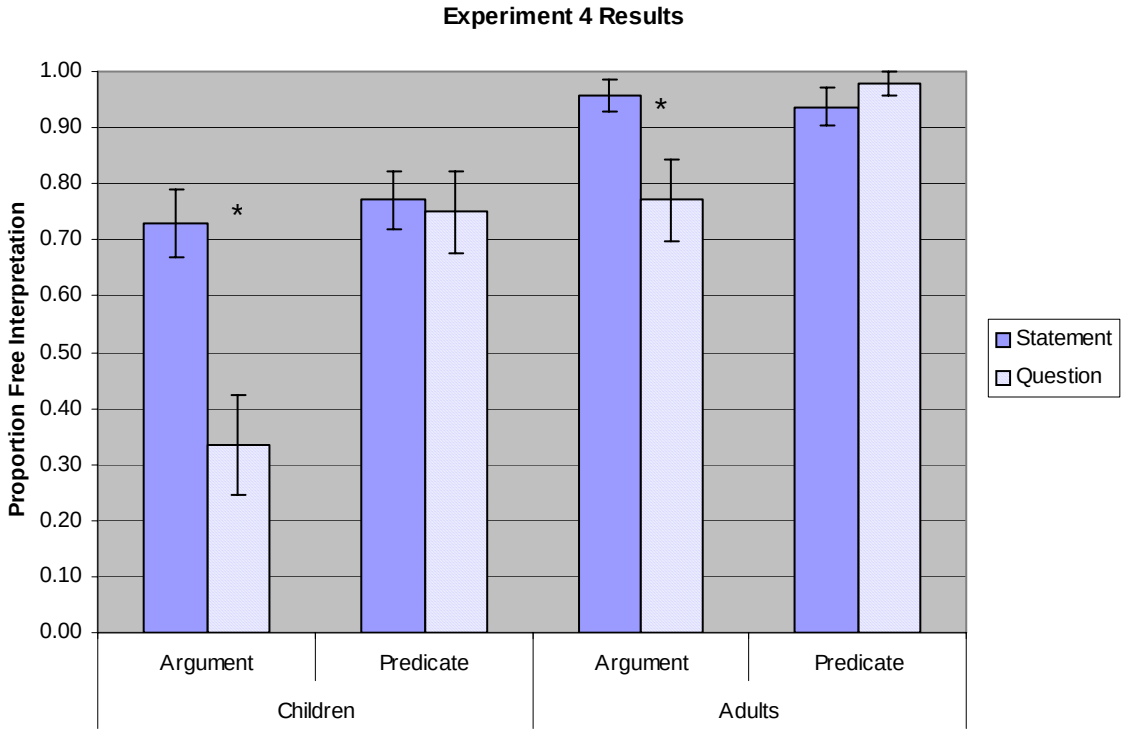


Figure 4. Mean proportion free interpretation responses for child (n = 24) and adult (n = 24) groups for statements and questions subject to Principle C in argument and predicate conditions.

Unlike their performance in the predicate condition, both children and adults fail to consistently assign a free interpretation in the argument question condition. In fact, children are shown to actually prefer coreference for argument questions: while they chose the free interpretation for the pronoun in the argument statements over 70% of the time, they only chose the free interpretation for the corresponding question items 33% of the time (assigning coreference 66% of the time). Likewise, adults' overwhelming preference for the free interpretation is weakened for the argument question items

(although it remains preferred): in contrast to their ceiling performance on the argument statements, they only judged the corresponding questions to have the free interpretation 77% of the time. Those adults who allowed coreference were hardly consistent, however. Of the 24 adults tested, only 2 always assigned the coreferential reading to questions in the argument condition; 7 assigned the coreferential reading to one item and the disjoint reading to the other, and 15 always assigned the disjoint interpretation.

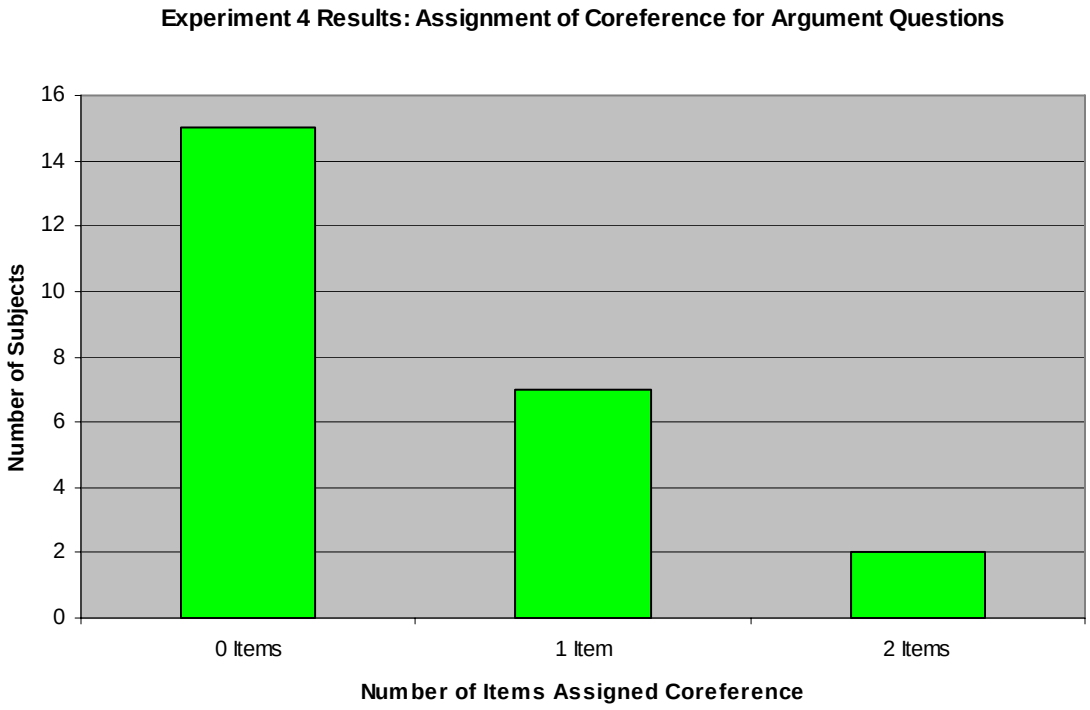


Figure 5. Number of subjects (n = 24) assigning coreference to no items, 1 item, or 2 items (of a total of 2) in argument question condition.

Furthermore, the coreferential interpretations were evenly distributed across items, with three assignments of coreference (across 12 subjects) in the case of three of the argument questions, and two in the other.

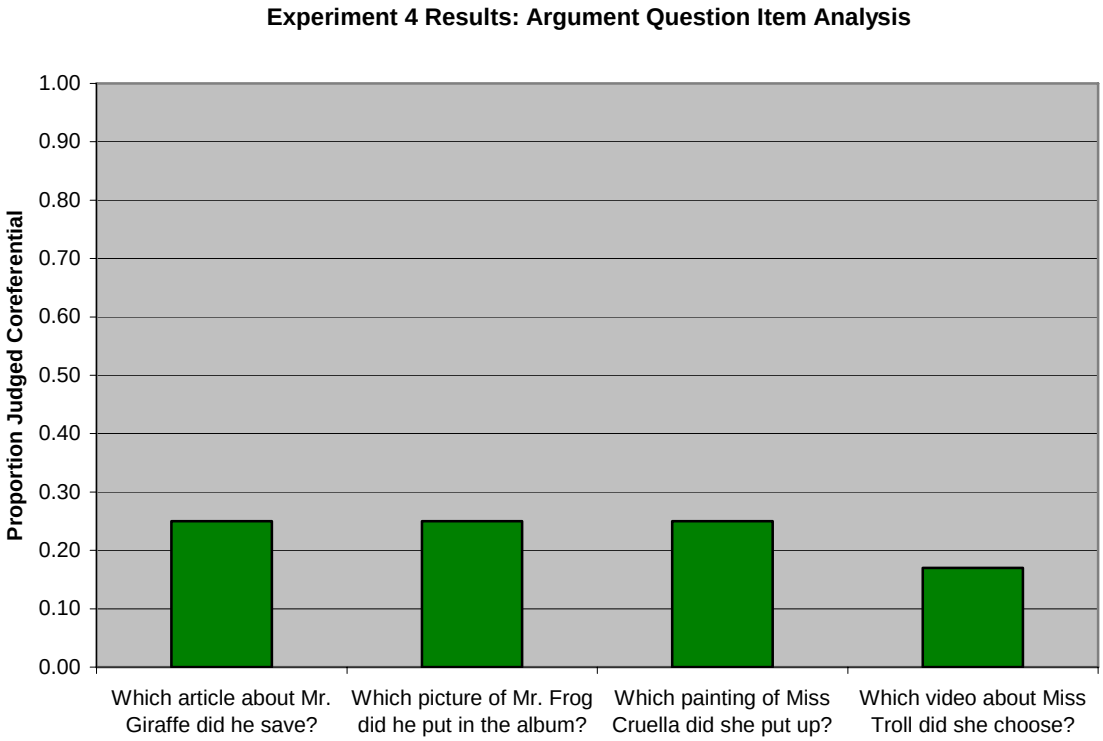


Figure 6. Proportion of coreferential judgments by 12 subjects for each item in argument question condition.

In summary, while the results from the predicate items continue to support knowledge of reconstruction, the argument results suggest that even adults do not consistently assign a reconstructed interpretation to moved arguments, and children seem to actually disprefer the reconstructed reading in this case. Such a result is in fact consistent with several

existing theoretical analyses of reconstruction, which have long observed an asymmetry between reconstruction for moved arguments versus moved predicates.

2.4.3. Discussion

The above results reveal that while both children and adults overwhelmingly generate an interpretation of predicate questions (as in (35)) that is consistent with reconstruction, they fail to do so in the case of argument questions (as in (37)):

(35) How pleased with Alice was she?

(37) Which painting of Miss Cruella did she put up?

In other words, interpreting "she" as Alice in (35) is only ruled out on the reconstructed interpretation where "Alice" is c-commanded by "she," which results in a Principle C violation. The fact that both children and adults consistently ruled out this interpretation thus provides evidence that both groups obligatorily assigned the reconstructed interpretation. However, if the name in (37) is interpreted in its reconstructed position, coreference between the pronoun and Miss Cruella is likewise ruled out. Indeed, the data from the corresponding argument statement items shows that both adults and children rule out this interpretation when "she" c-commands "Miss Cruella." Therefore the results from the argument questions suggest that reconstruction is actually optional for these items, since it is only by interpreting the wh-phrase in its surface position that one could assign a coreferential interpretation. While adults still prefer the reconstructed, disjoint interpretation, children actually appear to disprefer it, as their answers were more often consistent with a non-reconstructed, coreferential interpretation.

As mentioned above, it has long been noted in the theoretical literature that while reconstruction is obligatory for moved predicates, it may not be obligatory for moved arguments like the picture-NP's above (Barss, 1986, 1988; Cinque, 1984; Heycock, 1995; Huang, 1993; among others). Heycock (1995) uses the examples in (38-39) to note this contrast for items potentially subject to Principle C:

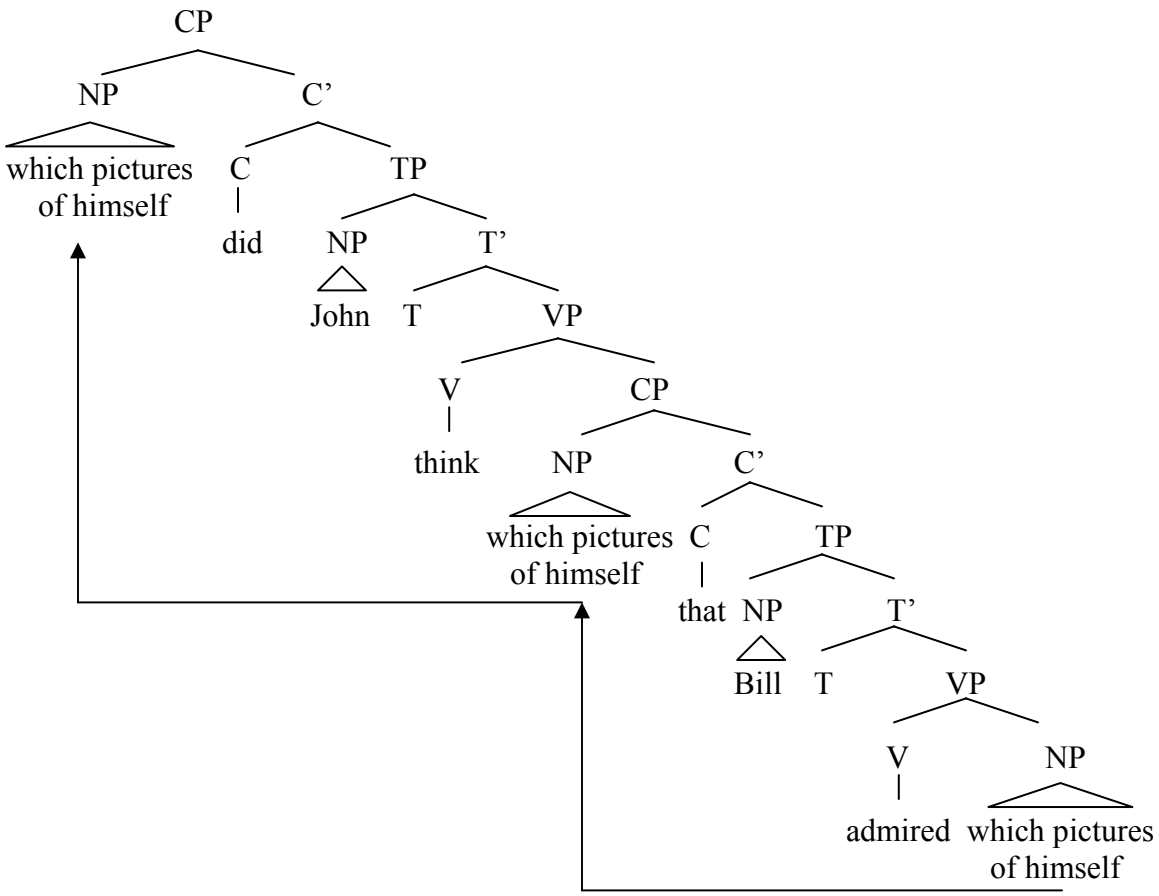
(38) Which allegations about $John_i$ do you think he_i will deny?

(39) *How proud of $John_i$ do you think he_i is ?

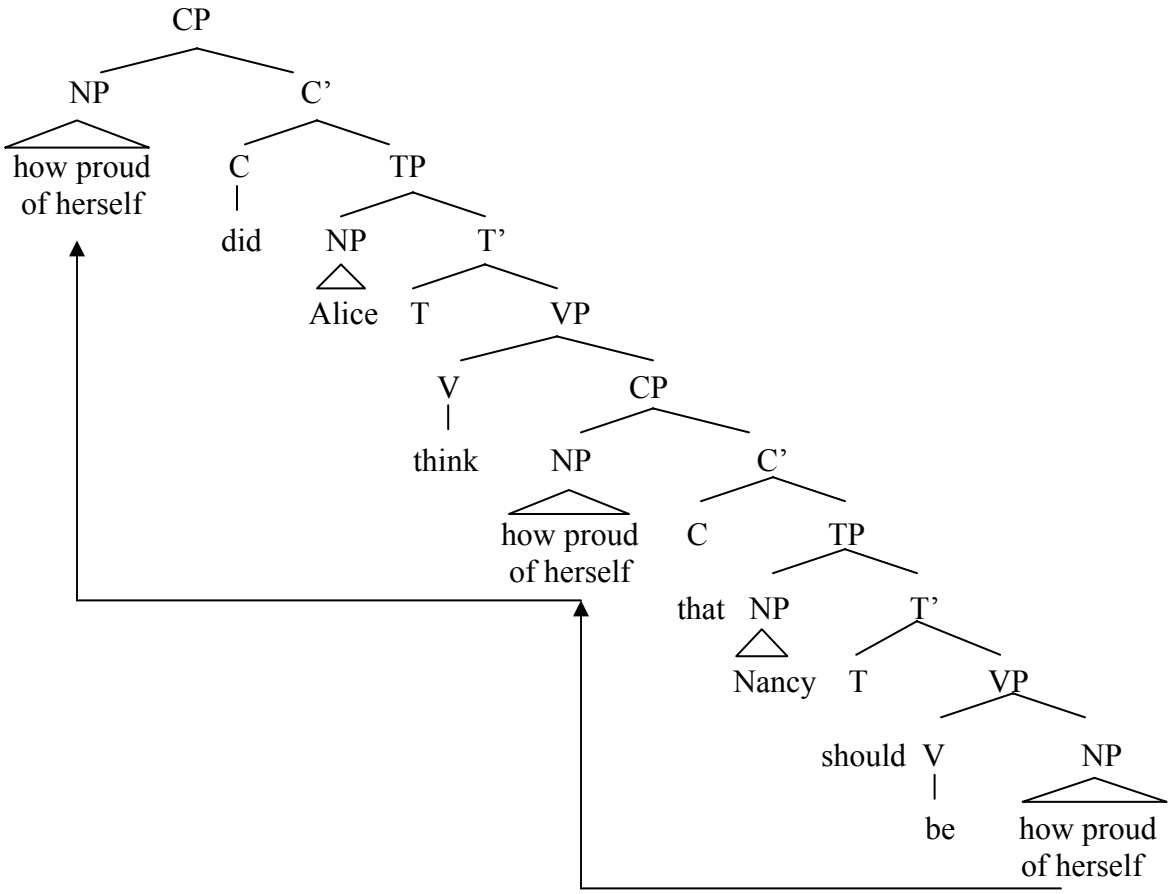
While coreference is clearly ungrammatical for the predicate question in (39), some speakers seem to allow it for the moved argument item in (38)[17]. Likewise, for items where the moved constituent contains a reflexive (which by Principle A requires an antecedent to bind it), moved predicates behave as if they are obligatorily reconstructed to their original position, but moved arguments may be interpreted in any position they occupied during the course of the derivation. The sentences in (40-41) illustrate:

[17] Of course, the grammaticality of (38) may be due to the PP "about John" being an adjunct, and therefore inserted late into the structure (avoiding reconstruction), as on Lebeaux's analysis (1988, 1990, 1991). This possibility will be further discussed in Chapter 3. For present purposes, it suffices to note the asymmetry between movement of predicates (which apparently obligatorily reconstruct to their original position) and movement of arguments (where reconstruction possibilities may be mediated by other constraints).

(40) Which pictures of himself$_{i/j}$ did John$_i$ think that Bill$_j$ admired?



(41) How proud of herself$_{*i/j}$ did Alice$_i$ think that Nancy$_j$ should be?



While in (40), the reflexive may be bound by either the subject of the embedded clause or the subject of the matrix clause (depending on the position where it is interpreted), in (41) the reflexive can only be interpreted as being bound by the subject of the embedded clause, therefore demonstrating that it must be interpreted in its original position.

The results of Experiment 4 add to the literature on the predicate/argument asymmetry by showing through a formal experiment that adults do not uniformly assign

the pronoun a free interpretation in argument questions like (37), demonstrating that reconstruction for moved arguments (in contrast to moved predicates) is not obligatory.

(37) Which painting of Miss Cruella did she put up?

Furthermore, the children's results show that for them reconstruction is not only optional for argument questions, it is actually dispreferred. Such a finding is consistent with the scope ambiguity results discussed in Chapter 1 (Musolino & Lidz, 2004), which show that children do have reconstruction, but disprefer it when a surface (non-reconstructed) interpretation is available. This preference will be explored further in Experiment 5.

2.5. Summary and Open Questions

Experiments 1-4 provide strong evidence that children have reconstruction as part of their grammar. In every case where reconstruction is obligatory, children consistently access the reconstructed interpretation, as do adults. In particular, Experiment 1 demonstrates that when reconstruction is required to satisfy Principle A, both children and adults consistently access the bound interpretation, which is only available when interpreting the anaphor in its reconstructed position. Experiments 2 and 3 likewise show both children and adults to access the free interpretation of the pronoun in sentences subject to Principle B; while this alone does not provide conclusive evidence for reconstruction, both children's and adults' interpretations of the question items are consistent with it. These Principle B experiments also demonstrate the importance of salience when designing stories for the TVJT/questions after stories task, especially as the task places relatively heavy demands on child participants. It was shown that

manipulating salience may have an effect on children's performance, as it did for the predicate question items in these experiments. Nevertheless, salience alone does not determine children's responses, as they were able to overcome any context bias when judging the truth/falsity of the predicate statements, demonstrating consistent knowledge of Principle B.

Experiment 4, which features test items subject to Principle C, provides the most interesting results of this set. Testing sentences subject to Principle C allows for examination of the reported predicate/argument asymmetry: since reconstruction is not obligatory in order to establishing binding for a reflexive (as it is in Experiment 1), and interpretations differ depending on whether or not the reconstructed interpretation is accessed (unlike Experiments 2 and 3), Experiment 4 is the only study so far to shed light on this question. Indeed the results from this study support an analysis where reconstruction is obligatory for moved predicates, but not for moved arguments. Once again, both adults and children demonstrate knowledge of reconstruction when it is obligatory: both groups consistently judge the predicate test questions to have a disjoint interpretation, which is only forced when the reconstructed reading is accessed.

In contrast to their performance on the predicate items, adults demonstrated some variability in judgments of the moved argument items. While they continued to prefer the disjoint interpretation in this condition, they also allowed for a coreferential interpretation about a quarter of the time, demonstrating that reconstruction for such items is not obligatory. As mentioned earlier, this predicate/argument asymmetry may actually be a reflection of the proposed distinction between arguments and adjuncts,

where adjuncts may be inserted late into the structure and avoid reconstruction. Therefore, in the case of the moved argument picture-NP's, it may be that adults are sometimes able to assign coreference because they analyze PP's contained within the wh-phrase as adjuncts, therefore avoiding the Principle C violation that would arise upon interpreting the PP in its original position. Analyses of the adult results will be further discussed in Chapter 3. For now, simply note that Experiment 4 reveals adults to obligatorily reconstruct moved predicates, while allowing for variability in the reconstruction possibilities for moved arguments.

This experiment likewise shows that children, in contrast to adults, not only allowed for the non-reconstructed, coreferential interpretation of questions with moved picture-NP's, they actually preferred it. Indeed, a similar result was found in experiments examining children's preferences with respect to scope reconstruction: children consistently preferred a non-reconstructed, surface scopal interpretation over a reconstructed one (Lidz & Musolino, 2002; Musolino, 1998, Musolino, Crain & Thornton, 2000, Musolino & Lidz, 2003). While the predicate question results from Experiment 4 (as well as the results from Experiment 1) show children do have reconstruction as part of their grammar, they appear to disprefer reconstruction when it is not obligatory.

One interpretation of the Experiment 4 results is that children only assign reconstructed interpretations when forced to; when a non-reconstructed reading is available, that is the only one they consider. In other words, if the non-reconstructed interpretation is found to be grammatical, the reconstructed interpretation is simply not

generated; when it is not obligatory, the reconstructed reading does not exist for children. An alternative analysis is that reconstruction is as optional for children with respect to moved picture-NP's as it apparently is for adults. The difference between children and adults is simply that they have different preferences: adults prefer reconstruction, and children disprefer it. Of course, these varied preferences would then require an explanation: how would children ever change their preference and become adult-like? These hypotheses will be further explored in Chapter 3.

CHAPTER 3

The results of Experiment 4 reveal an asymmetry between interpretations of questions with moved predicates versus moved arguments, which has likewise been observed in the theoretical literature (Barss, 1986, 1988; Cinque, 1982; Heycock, 1995; Huang, 1993; Takano, 1995). While both children and adults consistently assigned a reconstructed interpretation to moved predicates, performance on questions with moved arguments was more varied. Specifically, while adults preferred a disjoint, reconstructed interpretation for sentences like (37), children actually preferred a coreferential interpretation:

(37) Which painting of Miss Cruella did she put up?

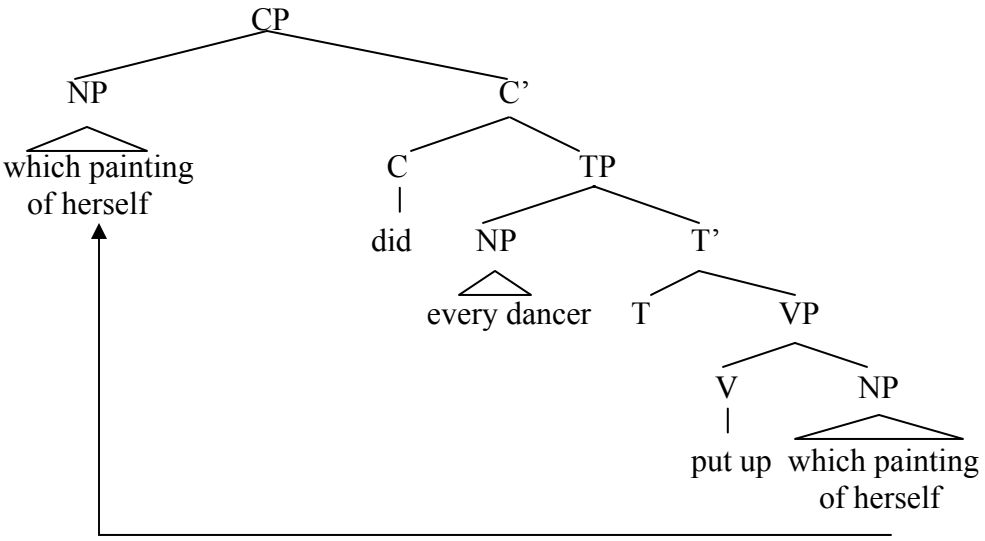
The coreferential interpretation preferred by children is only compatible with a non-reconstructed reading: if "Miss Cruella" is interpreted in its reconstructed position, it will be c-commanded by "she," resulting in a Principle C violation. Only by interpreting "Miss Cruella" in its surface position can a Principle C violation be avoided.

Children's preference for coreference in Experiment 4 is in line with previous studies that show children to prefer the surface scope interpretation of scopally ambiguous sentences where the inverse scope reading requires reconstruction (Lidz & Musolino, 2002; Musolino, 1998; Musolino, Crain, & Thornton, 2000; Musolino & Lidz,

2003). In other words, children prefer surface interpretations of sentences that involve scope reconstruction, as well as sentences that involve reconstruction for the purposes of binding theory. Experiment 5 seeks to establish the nature and strength of children's preference for surface structure, exploring whether they will ever assign a reconstructed interpretation to a sentence when a non-reconstructed interpretation is licensed.

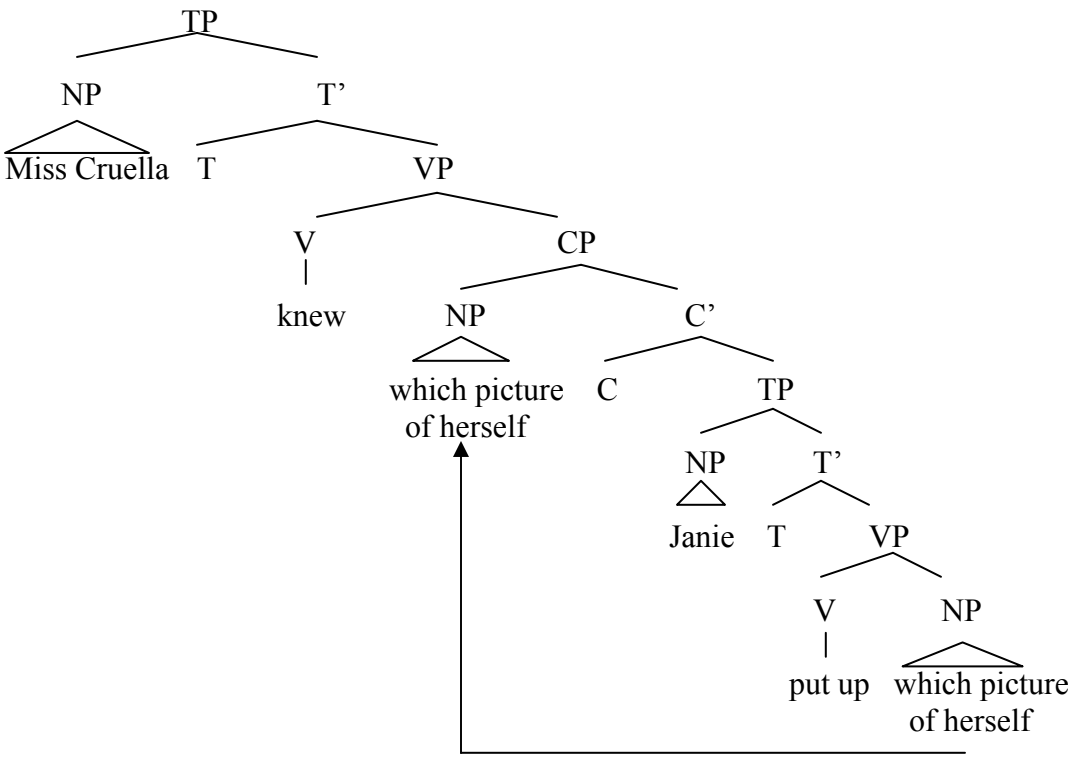
Recall that for adults, reconstruction is not obligatory for the wh-arguments tested, even in Principle C environments: while they may prefer an interpretation consistent with reconstruction, Experiment 4 shows that they are able to access both reconstructed and non-reconstructed readings. Children, in contrast, consistently assign only the non-reconstructed interpretation. This is not to say that their grammars do not allow for reconstruction of moved arguments. Indeed, Experiment 1 showed that children do assign a reconstructed interpretation to questions with moved arguments when required to do so by their grammar: in that case, reconstruction was required so that the anaphor could be bound and satisfy Principle A, as in (22) repeated below:

(22) Which painting of herself$_i$ did every dancer$_i$ put up?



Only by interpreting the anaphor in its reconstructed position may it be bound by the subject. Thus Experiment 1 showed children's grammars do allow for reconstruction of moved arguments when it is required to satisfy a grammatical constraint. It is not clear, however, whether children would allow for reconstruction of moved arguments when they have the option of assigning a competing surface interpretation. Experiment 4 did demonstrate that children prefer coreference for argument questions subject to Principle C, which is consistent with a preference for surface structure. Experiment 5 aims to more conclusively establish this preference with embedded questions subject to Principle A, as in (42), where the reconstructed versus non-reconstructed interpretations may be tested more directly: if the reconstructed interpretation is assigned, the anaphor is bound by Janie, and if the surface interpretation is assigned, the anaphor is bound by Miss Cruella:

(42) Miss Cruella$_i$ knew which painting of herself$_{i/j}$ Janie$_j$ put up.



In the position where it is pronounced, the anaphor is in the local domain of "Miss Cruella" and is c-commanded by it, thus establishing binding between the anaphor and the matrix subject antecedent. On the other hand, if the anaphor is interpreted in its underlying position, it is only in the local domain of "Janie," and being c-commanded by it, is interpreted as bound by this embedded subject antecedent. Thus Experiment 5 uses items like those above to test whether children's grammars allow for a reconstructed interpretation (e.g. binding by the embedded subject antecedent) when a non-reconstructed reading (e.g. binding by the matrix subject antecedent) is available.

The results of Experiment 5 demonstrate that children actually reject the reconstructed interpretation of a moved argument when a non-reconstructed reading is

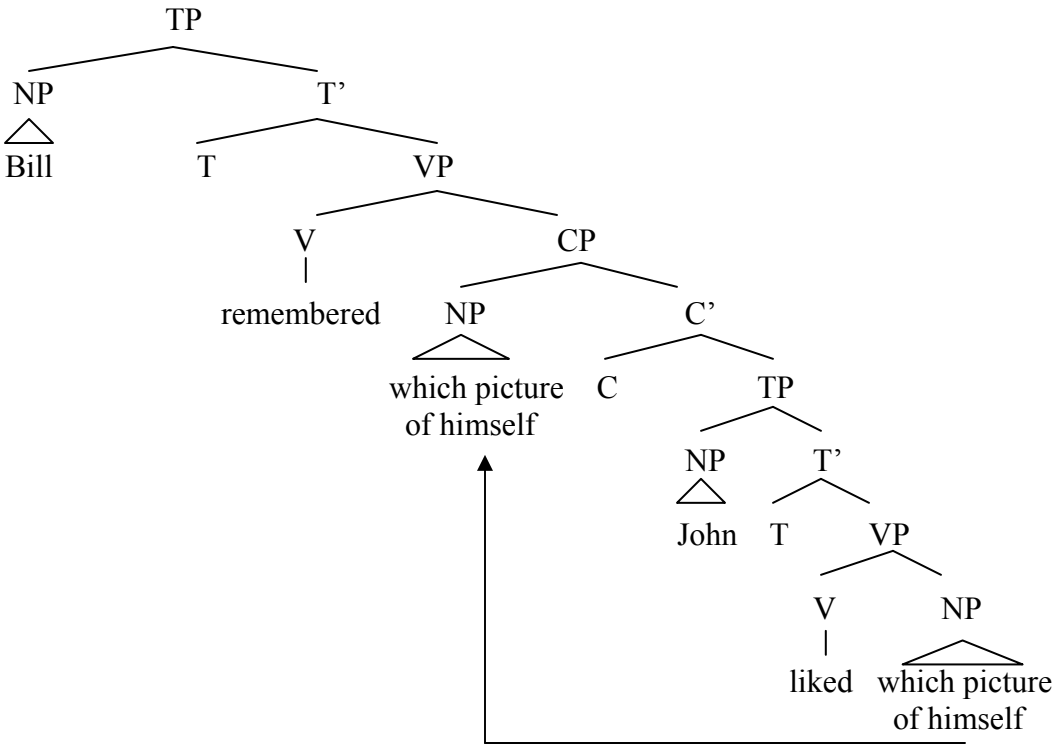
licensed. Adults, on the other hand, once again access both interpretations, although in contrast to Experiment 4, appear to prefer the non-reconstructed reading. These apparently conflicting preferences are further explored in Experiment 6.

This chapter concludes with a discussion of various theoretical analyses of the results from Experiments 1-6. After considering several alternatives, a referentiality-based account of the predicate/argument asymmetry, combined with a processing analysis of the argument results, is shown to best account for both children's and adults' preferences. Both children and adults are shown to obligatorily assign a reconstructed interpretation to moved predicates, in contrast to moved arguments. This pattern is predicted if nonreferential items like wh-predicates are required to be interpreted in their reconstructed position, as postulated in Heycock (1995). With respect to moved arguments, which may be interpreted either in their surface or reconstructed position, the child results show that children employ a parsing strategy that favors the surface interpretation. When an interpretation that corresponds to the surface structure of the sentence is licensed by their grammar, that is the reading children will persist with, as they have difficulty revising their initial parse of a sentence (Trueswell, Sekerina, Hill, & Logrip, 1999). In other words, children's parsing strategy actually masks their adult-like knowledge of reconstruction in environments where reconstruction is not obligatory. Adults, in contrast, follow economy constraints in generally preferring the reconstructed interpretation, even when it is not required (Chomsky, 1993; Fox, 1999, 2002). This preference may be mitigated by competing factors, however, such as a preference for quickly resolving anaphoric antecedents.

3.1. Experiment 5

Experiment 5 is designed to further examine children's and adults' preferences with respect to optional reconstruction by testing their interpretations of embedded questions subject to Principle A. For example, the sentence in (43) is ambiguous, with its meaning determined by whether the anaphor is interpreted in its surface or reconstructed position:

(43) $Bill_i$ remembered which picture of $himself_{i/j}$ $John_j$ liked.



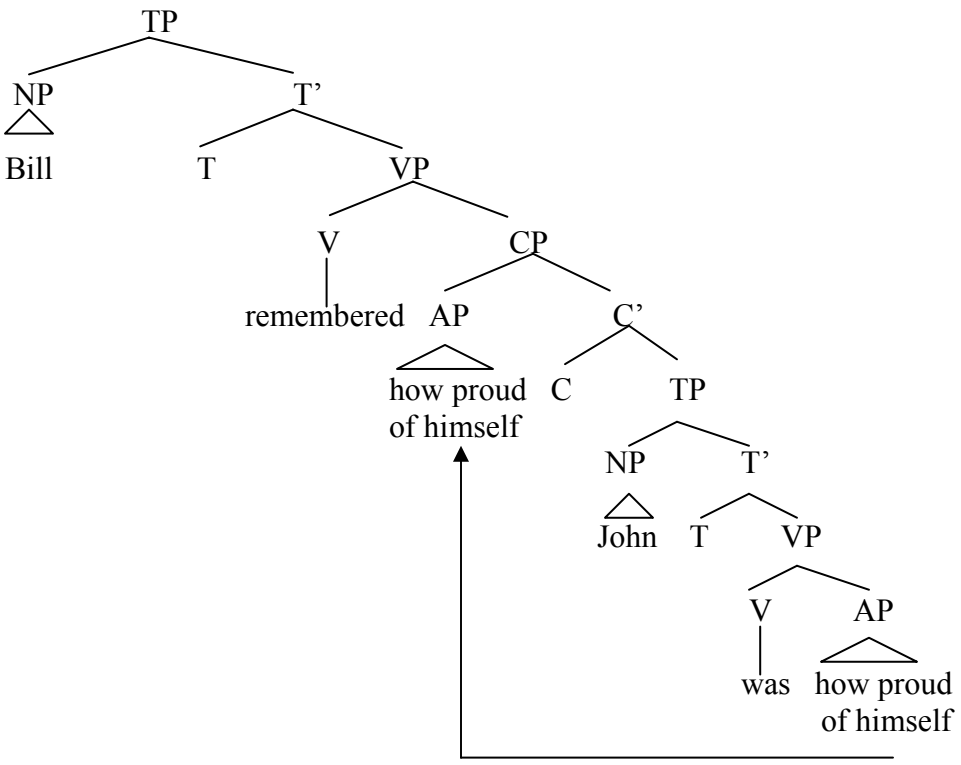
If the anaphor is interpreted in its surface position, then Bill is the antecedent for the reflexive, since "Bill" locally c-commands the anaphor. However, if the anaphor is

interpreted in its reconstructed position, John is the antecedent, since in its base position "John" is the only NP c-commanding the reflexive in its clause.

Experiment 5 tests the strength of children's preference for non-reconstructed, surface interpretations, by establishing whether children ever assign a reconstructed reading when a competing surface interpretation is available. Indeed, if children consistently fail to assign the reconstructed interpretation when it is not obligatory, they would be predicted to actually reject (43) as false in a context where Bill remembers which picture of John that John liked (since this interpretation is only generated via reconstruction). Adults, on the other hand, are predicted to access either reading, if reconstruction of moved arguments is truly optional for them.

Embedded questions where the wh-phrase is a predicate provide an appropriate control condition for items like those in (43), as both children and adults obligatorily assign a reconstructed interpretation to wh-predicates. Thus a sentence like (44), which has a surface structure similar to (43), is actually unambiguous:

(44) $Bill_i$ remembered how proud of $himself_{*i/j}$ $John_j$ was.

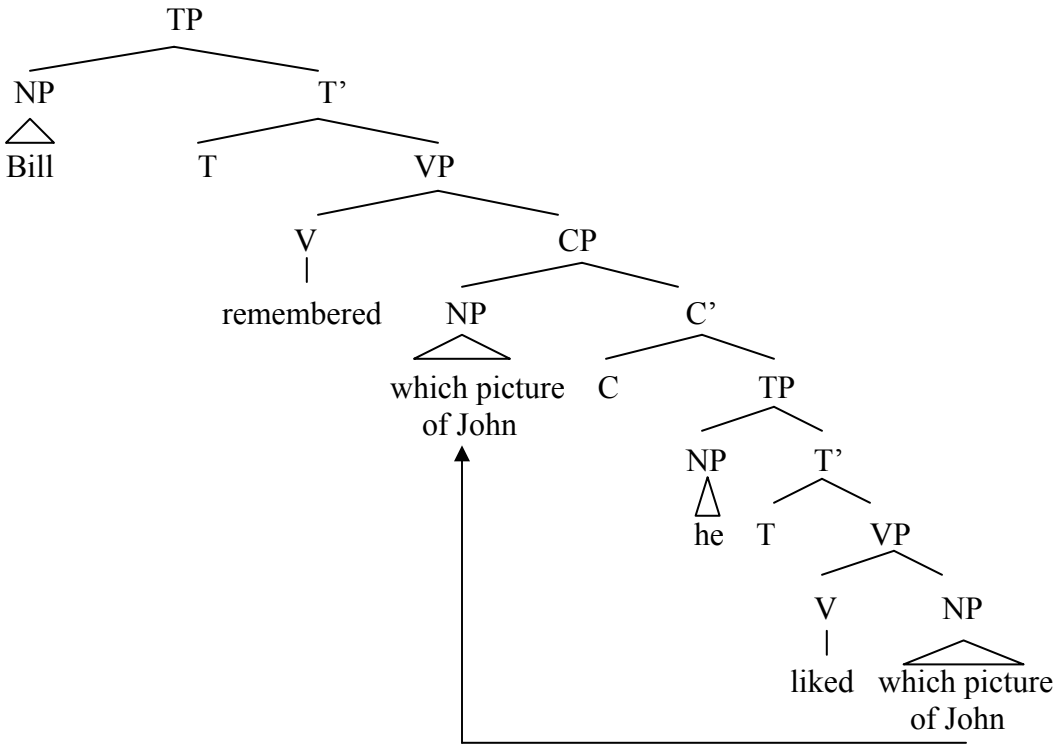


In this case, the antecedent for "himself" must be John, demonstrating that the wh-phrase must be interpreted in its original, reconstructed position. Experiment 4 revealed that both children and adults overwhelming prefer the reconstructed interpretation for predicate questions. Therefore we may predict that while both adults and children would consistently assign the reconstructed interpretation to embedded predicate questions like (44) they would differ in their performance on embedded argument questions like (43): for these sentences adults are predicted to freely access both the reconstructed and non-reconstructed interpretations, while children are predicted to consistently reject the reconstructed interpretation in favor of the non-reconstructed one.

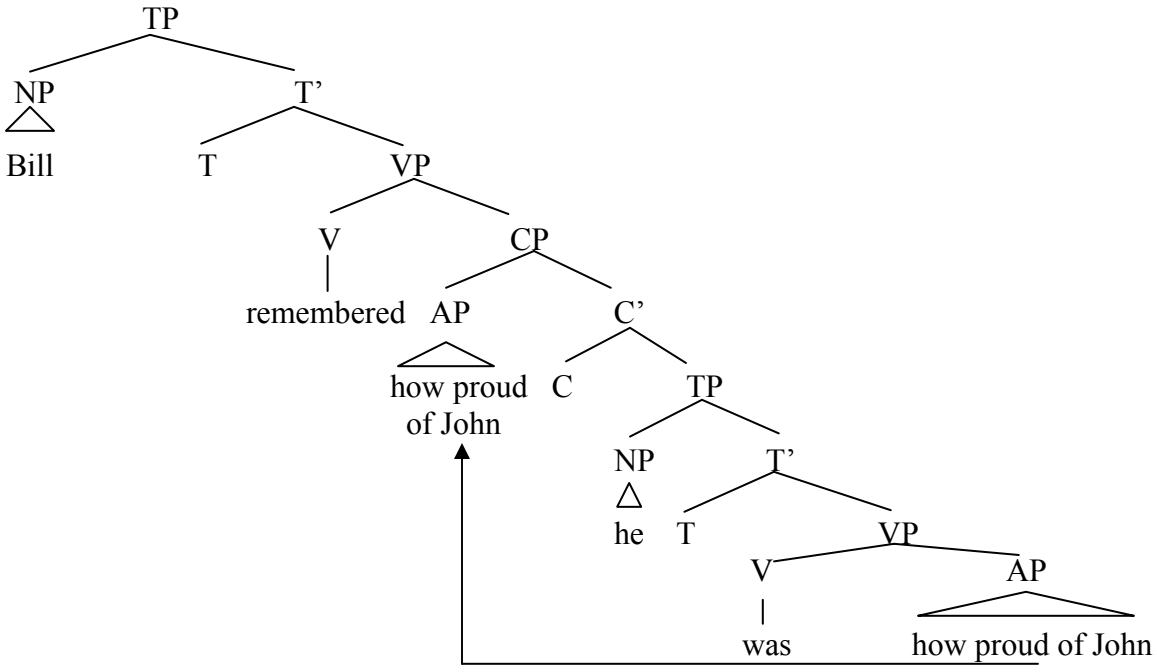
Testing sentences like those above also may shed light on the logophoricity or "exempt anaphors" analyses mentioned above (Goldwater & Runner, 2004; Pollard & Sag, 1992; Reinhart & Reuland, 1993). These accounts propose that reflexives in picture-NP's are actually not subject to Principle A, and may find antecedents in a wider range of structural contexts than what Principle A would suggest. Thus if anaphors embedded in picture-NP's are unconstrained by Principle A, then both the matrix and embedded subjects should be equally likely antecedents in (43). Finding that children rule out the embedded subject as an antecedent would provide evidence that structural configuration *does* matter for assigning interpretations to anaphors, and furthermore that children are sensitive to it.

To complement Experiment 4, another experiment testing embedded questions subject to Principle C, as in (45-46), was also considered:

(45) $Bill_i$ remembered which picture of $John_j$ $he_{i/j}$ liked.



(46) $Bill_i$ remembered how proud of $John_j$ $he_{i/*j}$ was.



On the reconstructed reading of (45), interpreting "he" as John is ruled out by Principle C, forcing the pronoun to be coreferential with Bill. On a surface interpretation, however, coreference with either "Bill" or "John" is licensed; in that case, there is no pronoun c-commanding either R-expression to generate a Principle C violation, so neither interpretation is blocked. In contrast, in (46), where the moved constituent is a predicate, reconstruction of the wh-phrase is obligatory. Thus interpreting "he" as John is ruled out, but interpreting "he" as Bill is perfectly fine. Unfortunately, testing sentences like those in (45) has the disadvantage of losing the asymmetry between children's and adults' responses predicted to emerge in the corresponding Principle A test described above. Reconstruction in (45) simply rules out one interpretation that would otherwise be allowed, it does not add another interpretive possibility like (43) does. Both children and adults would be expected to allow "he" to refer to John in (45): adults because reconstruction for them is optional for moved arguments, and children because they disprefer reconstruction. For this reason, Experiment 5 was limited to testing embedded questions subject to Principle A, which are predicted to reveal a contrast between children's and adults' interpretations of moved arguments.

3.1.1. Method and Design

Experiment 5 tested children and adults on items like those in (43-44). In order to maximize the number of test sentences subjects responded to, a new modification of the TVJT was used: instead of responding to one question and one statement after each story, participants were asked to judge the truth/falsity of two statements. Because participants had no difficulty with the combination TVJT/questions after stories task used in

Experiments 1-4, there was no reason to suspect two statements would be too taxing for children (if anything, it would be expected to be easier than having to respond to a question and then judge a statement). Using two statements also allowed for each story to have one test item and one filler associated with it, as with the earlier experiments. In Experiment 5, the test statement was always presented as the first statement to be judged by the participant; filler statements were designed to ensure subjects were paying attention and understanding the stories appropriately. Before uttering the test statement, the puppet experimenter again provided a recap sentence where all of the characters were named. The order in which the characters were mentioned was varied to control for any salience effects. Likewise, the order in which the test items were presented was varied across subjects, with half receiving the items in one order, and half receiving them in the reverse, in order to control for any ordering effects. Each subject received four items in each embedding context (argument versus predicate) for a total of eight test items. Items were varied so that within a given condition, a single subject saw two stories where the context made the matrix subject antecedent true (and the embedded subject antecedent false), and two where the context made the embedded antecedent true (and the matrix antecedent false). A complete list of test statements and fillers for Experiment 5 can be found in Appendix E.

The stories used in Experiment 5 again resembled those used in Experiments 1-4. For example, one version of the story corresponding to the argument item in (42) (repeated below) featured Miss Cruella, Janie, and Mr. Lion:

(42) Miss Cruella knew which painting of herself Janie put up.

In this story, Miss Cruella asks Janie and Mr. Lion for help decorating her dance studio. She has four paintings she wants to put up on a large wall: two with her picture in them (one red, one white), and two with Janie's picture in them (one red, one white). She is very busy, so she asks if Janie and Mr. Lion can put up the paintings, and they agree. Before she leaves to go back to her office (behind the wall), she asks Janie and Mr. Lion to share the job equally, since they are both such good workers. They agree, and say each of them will put up one painting with Janie in it, and one with Miss Cruella in it. Miss Cruella is pleased, and leaves (going behind the wall).

The story continues with Mr. Lion going first to put up his paintings. He deliberates, but because red is his favorite color, he decides to put up the red painting of Miss Cruella, and the red painting of Janie. He'd like to put them up high on the wall, but because he is so big and cannot jump high enough to get them up there, he puts both paintings down low on the wall. Janie goes next. Because she is such a good dancer, she is able to jump high, and after some deliberation she decides to put Miss Cruella's white painting way up high on the wall, where it will look really important. Miss Cruella is the boss, after all. But after thinking about it, Janie decides to put her own white painting down low on the wall, so it can be next to the red one.

Miss Cruella returns and admires the good work Janie and Mr. Lion have done. She decides to play a little game, and see if she can figure out which paintings each of them put up. She deliberates, and notices that her own white painting is way up high on the wall. Miss Cruella knows that Janie is the only one who could have jumped high enough to put a painting up that high. She just *knows* Janie put up the white painting

with her (Miss Cruella) in it. Janie confirms this, and Miss Cruella reiterates that she does know which of her paintings Janie put up. But now Miss Cruella considers the rest of the wall. She notices both of Janie's paintings are down low. After thinking about which one Janie put up, she gives up, saying she just doesn't know which painting with Janie in it Janie put up.

This context therefore makes the interpretation where the anaphor is bound by the matrix subject antecedent true, and the interpretation where it is bound by the embedded antecedent false: Miss Cruella knew which painting with Miss Cruella in it Janie put up, but did not know which painting with Janie in it she put up. Thus the condition of falsification is satisfied, as is the requirement of plausible dissent, since Miss Cruella deliberated before eventually only figuring out one of the paintings Janie put up. Given this version of the story, all participants are expected to accept the sentence as true, since adults should have both the reconstructed and non-reconstructed interpretations available, and children prefer the non-reconstructed reading where the reflexive is bound by the matrix antecedent. On the alternate version of this story, which makes binding by the embedded antecedent true, the scenario is simply amended so Janie puts the painting with her own picture in it up high (Miss Cruella follows the same logic to figure out which ones Janie put up). With this version of the story, adult participants should judge the sentence in (42) as true, since they have a reconstructed interpretation available to them. Children, on the other hand, if they will not assign a reconstructed interpretation when a non-reconstructed one is available, are predicted to reject this sentence as false (since Miss Cruella did not know which painting with Miss Cruella's picture in it Janie put up).

The predicate stories also resembled their counterparts used in the previous experiments. For example, the story for the test item in (47) featured Mr. Whale and Mr. Walrus:

(47) Mr. Whale knew how happy with himself Mr. Walrus was.

In this story, Mr. Walrus has been teaching Mr. Whale how to balance a ball on his nose while swimming across a pool. Mr. Walrus is pretty new to ball balancing too, but together they have practiced quite a bit, and they are getting ready for the big show tomorrow. In the show, they will try to balance their balls all the way across the pool. Since ball balancing is so difficult, Mr. Whale suggests they practice before tomorrow's show, and Mr. Walrus agrees, as he wants to do well for his teacher. Mr. Walrus also wants to do well, and suggests they see how happy they can make him by how far they can balance. Mr. Walrus goes first, struggles a bit, but manages to balance his ball all the way across the pool. Mr. Whale then tries, but only balances his ball a little ways. Mr. Whale is worried, and wants to figure out how happy Mr. Walrus is with their performance. He thinks aloud a bit, finally deducing that Mr. Walrus must be very happy about how he (Mr. Walrus) did, since Mr. Walrus balanced all the way across the pool. Mr. Walrus confirms that is right, and Mr. Whale is pleased that he figured it out, he just knew Mr. Walrus must be happy about his performance. He reiterates that he does know how happy Mr. Walrus is about how he did. Afterward Mr. Whale wants to figure out how happy Mr. Walrus is about how Mr. Whale did. He thinks aloud, saying that he has not been ball balancing long, and even getting a little ways across the pool is pretty good, but it might not have been as good as Mr. Walrus was expecting. In the end, he just

cannot figure it out; he does not know how happy Mr. Walrus is about how he (Mr. Whale) did.

In this version of the story, binding by the embedded antecedent is made true, and binding by the matrix antecedent false, satisfying the condition of falsification. The requirement of plausible dissent is also met, as Mr. Whale must do some deducing, making it equally possible that he figure out Mr. Walrus' level of happiness with one of them, but not the other. Because the embedded antecedent is true in this case, participants are expected to accept the sentence in (47) as true if they access the reconstructed interpretation. In the alternate version of this story, Mr. Whale balances his ball all the way across the pool, but Mr. Walrus does not. The build up to the action emphasizes how difficult ball balancing is for both characters (even though Mr. Walrus is still the one teaching Mr. Whale how to do it). The rest of the story is the same, however, with this time Mr. Whale only knowing how happy Mr. Walrus is with Mr. Whale's performance, and not how happy he is with his own performance. In this case, the matrix antecedent is made true, but the embedded one is false. Therefore, if participants access the reconstructed interpretation, they should judge the sentence in (47) to be false.

Due to the difficulty of finding matrix verbs that select for embedded questions that could be depicted in a story acted out with toys, the same four verbs were used in the argument context as were used in the predicate context (*know, remember, forget, figure out*). The stories were constructed so that the order in which the character remembered, figured out, etc. the relevant piece of information was varied in order to prevent any salience bias; half of the time the character figured out about himself first, and half of the

time figured out about the other character first. As mentioned previously, the recap sentences were also varied in the order in which the characters were mentioned, to prevent creating any salience bias from mentioning one last.

In line with the previous experiments, both adults and children were expected to show obligatory reconstruction of moved predicates, accepting only sentences where the story makes binding by the embedded antecedent true, and rejecting those where binding by the matrix antecedent is made true. For the argument items, adults were expected to accept either antecedent, as they are predicted to allow for either the reconstructed or non-reconstructed interpretation. Children, like adults, were expected to accept binding by the matrix antecedent, as they have a preference for surface structure readings. Their performance on the argument items that make the embedded antecedent true (in italics below) is thus the crucial condition. If they do not allow for reconstruction when a competing surface reading is available, they should reject binding by the embedded antecedent, even when the story makes this reading true.

	Predicate		**Argument**	
	Matrix True	**Embedded True**	**Matrix True**	**Embedded True**
Adults	False	True	True	True
Children	False	True	True	***False***

Table 1. Predicted judgments for Experiment 5.

3.1.2. Results

Thirty 4-year-old children (16 males, 14 females; mean age 4;5) and 24 Northwestern undergraduates participated in this study. Six children were excluded from the final

analysis: three for missing more than one filler item, and three for not being able to sit through the entire experiment. As the stories were more complicated than the ones used in Experiments 1-4, such a result was not entirely unexpected; the task clearly demanded much concentration from the participants. Adults once again generally outperformed children, a result that was again expected given the complexity of the test scenarios.

The Wilcoxon signed-ranks test was once again used to analyze this data. As expected, for the predicate items, where the embedded subject is the only licensed antecedent due to obligatory reconstruction, both children and adults accepted the test sentence when the context made the embedded antecedent true (75% acceptance rate for children; 88% for adults), and rejected it when the context made the matrix subject antecedent true (27% acceptance rate for children; 13% for adults). Significant differences between acceptance rates for predicate items where the matrix antecedent was made true versus the embedded antecedent were found for both groups ($Z = 3.411$, $p = .001$ for children; $Z = 4.239$, $p < .001$ for adults). Adults and children also performed as expected in the argument condition. Both groups consistently accepted the argument test sentences as true when the context made the matrix antecedent true (77% acceptance rate for children; 92% for adults). Interestingly, however, adults did not have as high of an acceptance rate (69%) when the story made the embedded antecedent true, although they clearly were above chance in assigning this reading, which is consistent with reconstruction. Closer examination of the adult results reveals that few adults consistently rejected the embedded antecedent: more often they would accept it on one test item and reject it on another, with no consistency across items. Children, on the

other hand, consistently rejected the embedded antecedent for the argument items, accepting that reading only 33% of the time. Significant differences were found for both groups between rates of acceptance for argument items where the story made the matrix antecedent true versus the embedded antecedent for both groups ($Z = 3.311$, $p = .001$ for children; $Z = 2.021$, $p = .043$ for adults).

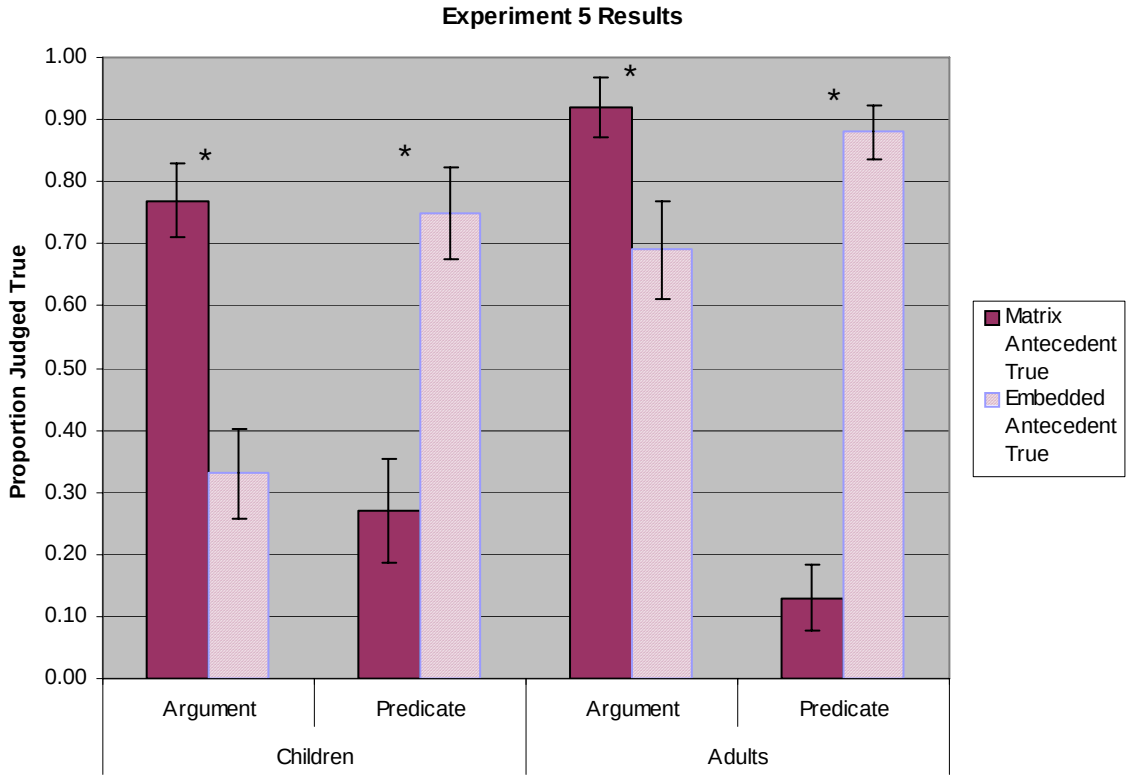


Figure 7. Mean proportion of embedded questions subject to Principle A judged true when the story makes binding by the matrix subject antecedent true versus binding by the embedded subject antecedent true for child (n = 24) and adult (n = 24) groups in argument and predicate conditions.

In accepting the test sentences for predicate items when the story made the embedded antecedent true, but rejecting them when the matrix antecedent was made true, both children and adults once again show evidence of accessing only the reconstructed interpretation when reconstruction is obligatory. For the argument items, the adult results were somewhat surprising: while they accepted both the reconstructed and non-reconstructed interpretations (as expected), they accepted sentences where the embedded antecedent was true less often. Children, as predicted, actually rejected sentences when the story made the embedded antecedent true, highlighting their strong preference for the non-reconstructed interpretation.

3.1.3. Discussion

Experiment 5 replicates the results from earlier experiments showing both children and adults consistently assign reconstructed interpretations to sentences where reconstruction is obligatory. Specifically, both groups once again demonstrated obligatory reconstruction of moved predicates in Experiment 5, consistently rejecting non-reconstructed interpretations of such sentences, even when this reading was made true by the context. These results stand in contrast to both groups' performance in the argument condition. In this condition, adults accepted either antecedent, as expected. However, their rate of acceptance for the matrix subject antecedent was significantly higher than their acceptance rate for the embedded subject antecedent, suggesting a preference for the non-reconstructed interpretation; recall that Experiment 4 revealed the opposite preference for adults, when they preferred the disjoint, reconstructed interpretation over

the surface interpretation. Adults' preferences with respect to antecedent choice will be further explored in Experiment 6.

Like adults, children consistently accepted binding by the matrix antecedent for the moved argument items in Experiment 5, demonstrating their ability to access the surface interpretation. However, when the story made only the reconstructed interpretation true, children actually rejected the sentences as false. This result underscores what was found in Experiment 4: when a non-reconstructed reading is available, children overwhelmingly prefer that interpretation. Crucially, however, children's grammars do allow for reconstruction of moved arguments. As was demonstrated in Experiment 1, children consistently access the reconstructed interpretation of moved arguments when required to do so by their grammar (in that case, to satisfy Principle A). Children's failure to assign the reconstructed interpretation in Experiments 4 and 5, where reconstruction is not required to satisfy any other grammatical constraint, may thus be explained as the result of a single mechanism: children have a parsing preference for surface structure interpretations. While their grammars include reconstruction, when faced with a surface structure interpretation that is licensed by their grammar, that is the reading children persist with.

This result closely mirrors findings from previous experiments examining children's interpretations of scopally ambiguous sentences (Lidz & Musolino, 2002; Musolino, 1998; Musolino, Crain, & Thornton, 2000; Musolino & Lidz, 2003). As mentioned earlier, these experiments showed that children consistently assigned a scopal

interpretation consistent with the surface structure of the sentence to sentences that were scopally ambiguous for adults, as in (2), repeated below:

(2) Every horse didn't jump over the fence.

(ii) None of the horses jumped over the fence. (**surface scope**)
(EVERY > NOT)

(ii) Not every horse jumped over the fence. (**inverse scope**)
(NOT > EVERY)

While adults freely assigned either a surface or inverse scope interpretation to scopally ambiguous sentences depending on context, children actually rejected the inverse scope reading. This was found both for sentences where the inverse scope interpretation was potentially generated via reconstruction as well as sentences where it was generated via quantifier raising. Subsequent studies went on to show that children do have access to these operations that generate the inverse scope interpretation (Lidz, et al, 2003 for quantifier raising; Musolino & Lidz, 2004 for scope reconstruction). Given this, children's preference for the surface scope interpretation required explanation. One hypothesis that may explain this result is that children are actually unable to generate an inverse scope interpretation when a surface reading is available. With respect to the current study, this would mean children never assign a reconstructed interpretation when a surface reading is licensed. Indeed, the results from Experiment 4, where children consistently assigned a surface interpretation instead of the reconstructed interpretation adults preferred, suggests this may be the case. Likewise, children's performance in Experiment 5, where they actually rejected the reconstructed interpretation when it was

made true by the story, supports the idea that once children have a surface reading available, they fail to generate any others.

However, Musolino & Lidz (2004) demonstrated that when the context sets the expectation for the inverse scope interpretation of a scopally ambiguous sentence, children will accept this reading. In other words, children are able to generate inverse scope, but have a strong enough preference for the surface interpretation that they reject sentences on the inverse scope interpretation. Given this result, as well as the importance of story context that was demonstrated in Experiments 2 and 3, it seems likely that children could be shown through further experimentation to accept a reconstructed interpretation of the moved argument in sentences like those tested in Experiment 5. As Experiments 1-4 provide strong evidence that children have reconstruction in their grammars, manipulation of the contexts that might promote reconstructed readings of sentences where reconstruction is optional is left for future work. What is clear from the current results is that children, unlike adults, have a strong preference for the non-reconstructed, surface interpretation regardless of the type of structure being considered (configurations subject to Principles A and C, scopally ambiguous sentences). Analyses of this preference will be discussed in section 3.3.

3.2. Experiment 6

Experiment 4 provided empirical evidence that reconstruction is optional for adults when interpreting questions with moved argument picture-NP's. In that study, while adults more often assigned a disjoint interpretation consistent with reconstruction

to such questions, they did allow for some variability, in contrast to their interpretations of predicate questions where reconstruction was obligatory (77% disjoint interpretation for argument items versus 98% for predicate items). In other words, while reconstruction was clearly not obligatory for the moved arguments tested, adults still preferred an interpretation of the relevant test sentences (as in (37)) that was consistent with reconstruction:

(37) Which painting of Miss Cruella did she put up?

In this case, the preferred disjoint interpretation is forced if the R-expression is interpreted in its reconstructed position. The fact that adults allowed for a coreferential interpretation of such sentences about a quarter of the time shows that they have a non-reconstructed reading available, in contrast to their interpretation of predicate items like (35) where reconstruction is obligatory:

(35) How pleased with Alice was she?

Experiment 5 aimed to further investigate adults' preferences when reconstruction is optional. As discussed above, adults in that experiment readily accepted the non-reconstructed interpretation of a sentence like (42), in which the reflexive is bound by the matrix antecedent, when the story made that reading true (92% acceptance rate).

(42) Miss Cruella knew which painting of herself Janie put up.

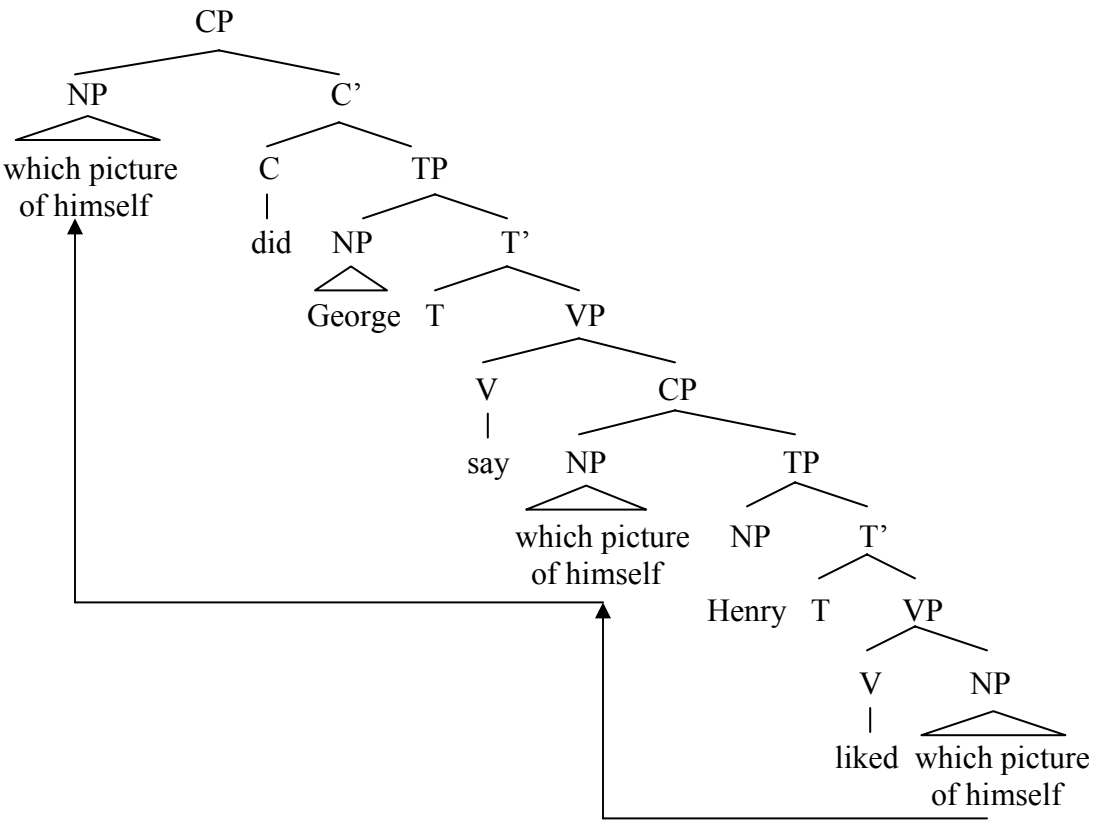
In contrast, while adults still accepted such sentences when the story made binding by the embedded antecedent true, they did so less often (67% acceptance rate).

These results, while suggestive, do not conclusively show that adults actually prefer binding by the matrix subject over the embedded subject. Since the experiment

was not designed to pit one reading against the other, it is impossible to know which reading adults truly favor. The Experiment 5 results simply show that adults are more likely to accept the test sentence when the story makes the non-reconstructed reading true than they are to accept it when the story makes the reconstructed interpretation true; it does not explicitly show which reading is preferred.

Nevertheless, previous experiments testing adults on similar sentences do show a preference for binding by the matrix subject over the embedded subject. In these experiments, the choice of antecedent is not divided between reconstructed and non-reconstructed interpretations, but rather (assuming Principle A) between two different reconstruction sites, as in (48):

(48) Which picture of himself$_{i/j}$ did George$_i$ say Henry$_j$ liked?



In a questionnaire study, Plunkett (1991) compared judgments of ambiguous sentences like (48) to judgments of unambiguous sentences like those in (49) (which are unambiguous due to a gender mismatch between the anaphor and one of the potential antecedents):

(49) a. Which lie about himself$_{i/*j}$ did George$_i$ think Sally$_j$ hated most?

b. Which lie about herself$_{*i/j}$ did George$_i$ think Sally$_j$ hated most?

The results revealed a strong preference for the matrix antecedent: 80% of participants preferred a sentence where the reflexive was unambiguously bound by the matrix subject (as in (49a)) to one with unambiguous binding by the embedded subject (as in (49b)). In

ambiguous cases, only 34.5% chose an interpretation where the reflexive was bound by the embedded antecedent.

Frazier, Plunkett & Clifton (1996) conducted an on-line follow-up to Plunkett's study using a self-paced reading task. Participants were asked to answer a comprehension question after reading each test item to verify which antecedent they had chosen. Both the reading-time and comprehension measures confirmed Plunkett's finding that the matrix subject antecedent is preferred by adults. Participants took significantly longer to read sentences with binding by an unambiguous embedded antecedent than they did to read corresponding sentences with an unambiguous matrix antecedent. They also had more difficulty comprehending sentences with an unambiguous embedded antecedent (63% correct answers to the comprehension follow-up question versus 93% correct for unambiguous matrix antecedent sentences). For the ambiguous sentences, participants also clearly preferred the matrix antecedent to the embedded antecedent when asked to choose one in the follow-up comprehension question (the matrix antecedent was chosen 68% of the time).

These studies show a clear preference for interpreting reflexives as bound by a matrix antecedent over interpreting them as bound by an embedded antecedent. Experiment 6 aims to replicate this result using the argument test sentences from Experiment 5 (the predicate test sentences were omitted, as the reflexive is always unambiguously bound by the embedded antecedent). Recall that Experiment 5 showed adults to be more likely to accept a test sentence as true when the story made binding by the matrix antecedent true than they were when it made binding by the embedded

antecedent true. Experiment 6 pits these two readings against each other, asking adults to choose one, and thus reveal which antecedent is preferred.

3.2.1. Method and Design

In contrast to previous experiments, only adults participated in Experiment 6. Because children consistently rejected the reading where the reflexive was bound by the embedded antecedent in favor of binding by the matrix antecedent in Experiment 5, their preference was clearly established, and there was no need to re-test them in Experiment 6. Adults, however, accepted readings where the reflexive was bound by either antecedent in Experiment 5 (albeit at different rates), so further study was necessary to determine their preference.

The argument test sentences from Experiment 5 were once again tested using the TVJT in Experiment 6 (see Appendix E). However, unlike Experiment 5 where the stories were constructed to make the reading where binding by one antecedent was true and binding by the other false, the stories in Experiment 6 were constructed so both readings were true. The TVJT method was again followed, with participants being asked to judge the sentence true or false, but in this case, all of the test sentences were expected to be judged true (since all were true on both logical interpretations). In order to determine which interpretation had been assigned, and thus which antecedent was preferred, participants were asked to justify their answer on all items, saying why they thought the sentence was true. For test items, they were also explicitly asked to identify who the reflexive referred to, choosing between the matrix and embedded subjects. An example story will help illustrate.

For the story corresponding to the sentence in (42), once again Miss Cruella, Janie, and Mr. Lion are faced with a picture-hanging task.

(42) Miss Cruella knew which picture of herself Janie put up.

Miss Cruella asks Mr. Lion and Janie to help her, since she is so busy, and does not have time to put up the paintings to decorate their studio. There are again four paintings, two with Janie's picture (one red, one white), and two with Miss Cruella's picture (one red, one white). Miss Cruella wants Janie and Mr. Lion to divide up the work, and each put up two paintings on the wall behind them. Janie and Mr. Lion agree, saying they will each put up one painting with Janie in it, and one with Miss Cruella in it. Miss Cruella thinks that is a fine idea, and leaves the room to go back to her office (behind the wall). Mr. Lion surveys the paintings, deciding which one with Miss Cruella in it he wants to put up. Since red is his favorite color, he decides to put up the red painting with Miss Cruella in it, and then also decides to put up the red painting with Janie in it. While he would like to put them up high on the wall, he is too big and heavy to jump that high, so he puts the two red paintings down low on the wall. Janie goes next. She thinks about it, but decides that because she can jump high, she will put both white paintings way up high on the wall, where they will look really important. Miss Cruella returns to the room, congratulating Mr. Lion and Janie on the good job they have done. She is so impressed and sorry she missed the action, but decides to make up for it by trying to figure out which paintings each of them put up. She looks at the wall, and mulls over which painting with her picture in it Janie must have put up. After deliberating for a while, she notices that her white painting is way up high on the wall, and knows that only Janie

could have jumped that high to get it up there, so figures Janie put up the white painting with her (Miss Cruella's) picture in it. Janie confirms she is right. Then Miss Cruella says the same must be true then about the white painting with Janie in it; Janie must have put up the white painting with her own picture in it. Janie again confirms that Miss Cruella is right. Miss Cruella says she is happy; she now knows which of the paintings with each of their pictures Janie put up.

Given this scenario, participants in this study are predicted to judge (42) to be true on both interpretations: the interpretation where the anaphor is bound by the matrix subject is true, because Miss Cruella knew which painting of Miss Cruella Janie put up, and the interpretation where the anaphor is bound by the embedded subject is also true, because Miss Cruella knows which painting of Janie that Janie put up. The condition of falsification does not apply in this case since both interpretations are true, but the requirement of plausible dissent is satisfied since Miss Cruella cannot immediately tell which pictures Janie put up, and must deliberate before figuring it out. Unlike previous experiments, only one version of the story was required, since again, both interpretations are presented as true.

As in Experiment 5, subjects judged two sentences after each story: one test item, and one filler. The test item was again always presented before the filler, and was preceded by a recap sentence naming all of the characters (the order of mention being varied to control for any salience effects). After judging the truth or falsity of the test item, participants were also asked to answer the question "who is herself/himself?" To do so, the matrix and embedded antecedents were given on their answer sheet, and

participants were asked to circle the one that corresponded to their answer. The order in which the matrix and embedded antecedents appeared was varied to control for any ordering effects. Participants were told at the outset of the experiment that they may think that more than one answer is correct; in that case, they should choose whichever answer they think is best. Fillers were varied so that half were expected to be judged false, and half true; this avoided a situation where all test items were true and all fillers were false (which would have resulted from using the usual system to vary fillers depending on the answer to the previous test item, as in Experiments 1-5). The order in which items were presented was likewise controlled for any ordering effects: half of the subjects received the stories in one order, and the other half received them in the reverse.

3.2.2. Results

Ten Northwestern undergraduates participated in this experiment. As expected, participants demonstrated a clear preference for the matrix antecedent, overwhelmingly selecting the matrix subject as the anaphor's antecedent. As mentioned above, each participant responded to 4 items, resulting in a total of 40 judgments (across 10 participants). Among these responses, there were only three for the embedded subject; in other words, the matrix antecedent was chosen 37 of 40 times (or 93% of the time). This distribution is significantly different than what would be expected if participants had no antecedent preference and thus responded at chance ($t = 11.129$, $p < .001$). The few embedded antecedent responses were likewise fairly evenly distributed across items, with one such response for three of the items, and zero for the other.

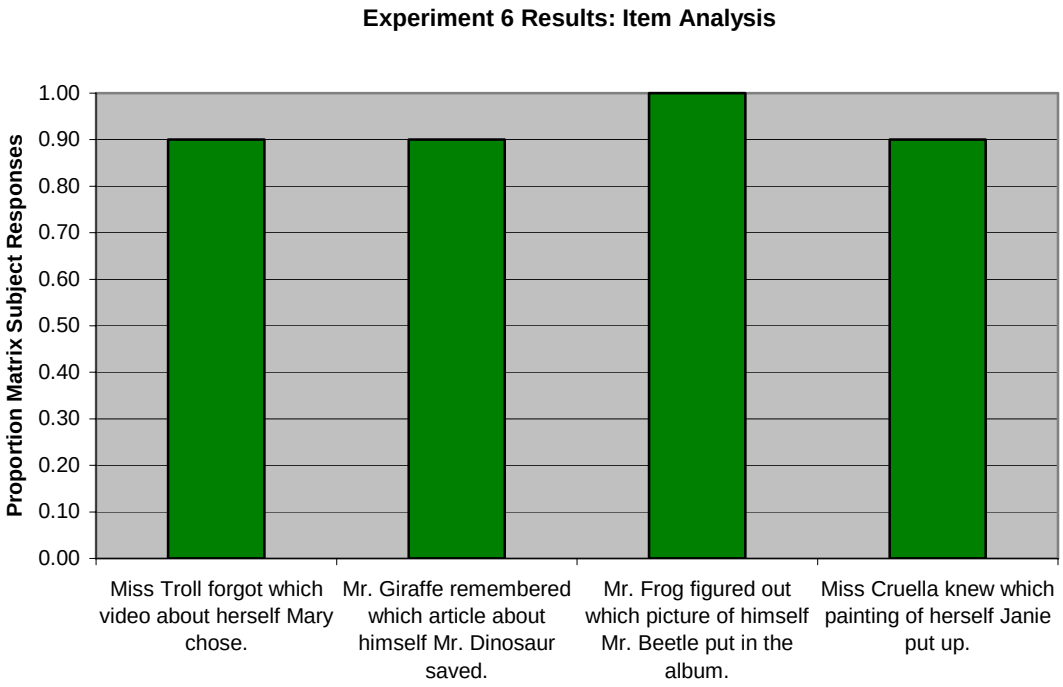


Figure 8. Proportion of matrix subject responses by 10 subjects for each item in Experiment 6.

These results thus reveal a strong preference in adults to resolve the reflexive pronoun antecedent to the matrix subject in embedded questions subject to Principle A.

3.2.3. Discussion

As expected, Experiment 6 establishes adults' preference for interpreting the anaphor as bound by the matrix subject over the embedded subject in sentences like (42).

(42) Miss Cruella knew which picture of herself Janie put up.

While the results of Experiment 5 were suggestive of this preference, the design of that experiment did not allow for direct comparison of adults' preference for the matrix versus

embedded subject antecedents. Experiment 6, in using a forced-choice task to establish adults' preferred interpretation, allowed for a direct comparison of the potential antecedents. The results reveal that like children, adults have a clear preference for the non-reconstructed, surface interpretation of embedded questions with moved arguments.

3.3 Theoretical Analysis of Results

The results of Experiments 1-6 show that by age 4, children, like adults, have reconstruction as part of their grammars. Furthermore, both groups distinguish moved arguments from moved predicates, and interpret moved predicates as obligatorily reconstructed. For moved arguments, adults show evidence of optional reconstruction, as they allow for surface, non-reconstructed interpretations a significant portion of the time in Experiments 4 and 5. However, while adults prefer the disjoint interpretation consistent with reconstruction for the Principle C questions in Experiment 4, they prefer the non-reconstructed interpretation where the anaphor is bound by the matrix antecedent in Experiments 5-6. In contrast, children consistently prefer the surface, non-reconstructed interpretation in all cases where reconstruction is not obligatory. Various theoretical analyses of these results are discussed in turn below. Eventually a combination of approaches is shown to best account for both the child and adult data.

3.3.1. Argument/Adjunct Asymmetry

As mentioned previously, one possible avenue for explaining the above results relies on an asymmetry between arguments and adjuncts with respect to reconstruction first noted in Freidin (1986) and elaborated in Lebeaux (1988, 1990, 1991). For example, while

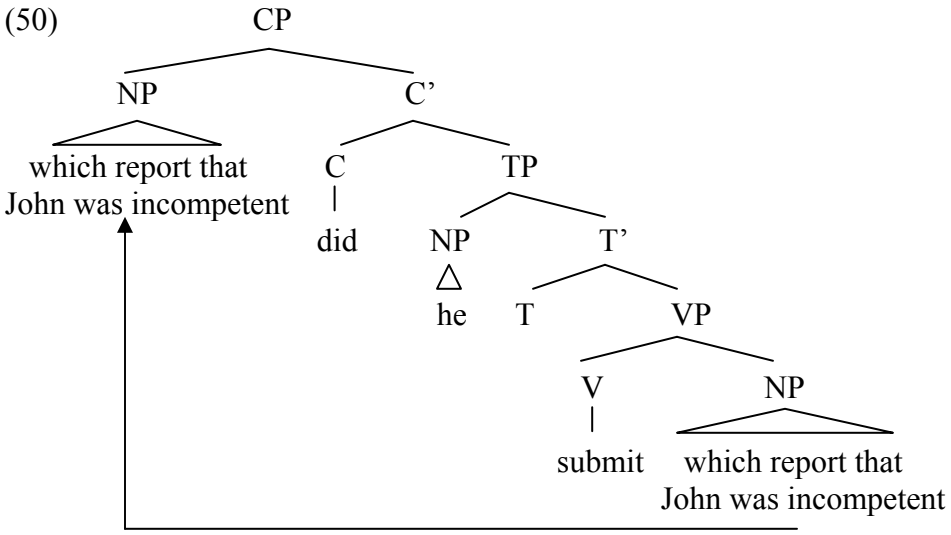
coreference appears to be barred in (50), where the R-expression is contained in an argument of the noun, it is permitted in (51), where it is contained in an adjunct (examples from Friedin, 1986):

(50) *Which report that $John_i$ was incompetent did he_i submit?

(51) Which report that $John_i$ revised did he_i submit?

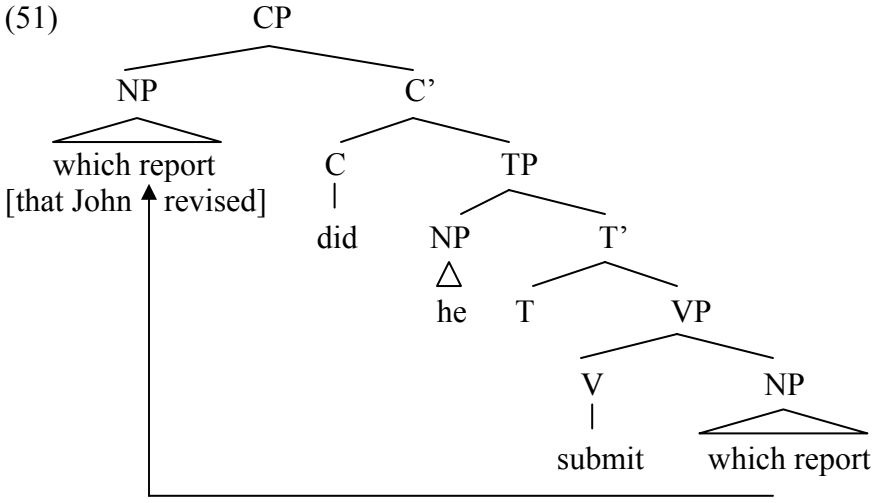
In other words, coreference is ruled out in (50), suggesting reconstruction is obligatory: "John" is c-commanded by "he," resulting in a Principle C violation. However, somehow this violation is avoided in (51), a phenomenon often called "anti-reconstruction." Lebeaux analyzes this asymmetry as arising due to when arguments and adjuncts are introduced into the syntactic structure. On this account, arguments must be inserted into the structure when they are projected at D-structure. Principle C is analyzed as a condition that applies throughout the derivation; once it is violated, the sentence is ungrammatical. Thus (50) is ungrammatical because a Principle C violation occurs as soon as the phrase "that John was incompetent" is introduced as an argument of the noun "report" at D-structure; in this position, "John" is c-commanded by the coindexed "he," as shown below:

(50)



In contrast, (51) is grammatical because the R-expression is contained in a relative clause, which is analyzed as an adjunct. On Lebeaux's analysis, adjuncts may be inserted into the structure after wh-movement has occurred, thus avoiding a Principle C violation in this case.

(51)



In this example, the R-expression "John" is never in a position where it is c-commanded by the pronoun, since the relative clause may be added after wh-movement has occurred. Thus coreference between the pronoun and John is grammatical.

Chomsky (1993, 1995) adopts this analysis in spirit, while abandoning reference to various levels of representation in accordance with minimalist theory. On his account, adjuncts are not subject to the Extension Condition, which states that syntactic operations target only root syntactic objects: in other words, the tree may only be extended at the root. However, if adjuncts are not subject to this requirement, they may be added into the structure after the wh-phrase has moved, thus avoiding a Principle C violation for items like (51) when the binding theory conditions are evaluated at LF.

This analysis of the argument/adjunct asymmetry may be applied to the adult Principle C results from Experiment 4. Recall that adults in this experiment varied in their interpretations of sentences like (52), allowing coreference about a quarter of the time:

(52) Which video about Miss Troll did she choose?

One way to capture this result is to postulate that the PP "about Miss Troll" contained in the picture-NP is ambiguous between an argument and an adjunct. If it is an adjunct, it may be inserted late into the structure, avoiding a Principle C violation, and allowing for coreference. If it is an argument, it is obligatorily inserted into the structure before wh-movement, thus barring coreference by Principle C. In order to derive the observed predicate/argument asymmetry, this analysis would have to assume that reconstruction is obligatory for any item inserted into the structure early; in other words, the only way to avoid reconstruction is to be an adjunct that is inserted late[18]. As the PP's contained in

[18] If adjuncts could be inserted early and still avoid reconstruction, the argument/adjunct distinction would lose its force: the whole reason for positing the asymmetry is to capture the intuition that reconstruction is obligatory for moved arguments but not for moved adjuncts. Reconstruction is said to be obligatory for

moved predicates are unambiguously arguments of the adjective, this assumption would predict such questions (as in (35)) to obligatorily have reconstructed interpretations, as was observed:

(35) How pleased with Alice was she?

Experiment 4 showed adults consistently assign the reconstructed, disjoint interpretation to questions like (35), which is expected if arguments are inserted early into the syntactic structure.

However, the hypothesis that the PP's contained in picture-NP's are ambiguous for adults might also be expected to result in some consistency across either subjects or items in Experiment 4. Specifically, we may expect to find that participants either always allowed for coreference or never did, suggesting that for certain people, the PP's are always analyzed either as adjuncts or as arguments. In fact, however, few participants were consistent in assigning coreference to all argument questions. The results of Experiment 4 likewise failed to show any item effects; it was not the case, as may be expected under the PP-ambiguity hypothesis, that certain items were more readily analyzed as arguments versus adjuncts. Thus to maintain the PP-ambiguity hypothesis, adults would have to be said to decide on the fly for every structure whether the PP was an argument or adjunct, which seems rather unlikely. It would also require additional machinery to explain why adults prefer the argument analysis over the adjunct, as they are shown to prefer the disjoint, reconstructed interpretation.

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arguments because arguments are inserted into the structure early. Therefore if adjuncts are inserted early, they too must obligatorily be interpreted in their reconstructed position.

This hypothesis faces similar shortcomings in accounting for the children's results. In order to be maintained, the analysis would first have to make the relatively uncontroversial assumption that children can distinguish arguments from adjuncts, and know when each may be inserted into the syntactic structure of a sentence. Previous results suggest children do distinguish arguments and adjuncts with respect to movement across islands (de Villiers, Roeper & Vainikka, 1990), and it is certainly possible that in knowing this distinction children also know about the possibilities for timing of insertion. Therefore on this account, children would be said to consistently analyze the PP's contained within moved predicates as arguments obligatorily inserted early.

However, such an analysis would likewise have to maintain that the PP's contained in picture-NP's are unambiguously adjuncts for children. Since children consistently fail to access the reconstructed interpretation, it follows that they must always insert the PP after wh-movement. While such an explanation may account for the data, we are still left without a reason *why* children would always assign an adjunct interpretation to these PP's, while they are ambiguous for adults. They would furthermore be faced with a fairly significant learning problem, as they would have to learn that the PP's they start out consistently analyzing as adjuncts are actually ambiguous. In short, the PP-ambiguity hypothesis does little to provide insight into the questions at hand; it simply shifts the question of why children disprefer reconstruction to why they analyze PP's contained in picture-NP's as adjuncts. While it may be plausible that children start out assuming such PP's are adjuncts (since few nouns select for complements and children may not learn that they are able to do so until later), the

problems with applying this account to the adult analysis suggest an alternative account may be more appropriate.

While the PP-ambiguity hypothesis provides one explanation for the above results, Lebeaux's proposal does allow for another. Instead of postulating that the PP's contained within picture-NP's as ambiguous for adults, an alternative analysis might assume that both adults and children analyze them as adjuncts. Recall that on Lebeaux's account, while arguments must be inserted early into the syntactic structure, adjuncts may be inserted early *or* late. A way to avoid the problem of children having to learn that these PP's may be arguments is thus to say that both children and adults analyze the PP's as adjuncts, but while adults prefer to insert them early, children prefer to insert them late. Children's interpretations could then be explained by a preference for a surface interpretation, which seems plausible; in short, children prefer an interpretation that most closely mirrors the surface structure of the sentence (motivation for this preference is discussed in section 3.3.5).

Adult's preferences under this account are less easily explained, however. Why would adults prefer to insert the PP adjunct into the structure early as opposed to later on? Furthermore, the results of Experiment 5 might be thought to suggest that adults actually prefer to insert the PP contained in picture-NP's late, as they preferred the anaphor to be bound by the matrix antecedent for items like (53):

(53) Miss Troll forgot which video about herself Mary chose.

The argument/adjunct asymmetry alone thus fails to account for adults' varying preferences with respect to reconstruction across Experiments 4-5. Additional

mechanisms are still required to generate adults' apparent preference for reconstruction in Experiment 4, and preference for the non-reconstructed interpretation in Experiment 5. Assuming all PP's contained within picture-NP's are adjuncts allows for continuity between children and adults, but it fails to provide an explanation for why children would prefer to insert the PP late in sentences like (52), while adults prefer to insert it early. Likewise, children are still left with a learning problem: instead of having to learn that these PP's are arguments (as under the ambiguity hypothesis), now they must learn a preference for inserting adjuncts early.

Finally, certain researchers have cast doubt on the validity of the argument/adjunct asymmetry as it explains the presence or absence of Principle C effects in general. Along with Chierchia (1995), Barss (2001) provides some anecdotal evidence against this asymmetry, namely that some speakers he polled do not find (50) (repeated below) to be strongly ungrammatical, or at least certainly not on par with clear Principle C violations like those in (54). Indeed, Lebeaux's analysis predicts that both sentences below should be equally ungrammatical; on this account, Principle C rules out coreference in (50) just as it does in (54). However, some speakers maintain that coreference seems better in the question version of this item than it does in the corresponding statement.

(50) ?*Which report$_i$ that John$_i$ was incompetent did he submit?

(54) *He$_i$ submitted a report that John$_i$ was incompetent.

Likewise, some speakers are reported to find a contrast between questions with moved arguments containing arguments (as in (50)), which on this analysis must reconstruct, and questions with moved predicates, like (35):

(35) *How pleased with Alice$_i$ was she$_i$?

In short, while coreference in (35) is clearly ungrammatical, some speakers find it marginal in (50). Lebeaux's analysis, which predicts early insertion in both cases, does not predict such a contrast; in both cases coreference is predicted to be ruled out by Principle C. Finally, intuitions on these sentences are notoriously difficult to gather, given the difficulty of constructing scenarios where such sentences may be felicitiously uttered. Given these doubts on the validity of the asymmetry as it applies to reconstruction possibilities, as well as its failure to provide much insight into children's and adults' interpretations in Experiments 4-5, alternative analyses of the data will be considered.

3.3.2. Copy Theory of Movement

As noted in Chapter 1, most of the current syntactic approaches to movement assume the copy theory of movement first introduced by Chomsky (1993), and it has likewise been assumed throughout this dissertation. However, the implementation of this theory is not universally agreed upon. While the proposal that movement leaves behind not a trace but rather a full copy of the moved constituent nicely predicts reconstruction effects, how these effects are generated depends on the details of the theory. There are two main approaches to the copy theory that are widely accepted: Chomsky's original analysis (see also Grohmann, 2003; Hornstein, 2001; Hornstein, Nunes, & Grohmann, 2005; among

others) and Fox's (1999, 2002) account (see also Sauerland, 2000, 2004; among others). Chomsky's approach assumes that in order for the derivation to converge, only one copy of each item in the moved phrase may remain at LF, while the other is deleted. On Fox's account, however, both copies are left for interpretation, as deletion is considered an extra operation that is therefore dispreferred for economy reasons. As will be shown below, while both of these analyses account for some portion of the current data, both also encounter similar problems in predicting the full range of interpretations and preferences observed. In the end, Chomsky's analysis is shown to be most compatible with the current results.

3.3.2.1. Chomsky (1993)

A crucial component of Chomsky's approach to the copy theory of movement is the Preference Principle, which postulates a preference for minimizing operator restrictions. For example, in (52), the wh-operator must be interpreted in its surface position (to establish the appropriate operator-variable structure for wh-questions), but the material in its restriction is interpreted in the lower copy, in accordance with the Preference Principle:

(52) *[which ~~video about Miss Troll~~] did she$_i$ choose [~~which~~ video about Miss Troll$_i$]

Interpreting the restrictor in its reconstructed position results in a Principle C violation, thus ruling out coreference. In essence, the Preference Principle amounts to a rule stating "reconstruct if you can." It is an economy principle, which chooses a preferred LF from convergent options. That it is defined as a preference allows it to be overridden if it

interacts with another grammatical principle, but otherwise it is expected to apply uniformly across all structural environments. Therefore to explain why adults are sometimes able to assign a coreferential interpretation to (52), it would have to be said that factors other than the interaction of various parts of the grammar can cause this preference to be overridden, which may not be surprising given that the rule is formulated as preference and not a strict rule of grammar. Of course, Experiment 4 showed adults to generally adhere to the Preference Principle in assigning an interpretation consistent with reconstruction. Experiment 5, in contrast, provides illustration of how it may be overridden.

Recall that adults were shown to access both reconstructed and non-reconstructed interpretations in Experiment 5. Therefore both interpretations of embedded questions subject to Principle A like (53) must be licensed, where the anaphor may either be bound by the embedded subject (in accordance with the Preference Principle) or by the matrix subject:

(53) Miss Troll forgot which video about herself Mary chose.

Crucially, there needs to be a way to ensure that the Preference Principle does not rule out an interpretation where the anaphor is bound by the matrix subject antecedent. Chomsky assumes, following Lebeaux (1983), that because anaphors agree in person, number, and gender with their antecedents, they must be in a local relation with their antecedent at LF. Therefore, anaphors must move to establish this local relation. To derive the reading of (53) where the reflexive is bound by the embedded antecedent, the lower copy of the anaphor must move to adjoin to the embedded subject:

(53') [$_{TP}$ Miss Troll forgot [$_{CP}$[which ~~video about herself~~][$_{TP}$ Mary+herself chose [~~which~~ video about ~~herself~~]]]]

Under this interpretation, the lower copy of the anaphor establishes its local relation with the embedded subject by adjoining to it. The restriction of the upper copy of the wh-phrase deletes, in accordance with the Preference Principle, as does the lower copy of the anaphor (as only a single copy may be left at LF). The LF that remains thus generates an interpretation where the anaphor is bound by the lower antecedent.

However, as Experiments 5 and 6 revealed, binding by the matrix antecedent is also licensed, and is actually preferred. To generate this interpretation, the higher copy of the anaphor moves to establish a local relation with the matrix subject. However, if this structure deletes the restriction of the higher wh-phrase in accordance with the Preference Principle, the remaining LF will crash:

(53") [$_{TP}$ Miss Troll+herself forgot [$_{CP}$[which ~~video about herself~~][$_{TP}$ Mary chose [which video about herself]]]]

In this case, applying the Preference Principle and deleting the restriction of the wh-operator would break the anaphor chain and result in a non-local relation between the remaining anaphors (only the lowest copy, in the binding domain of "Mary," and the highest copy attached to "Miss Troll" would remain). Therefore, to allow the derivation to converge, a non-optimal deletion may be considered. If the lower copy of the wh-operator restriction is deleted, a local relation may be established between the highest copy of the anaphor and its intermediate copy, thus generating an interpretation where it is bound by the matrix subject; the intermediate copy of the anaphor may then be deleted:

(53’’’) [$_{TP}$ Miss Troll+herself forgot [$_{CP}$[which video about ~~herself~~][$_{TP}$ Mary chose [~~which video about herself~~]]]]

Because the derivation consistent with the Preference Principle in (53”) does not converge, it does not block the derivation in (53’’’). In keeping with the minimalist assumption that only convergent LF’s may be compared for economy purposes, once an economy principle (like the Preference Principle) leads to a derivation that does not converge, non-optimal derivations may be considered. For this example, obeying the Preference Principle results in an LF that does not converge. So it does not help decide between possible LF’s, and is in a sense inapplicable in this case (see Hornstein, Nunes, & Grohmann, 2005 for further discussion).

With respect to the current study, a Preference Principle account clearly predicts the adult Principle C data, although it does not provide as explanatory a framework for the embedded Principle A questions. In particular, Experiments 5 and 6 found adults to prefer binding by the matrix antecedent for items like (53). It was shown above that an interpretation where the anaphor is bound by the embedded antecedent is consistent with the Preference Principle, but that the principle fails to apply for binding by the matrix antecedent. While this analysis allows for binding by either antecedent, and adults are clearly able to establish binding by both of them, it does not offer an account for why adults would prefer binding by the matrix subject. Indeed, given that binding by the embedded antecedent is consistent with the Preference Principle, it seems that interpretation should be favored, if any. Thus an additional mechanism would have to be proposed to account for adults’ preferences.

Furthermore, to account for the child data, where reconstruction is always dispreferred, one way to save this analysis that posits a preference for reconstruction would be to assert that children simply lack the Preference Principle. On this view, children would have to somehow learn the Preference Principle, but it is far from clear how such learning might occur, or what input may help them to do so. Alternatively, children may be thought to have the Preference Principle in place, but to generally ignore it in favor of obeying other constraints. Such a possibility will be further discussed in section 3.3.5.

In either case, an analysis is still need to explain the observed asymmetry between moved predicates and moved arguments for both children and adults. As it stands, the principle on its own fails to predict this observed asymmetry. To maintain this theory, it would have to be stipulated that for moved predicates, the Preference Principle is somehow obligatory, but for moved arguments, it remains a preference. Such an analysis seems rather ad hoc, suggesting an alternative approach, or an account that combines the Preference Principle with additional machinery, may be more explanatory.

3.3.2.2. Fox (1999, 2002)

In contrast to Chomsky's analysis, Fox's approach to the copy theory of movement assumes both copies of the moved item remain available for interpretation at LF; in other words, no deletion occurs. Deletion, as it must be implemented as an additional operation, is dispreferred due to economy concerns. Specifically, on this view it is more economical to simply interpret both copies than it is to apply the additional deletion operation. With respect to the two copies, the higher one is said to be interpreted as an

operator, with the lower one being interpreted as a variable, as is standardly assumed. In the case of a complex wh-phrase like "which video about herself," the material in the restrictor of the wh-operator (in this example, "video about herself") is left in both the higher and lower copies. In the case of the higher copy, it is interpreted as a restriction on the wh-operator, and in the case of the lower copy, it is interpreted as a restriction on the variable. Fox proposes that the lower copy be converted into an item containing a variable by converting it into a definite description. Thus the example in (52) may be paraphrased as in (52i):

(52) Which video about Miss Troll did she choose?

(i) Which is the video about Miss Troll, x, such that she chose **the video about Miss Troll x**

This conversion of the lower copy is known as Trace Conversion. It is responsible for introducing a variable into the lower copy and replacing the wh-element with a definite determiner, as below:

(52') [Which video about Miss Troll] she chose [which video about Miss Troll]

Trace Conversion →

which video about Ms. Troll λx [she chose **the video about Miss Troll x**]

Thus the lexical material in the restrictor is left in both copies; in the lower copy, it is essentially redundant.

The presence of the R-expression "Miss Troll" in the lower copy above does predict adults' preference for disjoint reference in such sentences in Experiment 4. Coreference is clearly ruled out on this analysis, since a Principle C violation arises with

the lower copy of the R-expression being c-commanded by the pronoun. Therefore on this account, what requires explanation is not adults' preference for reconstruction (as in the Preference Principle analysis above) but rather why they ever accept coreference at all.

Despite deletion being disfavored for economy reasons, Fox (1999) does allow for the possibility of deletion of the restrictor in the lower copy in order to generate an interpretable antecedent-contained deletion structure (although an alternative analysis is proposed in Fox (2002)). Perhaps this idea could be resurrected to explain the adult data in Experiment 4: adults are able to delete the restrictor and generate a coreferential interpretation of questions like (52), although this derivation is dispreferred for economy reasons. Thus what separates Chomsky and Fox with respect to the Experiment 4 data is simply the locus of the economy consideration: for Chomsky, minimizing operator restrictions is economical, and results in a preference for the reconstructed interpretation, ruling out coreference. In other words, it is non-economical to leave the restrictor in the higher copy, which is why coreference is seldom allowed. For Fox, having both copies available for interpretation is economical, which rules out coreference with the presence of the lower copy of the R-expression. To apply deletion to the lower copy of the restrictor and allow for coreference is not economical, and therefore dispreferred. Thus for Chomsky, it is economical to interpret the lower copy, and for Fox, it is economical to leave both copies (including the lower one) available for interpretation. In both cases, disjoint reference is predicted to be preferred.

However, recall that children were shown to prefer the non-economical surface interpretation in Experiment 4, assigning coreference most of the time. On either the Chomsky or Fox account, therefore, children must be said to disobey economy: for Chomsky, children either must not have the Preference Principle or must allow other constraints to override it, for Fox, children must freely allow deletion to apply. Both of these proposals line up with results from a study examining children's interpretations of antecedent-contained deletion (ACD) structures. Syrett & Lidz (2005) found that while adults only access the embedded reading of the sentence below, children allow for an embedded or matrix interpretation of the VP ellipsis ("did"):

(55) Clifford said that Goofy read every book that Scooby did.

a. …that Scooby read (embedded reading)

b. …that Scooby said Goofy read (matrix reading)

These two readings are generated as part of resolving the ellipsis. While VP ellipsis is typically resolved by finding a VP that may serve as an antecedent for the ellipsis site, in this case the ellipsis site is actually contained in both potential VP antecedents (the VP "read every book that Scooby did" or the VP "said that Goofy read every book that Scooby did"), hence the term "antecedent-contained deletion." To illustrate, consider how the embedded reading above is generated. In trying to interpret the embedded antecedent VP in the ellipsis site, a new instance of ellipsis is introduced:

(55') Clifford said that Goofy read every book that Scooby <*read every book that Scooby did*>

Because replacing the ellipsis with either antecedent VP in this case would include another instance of the ellipsis site itself, infinite regress results: each attempt to resolve the ellipsis would require adding another ellipsis site.

To avoid this problem, it is commonly assumed that resolving ACD requires quantifier raising (QR) of the NP containing the ellipsis site ("every book that Scooby did" in this example) (Fiengo & May, 1994; Fox, 1999; Kennedy, 1997; May, 1985). The NP is replaced by a trace, leaving the VP in a form where it may replace the ellipsis without introducing infinite regress. The two readings above are determined by the landing site of the quantified noun phrase, which targets a VP-external position (Fox, 1999; Merchant, 2000): if it lands at the level of the embedded clause, the embedded reading is generated (55"a), but if it moves through this position to land at the level of the matrix clause, the matrix reading is generated (55"b).

(55") a. Clifford said that Goofy [every book that Scooby did]$_i$ read t_i (**QR**)
Clifford said that Goofy [every book that Scooby <*read t*>] [read t]

b. Clifford [every book that Scooby did]$_i$ said t_i that Goofy t_i read t_i (**QR**)
Clifford [every book that Scooby <*said that Goofy read t*>] [said that Goody read t]

Adults, being economical in preferring fewer movement operations, only accept the embedded reading given in (55"a). Children, on the other hand, are shown to accept the matrix reading (55"b) as well, which requires movement through the embedded clause to the matrix clause level. These results suggest children, unlike adults, are not economical: they do not obey economy considerations, and thus allow for interpretations generally not accepted by adults. Just as in the current study, where children disobey economy in

preferring the matrix interpretation of argument questions subject to Principle C, children also disobey economy in allowing for the matrix interpretation of multi-clausal ACD sentences.

While both Chomsky's and Fox's accounts are quite compatible with the results of Experiment 4, both face similar shortcomings in extending to Experiments 5 and 6. In these experiments, both children and adults were shown to prefer binding of the anaphor by the matrix antecedent in sentences with moved arguments (although children, unlike adults, rejected binding by the embedded antecedent):

(42) Miss Cruella knew [which painting of herself] Janie put up [which painting of herself]

On Fox's account, in leaving both copies of the moved item available for interpretation, it must be assumed that binding by one antecedent rules out binding by the other; after all, this sentence does not permit a reading where Miss Cruella knows which painting of Miss Cruella *and* which picture of Janie were put up. This result could presumably be achieved by requiring parallelism between the two copies, and not permitting copies of a single anaphor to bear different indices. Indeed, allowing one copy of the anaphor to be bound by one antecedent and the other copy to be bound by a different antecedent would presumably result in an uninterpretable structure along the lines of the one paraphrased below:

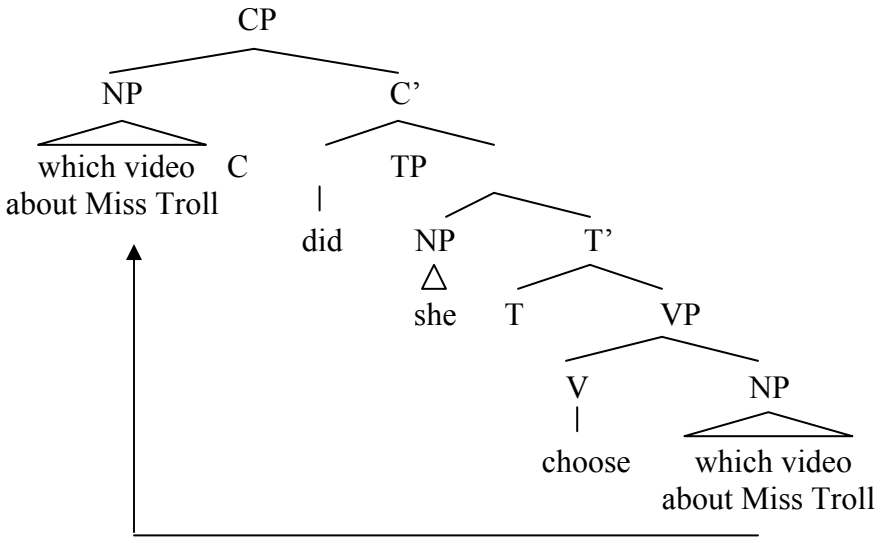
(42') which x, such that x is a painting of Miss Cruella, did Miss Cruella know Janie that put up x, such that x is a painting of Janie

Therefore while both copies are present at LF, only one instance of the anaphor is actually semantically active. Once again this achieves the same result at Chomsky's

analysis: instead of deleting one copy, one copy is left inactive for the purposes of interpretation. Likewise, this analysis on its own does not provide a means for establishing which binding relationship is preferred; with both copies available for interpretation, it seems binding by either antecedent would be equally likely.

Fox's account also does not provide a clear analysis of the argument/predicate asymmetry observed in Experiments 4-5. While both adults and children were shown to obligatorily assign a reconstructed interpretation to moved predicates, reconstruction of moved arguments was apparently not obligatory. Fox predicts a reconstructed, disjoint interpretation for any question subject to Principle C, regardless of whether the wh-phrase is a predicate or argument, since the presence of the lower copy should always trigger it:

(52) Which video about Miss Troll did she choose?



Therefore on this analysis, what requires explanation is why deletion of the lower copy is sometimes allowed for moved arguments (resulting in adults assigning a coreferential

interpretation), but never for moved predicates. In other words, it is not clear why adults would always obey economy in the case of moved predicates, but not in the case of moved arguments. Likewise, children would have to be said to always be economical when interpreting moved predicates as well, since they never allow coreference for such items; however, there seems to be no logical reason why children would disobey economy for moved arguments but not for moved predicates. Given that children have been shown to disobey economy when interpreting quite different structures (e.g. ACD), it seems unlikely that their adherence to economy would explain their obligatorily assigning disjoint reference for questions like (52). Recall that Chomsky's approach was shown above to similarly fail to predict the predicate/argument asymmetry. On that view, what would require explanation is why children and adults consistently obey the Preference Principle for moved predicates, but not for moved arguments. Thus both accounts similarly fail to account for the full range of data observed.

It was noted above that Chomsky's and Fox's accounts differ mainly in their approaches to economy: for Chomsky, the Preference Principle dictates that it is economical to minimize operator restrictions, and for Fox, it is economical to dispense with deletion and allow for interpretation of both copies. These two views of economy therefore achieve the same result through different means. For Chomsky, it is economical to interpret the lower restrictor instead of the higher one, and for Fox, it is economical to leave both copies, including the lower restrictor, available for interpretation. Thus with respect to the current study, it is quite difficult to distinguish these two accounts. Both analyses make the same predictions, nicely accounting for the

adult preference for a disjoint, reconstructed interpretation for moved arguments in Experiment 4. However, both approaches similarly fail to predict the preference for binding by the matrix antecedent for moved arguments in Experiments 5 and 6, and neither provides a clear means for capturing the predicate/argument contrast. Whichever analysis is assumed, it will require additional mechanisms to account for the full range of data observed.

Given the similarities between these two approaches, a firm choice between the two is not crucial. Neither approach appears to provide an explanatory framework for analyzing adults' preference for the matrix antecedent in Experiments 5-6, nor the predicate/argument asymmetry observed in both children and adults. However, in the case where both Chomsky's and Fox's economy principles most straightforwardly apply (the matrix Principle C questions in Experiment 4), Chomsky's formulation of the Preference Principle seems to be a slightly better fit for the current data. As mentioned earlier, the Preference Principle is designed to interact with other rules of grammar, and the possibility for overriding it is clearly established. On the other hand, as Fox mainly only discusses the possibility of deletion in reference to ACD structures, it is not exactly clear how it is to be implemented for other structures, or how it might interact with the grammar or parser. Given that the Preference Principle is designed to choose between possible convergent LF's, it has some of the flavor of a parsing constraint, or at the very least, a constraint that interacts with the parser. Furthermore, if it does interact with the parser, it must also interact with other factors thought to influence parsing decisions, one example being pragmatics.

In short, to allow for coreference in questions like (52), Chomsky need only say that the Preference Principle is overridden in favor of a pragmatic context that renders the coreferential interpretation more salient in that instance. Fox, on the other hand, would have to postulate a reason why deletion of the lower copy may apply in such cases, when deletion had previously only been formulated to allow ACD structures to converge. In other words, the way in which deletion has been discussed by Fox suggests it only applies in a very limited set of environments, and then, only for reasons of generating an interpretable structure. There seems to be no a priori reason why it should also be allowed in questions with wh-arguments. The flexibility of the Preference Principle, and the fact that it has already been designed to interact with other linguistic principles, makes it more amenable to the current data. Indeed, to look ahead a bit, the adult preference for binding by the matrix antecedent in Experiments 5-6 will later be shown to result from a parsing preference for resolving anaphoric dependencies as quickly as possible (section 3.3.5.). The Preference Principle thus fits nicely into a system that allows the weight of competing constraints in various structural environments to determine interpretation preferences. In such a way it also fits quite nicely with the child results; children may be said to have the Preference Principle in place, but override it due to the weight they place on other competing constraints, such as their preference for surface structure interpretations. The interaction between grammatical rules and the parser, and whether such a strict distinction is necessary, is further discussed in Chapter 5.

3.3.3. Rule I

While the above analyses rely primarily on a syntactic account of children's and adult's preferences with respect to reconstruction, the possibility of a pragmatic analysis is also worth exploring. For example, as mentioned above, some speakers disagree with the judgments used to justify the argument/adjunct asymmetry, as in (50-51), repeated below:

(50) *Which report that $John_i$ was incompetent did he_i submit?

(51) Which report that $John_i$ revised did he_i submit?

Chierchia (1995) notes that many speakers find (50) to be grammatical, or at least as good as (51). His account of this fact draws on the van Riemsdjik & Williams (1981) proposal that what matters is the depth of embedding for the R-expression, and not what type of phrase it is embedded in. In other words, for deeply embedded cases like those in (50-51), where the R-expression is contained in a clause attached to the NP, coreference is often allowed. But for more shallow embedding cases (like those tested in Experiment 4), coreference is typically dispreferred, while disjoint reference is preferred:

(37) ??Which painting of Miss Cruella did she put up?

Chierchia explains this contrast using Rule I (Grodzinsky & Reinhart, 1993; Reinhart, 1983). Rule I is a pragmatic rule designed to largely account for binding Principles B and C in pragmatic terms. It states that an LF with a bound variable interpretation is preferred over a minimally different LF with a coreferential interpretation. In other words, if the proposition can be generated by a structure with a bound variable interpretation, that structure is preferred. According to Chierchia, shallow embedding cases like (37) are the structures that Rule I most straightforwardly applies to; therefore

disjoint reference is preferred in sentences like (37) because they take a non-optimal path to coreference. A bound variable structure like (56) is instead the optimal path:

(56) Which painting of herself did Miss Cruella put up?

However, it is not clear that Rule I actually applies to the cases in (50-51). It is difficult to generate minimally distinct sentences with bound variable interpretations that express the same propositions as those sentences. Thus coreference may be allowed.

Since it is based on pragmatic strategy and not rules of grammar, this analysis has the advantage of allowing for some flexibility among adult judgments. Indeed, adults were not uniform in rejecting coreference in (37), which might be expected if coreference is not actually ungrammatical, but rather a pragmatic dispreference. Binding theoretic judgments tend to be quite stable across native speakers, so it is plausible that whatever explains the preference for disjoint reference in (37) is not due solely to Principle C, but rather arises due to pragmatic concerns. Recall that participants were uniform in rejecting coreference in the statement version of (37), given in (36):

(36) She put up the red painting of Miss Cruella.

Adults would be expected to assign disjoint reference to (37) as often as they do to (36) if Principle C is the only factor at work in both cases, but Experiment 4 showed otherwise. A Rule I analysis could explain this asymmetry by saying that for some reason speakers find the statement version an even less optimal path to coreference than the question version of this sentence, which results in higher rejection of coreference in (36) than it does in (37). While this explanation may be less than satisfying, one could imagine devising a scale of optimal paths to coreference and testing it, thus turning this into an

empirical question. The crucial point is that the pragmatic nature of Rule I allows for a certain flexibility that makes it amenable to many differing judgments.

While Rule I may offer a plausible explanation of the adult data from Experiment 4, it does not extend as easily to the child results. To maintain this account, adults would have to be said to apply Rule I in generally rejecting coreference in statements like (36) and questions like (37). Because it is a pragmatic strategy that may vary in strength in different instances, adults allow for a certain amount of flexibility, and sometimes accept a coreferential interpretation (at least in the case of questions). In contrast, children's preference for coreference would have to be explained as the result of difficulty in applying Rule I, as has been proposed in previous analyses of the delay of Principle B effect (Grimshaw & Rosen, 1990; Thornton & Wexler, 1999). On this analysis, a processing difficulty results in children's failure to rule out coreference in sentences like (37). Rule I requires maintaining two LF's in working memory and comparing them to see if one with a coreferential interpretation is distinct from one with a bound variable interpretation. With children having more limited processing capacity as compared to adults, these accounts propose that children may have difficulty maintaining the two LF's in memory and performing the comparison.

However, such an account also predicts a symmetry between judgments on statements and questions that does not emerge. If children have problems applying Rule I, they should have equal trouble ruling out coreference in (36) as they do in (37). However, Experiment 4 showed children to be quite adept at ruling it out in the statement items. Furthermore, many previous experiments show children to rule out coreference in

such statements, which is typically taken as evidence that they have Principle C (Crain, 1991; Crain & McKee, 1985; Crain & Thornton, 1998; Guasti & Chierchia, 1999/2000; Thornton, 1990). To maintain a Rule I account of the current results, it would again have to be stipulated that statements like (36) represent a less optimal path to coreference as compared to questions like (37), which is why children are better able to rule out coreference for statements. But if children's failure to rule out coreference in (37) is due to problems applying Rule I, there is no logical reason why those problems would not also extend to statements like (36). Rule I thus does not shed much light on the question of why children appear to disprefer reconstruction in the case of moved arguments, as it fails to distinguish between questions and statements.

Likewise, Rule I also fails to distinguish between moved predicates and moved arguments, an asymmetry that emerged for both children and adults in Experiments 4-5. For example, under Rule I, coreference should be as dispreferred for questions with moved arguments as in (37) as it is for questions with moved predicates like (35), repeated below:

(35) How pleased with Alice was she?

Without assuming some additional mechanism, there is no reason why Rule I would apply any differently to moved arguments than to predicates. However, it was shown that while disjoint reference was consistently assigned to the predicate questions, coreference was sometimes allowed for the argument questions. Once again, to explain this under Rule I would require a stipulation that somehow the path to coreference is less optional in the predicate cases (and in the argument statement items), which results in the uniform

assignment of disjoint reference. This explanation seems to raise as many questions as it answers, however.

Finally, an additional explanation would still be required for the Experiment 5 data under a Rule I analysis, since the rule fails to apply in those cases. Specifically, all of the sentences in Experiment 5 already have bound variable interpretations, so it is not clear how a more optimal path to coreference might be devised:

(57) Mr. Giraffe$_i$ remembered which article about himself$_{i/j}$ Mr. Dinosaur$_j$ saved.

(58) Mr. Whale$_i$ knew how happy with himself$_{*i/j}$ Mr. Walrus$_j$ was.

Again the problem of forcing binding by the embedded subject for the predicate items like (58) would be left unexplained by Rule I. Furthermore, children's rejection of an interpretation where the anaphor is bound by the embedded subject in cases like (57), and both children's and adults' preference for binding by the matrix antecedent, also find little insight in Rule I.

With these shortcomings, it is unlikely that Rule I could provide a comprehensive account of the data collected in these experiments. Given the stability of the judgments on all of the statement items across all experiments, traditional binding theory appears to offer a simpler account of the data. Furthermore, the stability of the judgments on the moved predicate items in Experiment 4 also suggests that disjoint reference is forced in these cases by a Principle C violation that arises due to obligatory reconstruction. Rule I simply fails to offer an explanation for the various asymmetries (predicates versus arguments, statements versus questions) that arise in the data from Experiments 1-6.

3.3.4. Predicate/Argument Asymmetry

An important shortcoming of each of the above analyses is their failure to account for the observed asymmetry between moved predicates and moved arguments, namely, that the former appear to obligatorily reconstruct, while reconstruction is not obligatory for the latter. The above experiments provide empirical evidence for this asymmetry, which has previously been discussed in the theoretical literature (Barss 1986, 1988; Cinque, 1982; Heycock, 1995; Huang, 1993; Takano, 1995). Several theoretical approaches to this asymmetry are discussed below. In the end, Heycock's (1995) referentiality-based approach is shown to account for the widest range of data, while also providing a likely analysis of the current results.

3.3.4.1. Referentiality

In a particularly influential analysis of reconstruction, Heycock (1995) argues that what appears to be an asymmetry between moved predicates and arguments is actually more complicated. For example, even certain arguments appear to obligatorily reconstruct, as in the sentence below:

(59) *How many stories about Diana$_i$ is she$_i$ likely to invent?

Heycock notes that coreference is ungrammatical in this sentence, which is only expected if there is obligatory reconstruction, resulting in a Principle C violation when "Diana" is interpreted in its lower position. Therefore reconstruction must be obligatory for certain moved arguments, just as it is for moved predicates.

Heycock's account begins by assuming Lebeaux's analysis of the argument/adjunct distinction: arguments are inserted early into the syntactic structure,

obligatorily reconstructing, while adjuncts may be inserted late, avoiding reconstruction. Therefore it is surprising that reconstruction appears to be obligatory in (59), since (as Heycock assumes) the PP "about Diana" is an adjunct, and should therefore be able to be inserted late, avoiding a Principle C violation. To account for sentences where adjuncts are obligatorily interpreted in their reconstructed position, Heycock proposes that in addition to the argument/adjunct asymmetry, there is a distinction based on the referentiality of the wh-phrase that is relevant for reconstruction. In short, non-referential wh-phrases are obligatorily interpreted in their reconstructed position, while referential ones are not. This single mechanism is designed to account for obligatory reconstruction of certain adjuncts, as well as obligatory reconstruction of predicates.

Heycock defines referential wh-phrases as presupposing the existence of a set of entities. For example, in (60), the wh-phrase "which of his toys" presupposes the existence of some toys. In contrast, the wh-phrase in (61), "how proud of his dad," quantifies over degrees. As such, it is non-referential in that it does not presuppose the existence of any set of entities.

(60) Which of his toys does every boy like best?

(61) How proud of his dad was every boy?

Heycock notes that Dobrovie-Sorin (1992) argues for independent reasons that the nonreferential reading of amount quantification is generated from a structure where only the wh-head is in the specifier of CP, and the remainder of the wh-phrase is interpreted in its base position. In other words, the only way to generate a nonreferential interpretation is to interpret the restrictor of the wh-operator in its reconstructed position:

nonreferentiality depends on this structural relationship, so nonreferentiality relies in a direct way on reconstruction.

The crucial contrast supporting Heycock's analysis is shown below. Note that as discussed earlier, the wh-phrase in (59) contains a PP adjunct, as does the wh-phrase in (62):

(59) *How many stories about Diana$_i$ is she$_i$ likely to invent?

(62) Which stories about Diana$_i$ did she$_i$ most object to?

Heycock reports a clear asymmetry in the grammaticality of these sentences; while (62) allows for coreference, (59) rules it out. This is unexpected given Lebeaux's analysis, which predicts that both of these sentences should permit coreference, since both contain adjuncts that may be inserted late into the structure and thus avoid Principle C violations. While Lebeaux's account correctly predicts the grammaticality of (62), it cannot explain why (59) is ungrammatical. Heycock's proposal clearly predicts this observed asymmetry, however. Because the wh-phrase in (59) is nonreferential, reconstruction is obligatory, resulting in Principle C violation that rules out coreference. The nonreferential interpretation is underscored by the use of the verb of creation "invent;" no set of stories may be presupposed if they do not yet exist, so a nonreferential interpretation of the wh-phrase is required. In short, nonreferential wh-phrases, even those that contain adjuncts, must be interpreted in their reconstructed position. Heycock's analysis thus correctly predicts the grammaticality of a broad range of data that previous analyses fail to account for.

3.3.4.2. Syntactic Accounts

Most competing accounts of the predicate/argument asymmetry do not consider apparent exceptions to this distinction as Heycock does. Instead they focus on syntactic reasons why predicates are apparently obligatorily reconstructed while arguments are not. Takano (1995) in particular provides an account that follows nicely from the copy theory of movement. He takes as a starting point several previous analyses of the predicate/argument distinction that rely on the presence of predicate-internal subject traces to explain this contrast (Barss, 1986; Huang, 1993). For example, in Huang's account, subjects are generated within the predicate and subsequently move to their surface position for case reasons, in accordance with the internal subject hypothesis (see McCloskey, 1997 for a review). Thus the moved wh-predicate contains a trace of the subject, which derives any binding theory effects observed without appealing to reconstruction. For example, in (7c), the trace of "he" remains in the wh-phrase, where it c-commands "John" and results in a Principle C violation no matter where the wh-phrase is interpreted:

(7) c. *How proud of John$_i$ was he$_i$?

[$_{TP}$ He$_i$ was [$_{AP}$ t$_i$ how proud of John]] (**subject raising**)

[$_{CP}$[$_{AP}$ t$_i$ how proud of John$_i$]$_k$ was [$_{TP}$ he$_i$ t$_k$]? (**wh-movement**)

Such an analysis, however, leaves the ungrammaticality of (63) unexplained (Barss, 1986):

(63) *How proud of $John_k$ does he_k believe Mary to be?

He believes [$_{TP}$ $Mary_i$ to be [$_{AP}$ t_i how proud of John]] (**subject raising**)

[$_{CP}$[$_{AP}$ t_i how proud of $John_k$]$_j$ does [$_{TP}$ he_k believe [$_{TP}$ $Mary_i$ to be t_j]? (**wh-movement**)

In this sentence, it is the trace of "Mary" and not "John," that remains in the moved predicate. This configuration should not result in a Principle C violation, since "John" is not c-commanded by any coindexed antecedent in the structure. However, the sentence is still ungrammatical.

Takano proposes that the representation in (63) is in fact not licit, because the trace of "Mary" fails to be bound by its antecedent, in violation of the Proper Binding Condition (PBC) (Fiengo, 1977). In order to make the structure comply with this condition (which Takano proposes is a filter at LF), the material in the wh-phrase (other than the wh-head) must be interpreted in its original position. In this way, the trace of the moved subject "Mary" may be bound by its antecedent. Thus reconstruction is obligatory for moved predicates, but not for arguments; since there is never movement of an internal subject from within the wh-argument, no trace is left, and no violation of the PBC arises. Takano's account has the advantage of following from independently motivated principles of the grammar. However, it fails to extend to the examples Heycock cites where reconstruction is obligatory for nonreferential moved arguments, as in (59):

(59) *How many stories about $Diana_i$ is she_i likely to invent?

On Takano's account, reconstruction is never obligatory for moved arguments, so additional machinery would have to be assumed to predict reconstruction in such cases. Heycock's analysis thus appears to offer the most explanatory account of the predicate/argument asymmetry of all of the approaches considered so far.

3.3.4.3. Referentiality and the Current Results

Heycock's analysis also provides a plausible account of the results from Experiments 4-5. In these studies, both children and adults demonstrate obligatory reconstruction of moved predicates which, as they quantify over degrees, are nonreferential. Independent analyses such as Dobrovie-Sorin (1992) have shown that nonreferential items must be interpreted with narrow scope. Therefore, nonreferentiality and reconstruction are inextricably linked: nonreferential moved items must be interpreted in their reconstructed position. Heycock's analysis thus predicts that as long as speakers know the referential/nonreferential distinction, they should demonstrate obligatory reconstruction of moved predicates, since predicates are nonreferential. Recall that both children and adults showed evidence of obligatory reconstruction of moved predicates in Experiments 4-5. On Heycock's analysis then, children as well as adults must be aware of the referential/nonreferential distinction, and use it when determining possibilities for reconstruction.

Previous studies suggest that children are indeed aware of the referential/nonreferential distinction (referential often termed "D-linked" (discourse-linked) in the literature). Using an elicited production task, Thornton (1990, 1995) demonstrated that some children actually form distinct syntactic structures for wh-

questions depending on whether or not the wh-phrase is referential. For example, when forming a question via extraction from an embedded clause, certain children consistently produced a medial wh-phrase between clauses for nonreferential wh-phrases like (64), but for referential ones either produced a medial wh-phrase that was not an exact copy, or produced no medial wh-phrase, as in (65a, b) (children's ages ranged between 2;10 and 5;5):

(64) Who_i do you think [$_{CP}$ who_i the cat chased t_i]

(65) a. $Which\ mouse_i$ do you think [$_{CP}$ who_i the cat chased t_i]

b. $Which\ mouse_i$ do you think [$_{CP}$ the cat chased t_i]

Thornton notes that this repetition of the medial wh-phrase supports a theoretical analysis where successive cyclic movement is proposed to be obligatory for nonreferential wh-phrases, but optional for referential ones (Cinque, 1990; Chung, 1994; Rizzi, 1990).

Evidence for children's knowledge of referentiality was also found in a study of their productions of matrix questions, where movement of the auxiliary verb to C was demonstrated to be obligatory for children for nonreferential questions, but optional for referential ones (children aged 4;1 to 5;4 participated in this study). For example, in the nonreferential example in (66), children were shown to consistently produce the higher instance of the auxiliary in addition to the lower. In the corresponding referential cases, however, movement of the auxiliary to C appears optional; children produced questions where this movement occurred (67a) and where no movement occurred (67b), in those cases, sometimes inserting a "that" complementizer (67c):

(66) What did the spaceman didn't like?

(67) a. What food did the spaceman didn't like?

b. What food the spaceman didn't like?

c. What food that the spaceman didn't like?

In short, these results show that children have the referential/nonreferential distinction in place, and use this distinction to inform their formation of wh-questions. While children often repeat a medial wh-phrase and consistently demonstrate movement of the auxiliary to C for nonreferential wh-phrases, these processes are optional for the formation of questions with referential wh-phrases. Knowledge of referentiality and its implications for wh-questions thus appears to be in place in preschool-aged children.

Children's knowledge of referentiality has also been shown in studies examining their knowledge of definiteness. Use of the definite article depends in part on referentiality, in that its use is licensed only when the referent is known to both the speaker and hearer, and has been mentioned in previous discourse, as in (68):

(68) There is a dog and a cat on the carpet. The dog is fluffy.

The indefinite may also be used referentially, when the referent is known only to the speaker and not the hearer:

(69) I bought a book yesterday.

Schaeffer (1997) demonstrated that while children's use of articles is adult-like by age 4, at earlier ages children appear to rely on referentiality in their use of the definite versus the indefinite, instead of modeling the hearer's knowledge as adults do. Specifically, the younger children overgenerate the definite article to contexts where adults would use the referential indefinite. While young children were also found to sometimes drop the

definite article in referential contexts, they never used the definite in nonreferential ones. Thus children appear to associate definiteness with referentiality and indefiniteness with nonreferentiality at a young age, until they master being able to model shared knowledge. Armon-Lotem & Avram (2005) replicated these results in Hebrew-speaking children, again finding overgeneration of the definite in indefinite referential contexts. These results show that the referential/nonreferential distinction is in place in very young children (in these studies, as young as 2 years of age) in distinct language communities. Such evidence supports the view that this distinction plays a significant role in guiding the construction of children's early grammatical representations, as suggested in Thornton (1995).

Taken together, these studies provide strong evidence that children know about referentiality at a young age, and use it when making decisions about syntactic structure. In the Thornton studies, children are shown to make reference to referentiality when building the syntactic structure of wh-questions, producing distinct structures based on whether the wh-phrase is referential or not. Likewise, the Schaeffer and Armon-Lotem & Avram studies show that children make decisions on whether to use definite or indefinite noun phrases based on referentiality as well. Therefore it certainly seems plausible that children might also exploit this distinction when determining possibilities for reconstruction, along the lines of Heycock's analysis.

Heycock's proposal provides a most explanatory account of the predicate/argument distinction by analyzing it as a direct result of the referential/nonreferential distinction: nonreferential items like predicates are obligatorily

interpreted in their reconstructed position, while referential ones, like argument wh-phrases containing picture-NP's, optionally are. Experiments 4-5 showed children to be adult-like in distinguishing the reconstruction possibilities for arguments versus predicates. That they have likewise been shown to have knowledge of referentiality lends further support to Heycock's analysis as it applies to the current study. Not only does it accurately predict the grammaticality patterns for a full range of data beyond what is tested in Experiments 1-6, given children's demonstrated knowledge of referentiality, it extends to the results of these experiments as well.

While Heycock's analysis provides a clear account of children's and adults' obligatory reconstruction of predicates, it alone does not explain why children disprefer reconstruction when it is not obligatory. It also fails to extend to the adult results that show adults prefer the reconstructed interpretation for matrix Principle C argument questions (as in 37)) but disprefer it for embedded Principle A questions (as in (42)):

(37) Which painting of Miss Cruella did she put up?

(42) Miss Cruella knew which painting of herself Janie put up.

In other words, while children prefer the non-reconstructed, surface interpretation for both items above, adults prefer the reconstructed reading for (37) but disprefer it for (42). On Heycock's analysis, reconstruction for referential wh-phrases like those above is determined by Lebeaux's argument/adjunct distinction. While nonreferential items are obligatorily reconstructed, referential items are said to obey Lebeaux's analysis: arguments must be inserted early and therefore obligatorily reconstruct, but adjuncts may be inserted late, avoiding reconstruction. While the wh-phrases above are both

arguments, and as such must be inserted early, they also both contain PP's whose status is much less clear. If the PP's are analyzed as adjuncts (as Heycock assumes), they may be inserted late, avoiding reconstruction. If they are analyzed as arguments, they must be inserted early and are obligatorily interpreted in their reconstructed position. Crucially, however, children and adults differ on their preferences with respect to (37), with adults preferring reconstruction and children dispreferring it. How might these results be reconciled on Heycock's analysis?

A possibility mentioned in the discussion of Lebeaux's analysis above would be to assume that the PP's contained in picture NP's are ambiguous between arguments and adjuncts for adults. On this analysis, adults' preference for reconstruction in (37) is actually a preference for analyzing the PP as an argument. However, the ambiguity of the PP allows for the possibility of a non-reconstructed, coreferential interpretation if the PP is analyzed as an adjunct. This ambiguity correctly predicts adults to be able to access either interpretation, and their preference for reconstruction must be explained as a preference for analyzing the PP as an argument (for some reason). Children, on the other hand, consistently interpret questions like (37) as having a non-reconstructed reading. Therefore, the PP's contained in picture-NP's must actually be unambiguous for them: such PP's are always adjuncts inserted late into the structure, avoiding reconstruction.

One problem with this analysis, discussed in section 3.3.1, is that it fails to capture the adult results of Experiment 4, which tested questions like (37). If the PP's contained in such questions are ambiguous, one might expect to find item effects, with the PP consistently being analyzed as an adjunct (and resisting reconstruction) for certain

picture-NP's, but analyzed as an argument and obligatorily reconstructing for others. However, no item effects emerged from these results. An alternative possibility is that certain adults consistently analyze the PP's contained in picture-NP's as adjuncts, never assigning a reconstructed reading, while others always analyze them as arguments. But in fact, the responses where adults assigned a coreferential, nonreconstructed interpretation were fairly evenly distributed. Given that there were no item effects, and that adults failed to consistently assign one interpretation over another, the ambiguity hypothesis appears doubtful. It may still be maintained by assuming that such PP's are ambiguous for all adults, who decide on one structural analysis over another for each given item on the fly, but such an account is not very explanatory.

A second possibility mentioned above for maintaining Lebeaux's analysis as Heycock does is to assume that the PP's contained in picture-NP's are unambiguously adjuncts for both children and adults. Recall that on Lebeaux's account, adjuncts *may* be inserted late into the structure, but are not required to. Therefore, even adjuncts may be inserted early and be interpreted in their reconstructed position. This assumption has the advantage of obviating any learning problem associated with analyzing the PP's as ambiguous for adults but unambiguous for children, since both groups always analyze the PP's as adjuncts. On such an analysis, what differs between children and adults is their preference for inserting the adjunct early versus late: adults prefer the reconstructed interpretation, and therefore prefer to insert adjuncts early, while children disprefer reconstruction, and therefore must prefer to insert adjuncts late.

One means of accounting for adults' preference to insert adjuncts early may be found in economy considerations like Chomsky's Preference Principle. Adults prefer to insert adjuncts early, because in accordance with this principle, they prefer to reconstruct when they can. However, such an account requires thinking about the Preference Principle in a slightly different way than it was originally discussed. Recall that Chomsky assumes the copy theory of movement, and designed the Preference Principle to account for interpretation of the lower versus higher copies. In short, it is a means for determining which of two copies is preferentially interpreted. To account for adults' preference for reconstruction in (37), it would have to be argued that the Preference Principle means adults prefer to insert adjuncts early in order to have a lower copy available for interpretation. Instead of simply deciding which of two copies is interpreted, it actually drives the generation of a lower copy which would otherwise not exist (e.g. if the PP were inserted late). Such an analysis is rather counterintuitive, as generating a lower copy that is not otherwise required seems *less* economical than not generating one. Furthermore, on this account children would have to be said to lack the Preference Principle, again creating a significant learning problem, since it is unclear how this might be learned. Alternatively, it may be argued that children have the Preference Principle, but override it due to other factors. A possibility along these lines is further discussed in section 3.3.5.

Contributing to the difficulty in assessing the analyses above is the lack of consensus on the status of the PP's contained in picture-NP's. Results from the standard "one" substitution test, designed to identify arguments versus adjuncts, are relatively

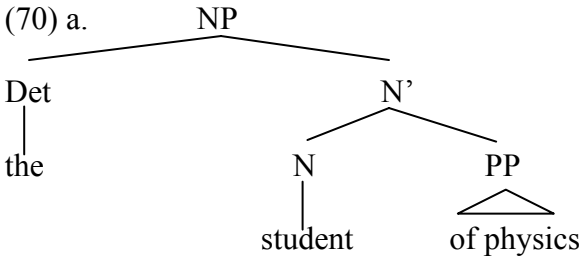
inconclusive. For example, "one" substitution is said to target items at the N' level, to which adjuncts are attached; adjuncts are sisters of N'. Complements, on the other hand, are sisters of the head noun, and daughters of N'. Therefore in the case of argument PP's, "one" substitution necessarily targets both the head noun and PP, as both are contained in N'. For adjuncts, "one" substitution may target the noun alone, as it forms its own N' (to which the PP is attached). Two standard examples are given below:

(70) a. *The student of physics and the one of chemistry

b. The student from France and the one from Spain

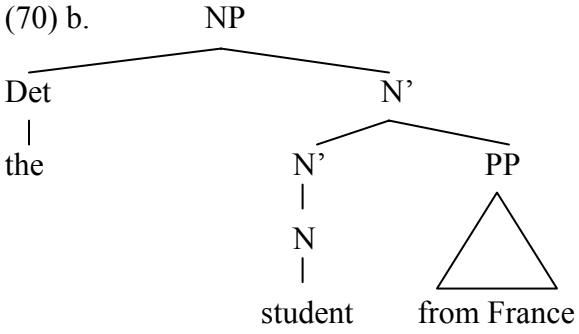
The ungrammaticality of (70a) arises due to the fact that the PP here is an argument; "one" may not replace the head noun on its own, since only the noun and the PP together form N':

(70) a.



In contrast, (70b) is grammatical, revealing that the PP is an adjunct. The noun forms an N' category on its own, to which the PP is attached; therefore the head noun "student" may be replaced by "one":

(70) b.



Unfortunately, the "one" substitution test does not provide clear results in the case of picture-NP items. While certain speakers find one-substitution in (71) to be fine, suggesting the PP is an adjunct, others find it ungrammatical (or at least degraded in grammaticality), suggesting it is an argument:

(71) ?The picture of Mary and the one of Jane

In short, few have clear judgments on (71) like they do for the items in (70). This lack of conclusive judgments makes it difficult to ascertain whether Lebeaux's account is on the right track. Ideally one would seek to establish how participants were analyzing the PP's contained in picture-NP's by using an independent measure like the "one" substitution test as a means for evaluating Lebeaux's proposal. However, even if such a test could conclusively establish adults' analyses (which seems unlikely given the variability in adults' interpretations), it is even more unlikely that such a test could be effectively conducted with children.

Nevertheless, it may be possible to establish adults' analyses of these PP's using a more indirect method. One way would be to compare performance on wh-questions containing picture-NP's to questions where the wh-phrase contains an unambiguous adjunct, as in (72):

(72) Which painting that John saw did he like best?

Relative clauses are standardly assumed to be adjuncts, which predicts that "that John saw" may be inserted into the structure above after wh-movement has occurred, avoiding a Principle C violation and allowing for coreference. Testing adults on questions like (72) would establish a baseline for how often they insert adjuncts late, by demonstrating how often they accept coreference for such items. Recall that adjuncts may be inserted into a syntactic structure early or late, showing reconstruction effects in the case of the former, but not the latter. By comparing performance on questions containing unambiguous adjuncts to performance on picture-NP's, it may be possible to establish whether adults consider the PP's in picture NP's to be adjuncts as well. Specifically, if adults assign coreference in the picture-NP case at the same rate that they assign it in the unambiguous adjunct case, that result may be taken as evidence that adults consider the two structures to have the same analysis: in short, they consider the PP's contained in picture-NP's to be adjuncts, just as they do for relative clauses.

On the other hand, if adults allow for coreference more often for the unambiguous adjunct questions (as in (72)) than they do for the picture-NP questions, that result may be taken as evidence that PP's in picture-NP's are not unambiguously adjuncts for adults. In this case, adults allow for coreference more often for the relative clause items, which is expected on Lebeaux's analysis (as adjuncts may be inserted late and avoid Principle C), but allow coreference less in the picture-NP case. This result would suggest that the PP in a picture-NP is not unambiguously an adjunct, as a similar rate of coreference would be expected if it were. However, it would not as definitively establish the analysis of the

PP as in the case where equal rates of coreference were found. Two distinct accounts would actually be compatible with these results. On one analysis, the PP would be said to be ambiguous, sometimes being analyzed as an adjunct and inserted late (allowing coreference), and sometimes being analyzed as an argument and inserted early (disallowing coreference). Alternatively, the PP may be said to be unambiguously an adjunct, just as relative clauses are, but whether the adjunct is inserted early versus late varies across adjunct type (e.g. relative clause versus PP). In other words, relative clauses tend to be inserted late, while PP's within picture-NP's tend to be inserted early.

In short, on the Lebeaux analysis, Experiment 4 showed that adults must consider the PP contained in picture-NP's to be an adjunct at least in some cases, as they allow for a non-reconstructed, coreferential reading about a quarter of the time. The question that then remains is whether the PP is always an adjunct, or whether it is ambiguously an adjunct. It is difficult to tell these two possibilities apart, as adjuncts may be inserted either early or late: adults' preference for the reconstructed, disjoint interpretation may always be explained as either a preference for analyzing the PP as an argument (and therefore inserting it early) or analyzing the PP as an adjunct and having a preference for inserting it early. As this question is slightly orthogonal to the main issue at hand, the experiment described above will be left for future work. Furthermore, given the difficulty of evaluating Lebeaux's analysis with respect to the current data, and the concerns about the validity of this account in general mentioned in section 3.3.1, alternative accounts will be explored.

Despite the shortcomings of Lebeaux's account, Heycock's analysis of the predicate/argument distinction nicely captures the predicate results for Experiments 4-5, where both children and adults demonstrated obligatory reconstruction of predicates. On this account, the wh-predicates, being nonreferential, are obligatorily reconstructed. Previous results (Armon-Lotem & Avram, 2005; Schaeffer, 1997; Thornton, 1990, 1995) have shown children to be aware of the referential/nonreferential distinction, and to use it in the formation of wh-questions. As such, it seems likely that they would be able to use this distinction when determining possibilities for reconstruction, just as adults do. What the Heycock/Lebeaux analysis fails to clearly predict are the results for the moved argument items in Experiments 4-6. In particular, Experiment 4 showed that adults preferred a reconstructed interpretation for Principle C matrix questions, while allowing for a non-reconstructed one; children consistently preferred a surface, non-reconstructed interpretation. While it may be possible to use Lebeaux's argument/adjunct distinction to arrive at an analysis of these results, the difficulty in determining the status of the PP's contained in picture-NP's makes such an analysis highly tentative. Furthermore, it fails to be very explanatory regarding the difference between children's and adults' preferences with respect to the Principle C questions in Experiment 4; in the end, children and adults would have to be said to differ in when they prefer to insert adjuncts into the syntactic structure, or whether they prefer to analyze PP's as arguments or adjuncts. Either way, there seems to be little logical reason why adults and children would differ in such a respect. Finally, given the debate discussed in section 3.3.1 over the validity of Lebeaux's analysis and the difficulty in obtaining clear judgments on the types of

sentences crucial for establishing it, further analyses of the argument data will be considered below.

3.3.5. Processing

While Heycock's analysis provides a clear account of children's and adults' obligatory reconstruction of moved predicates, more still needs to be said regarding their interpretations of wh-arguments. Recall that Experiment 4 showed children to prefer a coreferential reading of matrix questions with a moved argument like (37), which is only licensed on a non-reconstructed interpretation:

(37) Which painting of Miss Cruella did she put up?

Adults, on the other hand, preferred disjoint reference, but allowed coreference about a quarter of the time. In other words, adults preferred the reconstructed interpretation, but allowed for a surface interpretation as well. In contrast, Experiments 5-6 showed adults preferred the surface interpretation of sentences like (42), but were also able to access a reconstructed interpretation where the reflexive is bound by the embedded subject. Children, on the other hand, rejected this reconstructed interpretation, accepting only the surface reading where the anaphor is bound by the matrix subject:

(42) Miss Cruella knew which painting of herself Janie put up.

None of the analyses reviewed above alone provides a clear account of these results. With respect to the argument/adjunct approach, there seems to be no principled reason why children would always choose to analyze the PP within the picture-NP as an adjunct inserted late, while adults prefer to treat it either as an argument (or as an adjunct inserted early) in matrix questions, but an adjunct inserted late in embedded questions. A Rule I

account fails to predict the asymmetry between performance on the Principle C matrix questions and statements which emerged in the child data, as children uniformly ruled out coreference in statements, but preferred it for questions. It also does not extend to the embedded question results, as Rule I fails to apply due to those items already having a bound variable interpretation. The economy analyses based on the copy theory of movement, while nicely accounting for the adult preference for reconstruction in Experiment 4, fail to predict the pattern that was observed in Experiments 5 and 6; this approach provides no reason why adults would prefer one antecedent over the other (the Preference Principle if anything, predicts that adults would prefer the reconstructed interpretation, but in fact the opposite result was obtained). Furthermore, this analysis fails to predict the observed predicate/argument asymmetry that emerged in both the child and adult results. The referentiality account nicely captures this asymmetry, predicting children's and adults' obligatory reconstruction of moved predicates, but assuming Lebeaux's analysis for referential items (like the argument questions tested), encounters the same problems as mentioned above for the argument/adjunct approach.

Taken together, however, the results of Experiments 1-5 provide strong evidence that children have reconstruction as part of their grammar. In all cases where reconstruction is obligatory, either to establish a binding relation for a reflexive (Experiment 1), or because the moved item is nonreferential (Experiments 4-5), children consistently assign interpretations that are consistent with reconstruction. They likewise gave responses consistent with reconstruction in Experiments 2-3. Since children are adult-like in having access to reconstruction, it seems unlikely that a difference in the

content of their grammars could explain children's and adults' varied preferences in Experiments 4-5. More likely their performance may be explained by differences in parsing strategies across these two groups.

It is widely assumed that language processing occurs as words are encountered, with initial syntactic structures and interpretations being built before all of the words in a sentence have been heard. Garden paths are typically taken as evidence for this "incremental processing" approach. If no structure was built until hearing the entire sentence, there would be no reason for the processing difficulty of sentences like (73) (Bever, 1970), which require reanalysis once the matrix verb is encountered at the end of the sentence:

(73) The horse raced past the barn fell.

Incremental processing likewise comes into play when interpreting pronouns and anaphors. Several studies have found a tendency for pronouns to be resolved to the first mentioned (usually assumed to be the "most accessible") antecedent (Arnold, Eisenband, Brown-Schmidt, Trueswell, 2000; Arnold, Novick, Brown-Schmidt, Eisenband, Trueswell, 2001; Gernsbacher, 1989; Gernsbacher, Hargreaves, & Beeman, 1989; among others). For example, in a sentence like (74), listeners prefer to assign Clinton as the antecedent for the pronoun, and are likely to have some difficulty assigning the intended interpretation where Gore is the antecedent (from Arnold, Eisenband, Brown-Schmidt, & Trueswell, 2000):

(74) Clinton confessed to Gore when he asked for the truth.

While these studies have shown a preference for the first-mentioned antecedent when resolving pronoun resolution, they do not address the question of anaphor binding, which is a central concern in the current study. Furthermore, it is not clear from these studies, which concentrate on structures not subject to binding theory, when binding theory is applied during sentence processing. In other words, a preference for the first mentioned antecedent may not hold if selecting that antecedent results in a binding theory violation.

Several studies have indeed shown that Principle A is operational at the earliest stages of sentence processing (Sturt, 2003; Sturt & Lombardo, 2005). Sturt (2003) used an eye-tracking experiment to examine adults' processing of anaphors in a context where two possible antecedents had been mentioned. Crucially, only one of the two antecedents was in a position to bind the anaphor (the grammatical antecedent) while the other was not (the ungrammatical antecedent). A gender mismatch between the grammatical gender of the reflexive and the stereotypical gender of the antecedent was used to detect the difficulty of processing the grammatical versus ungrammatical antecedent[19]. Specifically, the study asked participants to read vignettes like those below, where a gender mismatch occurs in the second story but not the first:

[19] Previous studies show stereotypical gender violations are quickly detected and cause processing difficulty when mismatched anaphor is encountered (Carreiras, Garnham, Oakhill, & Cain, 1996; Osterhout, Bersick, & McLaughlin, 1997).

(75) a. Jennifer was pretty worried at the City Hospital. She remembered that the surgeon had pricked himself with a used syringe needle. There should be an investigation soon.
(**no mismatch with grammatical antecedent**)

b. Jonathan was pretty worried at the City Hospital. He remembered that the surgeon had pricked herself with a used syringe needle. There should be an investigation soon.
(**mismatch with grammatical antecedent**)

Measures of early eye movement after encountering the anaphor in these stories were compared to eye movements on similar stories where there was a match or mismatch with the ungrammatical antecedent (the matrix subject). The results revealed a processing difficulty when a gender mismatch was encountered between the anaphor and the grammatical antecedent (the surgeon), but no difficulty when there was mismatch with the ungrammatical antecedent (Jennifer in (75a), Jonathan in (75b)). Despite the fact that the first character mentioned is strongly in focus, as it was mentioned first and is referred to with a pronoun in second sentence, it is apparently not considered as antecedent for the reflexive (since doing so would violate Principle A). Participants thus appear to be using Principle A to calculate antecedent possibilities quite early on, and do not simply rely on first mention when choosing an antecedent for the anaphor.

Sturt & Lombardo (2005) used coordination structures to provide further evidence for incremental processing and early application of Principle A. A stereotypical gender mistmach effect was found once again for sentences like those below:

(76) a. The pilot embarrassed John and put himself in a very awkward position. (**no mismatch**)

b. The pilot embarrassed Mary and put herself in a very awkward position. (**mismatch**)

Performance on the above sentences was compared to similar sentences where the reflexives were replaced with pronouns. In the pronoun sentences, the subject of the sentence is not a grammatical antecedent for the pronoun, being ruled out by Principle B. Thus the stereotypical gender of the subject should not affect processing of the pronoun. Indeed, the results reveal exactly this pattern: a gender mismatch effect was found for the reflexive items, but no gender mismatch effect emerged for the pronoun items. These results demonstrate that the mismatch effect only arises in cases where there is a possible binding relation between the anaphor/pronoun and antecedent: binding theory appears to affect processing quite early on. Furthermore, that the mismatch effect emerged very early on in processing provides more support for incrementality, showing that the parser does not wait for second coordinate to be entirely built before computing binding relations.

The above studies show that while adults may prefer the first mentioned item as an antecedent, they only do so when this antecedent is grammatical with respect to binding theory. Therefore, adults must apply binding theory early on, computing binding possibilities upon encountering the anaphor as they incrementally process the sentence. Given these results, it is likely that a preference for first mentioned antecedent, in addition to early application of Principle A, explains adults' preference for the matrix antecedent in the argument questions in Experiment 5. While both antecedents are grammatical in the sentence below, only one comes before the reflexive in the linear order of the sentence:

(42) Miss Cruella knew which painting of herself Janie put up.

On a processing account, adults may prefer the matrix antecedent because binding by this item may be established as soon as the reflexive is encountered. The embedded matrix antecedent is likewise dispreferred because the initial binding relation between the reflexive and the matrix subject would have to be revised once the possibility of binding by the embedded antecedent is established. The results mentioned above, in showing that binding possibilities are taken into account upon encountering an anaphor, lend support to the idea that adults prefer to establish anaphoric binding as early as possible. Thus adults prefer the matrix antecedent for the argument questions in Experiment 5 because they want to resolve the anaphor as quickly as they can after encountering it.

Unfortunately, much less is known about children's parsing strategies than adults'. It has been shown, however, that children as old as 5 years of age show little ability to revise their initial parse of a sentence (Trueswell, Sekerina, Hill, & Logrip, 1999). In the Trueswell, et al. experiment, children's eye movements were recorded as an experimenter asked them to act on an array of items. For example, participants were shown a scene with two stuffed frogs, one on a napkin and one not, next to an empty box and empty napkin. They were then asked to respond to one of the sentences below:

(77) a. Put the frog on the napkin in the box. (**ambiguous**)

b. Put the frog that's on the napkin in the box. (**unambiguous**)

Children were shown to prefer interpreting the PP "on the napkin" as a destination and not as a modifier of the frog in the ambiguous condition, directing their gaze at the empty napkin more often than in the unambiguous condition, and often putting the frog on the

empty napkin (which never occurred in response to the unambiguous sentence). A fine-grained analysis of eye movements revealed children's processing to furthermore be highly incremental, with referential competition being resolved as soon as the participant had the information to do so (e.g., competition between the two frogs was resolved in the unambiguous condition upon hearing "napkin"). Adults were also shown to pursue a destination reading of the PP in the ambiguous condition before encountering the disambiguating material at the end of the sentence. However, unlike children, adults were always able to recover from this initial parse and correctly follow the experimenter's instruction, while children often incorrectly placed the frog on the napkin. These results suggest children have less ability to revise their initial interpretation as compared to adults.

Given this finding, children's performance in Experiments 4 and 5 may thus be explained by their limited ability to revise an initial parse, as shown by Trueswell and colleagues. It certainly seems plausible that children's initial parse of a sentence would be one corresponding most directly to their input; in other words, their initial parse reflects surface structure. Because they have difficulty revising this initial parse, if a surface structure interpretation is permitted by their grammar, that is the reading children will persist with. The current series of studies has shown, however, that children are able to compute interpretations that do not correspond to surface structure. Crucially, in interpreting movement structures, children have the ability to interpret either the higher or the lower copy depending on the structural environment and referentiality of the wh-phrase (e.g., they have been shown to access both non-reconstructed and reconstructed

interpretations). As mentioned earlier, this fact lends support to the idea that children have the copy theory of movement, as their ability to interpret either copy falls out naturally on this analysis. Given the opportunity to interpret either copy, however, children consistently prefer to interpret the copy that is pronounced; that is, they prefer the surface structure interpretation.

Recall that in Experiment 4, children preferred the coreferential interpretation of questions with moved arguments, which is only allowed on a surface, non-reconstructed interpretation:

(37) Which painting of Miss Cruella did she put up?

In other words, children failed to interpret the lower copy of the R-expression for such sentences, which would result in a Principle C violation and rule out coreference. As noted above, children's preference for the surface interpretation may not be explained as the result of their lacking reconstruction, since they consistently assign the reconstructed interpretation to moved predicates (Experiments 4-5) and moved arguments containing an anaphor that requires binding (Experiment 1). Instead, they proceed with an initial parse that mirrors surface structure as much as possible, interpreting the higher copy where it is pronounced. Knowing that the wh-phrase in (37) is referential, and therefore is not required to be interpreted down low, children find this parse to be grammatical. That children are consistent in assigning this surface interpretation may thus be accounted for by their limited ability to revise their initial parse of a sentence; once children establish the grammaticality of their initial parse that corresponds to surface structure, they will persist with this reading.

Children's preference for the surface interpretation may also explain their performance in Experiment 5. In this study, both children and adults preferred the reflexive to be bound by the matrix antecedent, which corresponds to a surface structure parse of the sentence. However, unlike adults, children consistently rejected the interpretation where the anaphor was bound by the embedded antecedent. In this case, children's inability to revise an initial parse is telling. Once they have established their initial surface structure parse and found it to be grammatical, they persist with this interpretation, despite the availability of a reconstructed reading: faced with a grammatical surface structure parse, children actually reject a competing reconstructed interpretation. Furthermore, like adults, children were also shown in the Trueswell, et al study to use an incremental processing parsing strategy. While no studies to my knowledge have been conducted examining the time course of children's application of binding theory, it is possible that, like adults, they would begin establishing binding relations as soon as they had enough information to do so. In the case of the Experiment 5 embedded questions, this would mean children would look for an antecedent for the anaphor upon encountering it in the speech stream. Finding the matrix antecedent would establish a binding relationship that children would have difficulty revising after encountering the embedded subject. Add to this children's preference for the surface interpretation, and it is not surprising that they would reject binding by the embedded subject. Thus children's limited ability to revise their initial parse of a sentence accounts nicely for the results of Experiments 4-5, which show children to prefer surface structure interpretations. Crucially, this is a preference, and not a reflection of grammatical

knowledge, as they are also shown to generate reconstructed readings when required to do so by their grammar.

Evidence from experiments testing children's interpretations of scopally ambiguous sentences lends further support to their preference for surface structure. As mentioned earlier, a series of studies by Musolino, Lidz, and colleagues (Lidz & Musolino, 2002; Musolino, 1998; Musolino, Crain, & Thornton 2000; Musolino & Lidz, 2003) revealed children to have a strong preference for the surface scope interpretation of scopally ambiguous sentences like the one below:

(2) Every horse didn't jump over the fence.

(i) None of the horses jumped over the fence. (**surface scope**)

(ii) Not every horse jumped over the fence. (**inverse scope**)

Crucially, children were shown to have access to the inverse scope interpretation under contextual conditions that made this reading salient (Musolino & Lidz, 2004), despite the fact that they had systematically rejected this interpretation in favor of the surface reading in all of the previous studies. In other words, just as in the current series of studies, children were able to generate interpretations that correspond to the reconstructed reading, but had a strong preference for the surface reading when it was available. In short, upon finding their initial surface parse to be grammatical, children will persist with that reading.

Thus a processing approach, combined with Heycock's referentiality-based account of reconstruction, appears to best account for children's and adults' performance in the current series of experiments. Both groups distinguish reconstruction possibilities

on the basis of referentiality, where reconstruction is required for nonreferential wh-phrases but not required for referential ones. When reconstruction is not obligatory, as with the embedded argument questions in Experiment 5, adults prefer to interpret the reflexive as it is encountered, applying Principle A early on and establishing a binding relation with the matrix subject (which has the added advantage of being first mentioned). Adults are able to easily revise this interpretation, however, and access a reading where the reflexive is bound by the embedded subject as well. Children, on the other hand, have difficulty revising their initial parse. It is plausible to assume that children initially assign a parse that most closely corresponds to the input, and interpret moved items where they are pronounced, reflecting surface structure. Therefore if children find their initial, surface parse of a structure to be grammatical, that is the interpretation they persist with. In the case of Experiment 5, binding by the matrix subject antecedent is reflected in the surface structure of the sentence, so this is the reading children prefer. Their preference for surface structure likewise explains their interpretation of the argument questions in Experiment 4, where they consistently assigned a coreferential, non-reconstructed interpretation.

One piece of the puzzle is left unexplained by the above analysis: adults' interpretation of the argument questions in Experiment 4:

(37) Which painting of Miss Cruella did she put up?

Recall that adults preferred disjoint reference for sentences like the one above, but allowed coreference about a quarter of the time. In this case, a parsing strategy that tries to resolve pronoun reference as early as possible does not help to distinguish the available

interpretations; if anything, mentioning Miss Cruella in the sentence might be thought to increase the likelihood of assigning a coreferential interpretation. However, adults were shown to prefer disjoint reference. One way to explain this preference is to say adults prefer interpreting the lower copy when possible, in accordance with the Preference Principle (Chomsky, 1993). In Experiment 5, where they prefer the nonreconstructed interpretation, their parsing strategy overrides this economy preference: quickly resolving the anaphor overrides their preference for interpreting the lower copy. Given that previous studies have shown children to disobey economy, this account could likewise be extended to children. In their case, the preference for a surface structure interpretation overrides any economy considerations. This view allows for continuity between the child and adult grammars, with children and adults only differing in their parsing strategies. The details of how children acquire such a system will be further discussed in Chapter 4.

3.4. Summary and Open Questions

The experiments described in Chapter 2 revealed an asymmetry between reconstruction of moved arguments versus moved predicates for both children and adults. While both groups obligatorily interpreted moved predicates in their reconstructed position, adults were shown to permit a non-reconstructed interpretation of moved arguments in matrix questions subject to Principle C (Experiment 4), and children actually preferred this non-reconstructed, surface interpretation. The experiments described in the current chapter aimed to further explore this difference between children and adults (why children preferred a surface interpretation in Experiment 4, while adults preferred a reconstructed

reading), as well as probe the nature and strength of children's surface structure preference.

Experiment 5, which tested children and adults on embedded questions subject to Principle A, showed that while adults were able to assign either a surface or reconstructed interpretation to such sentences, children consistently assigned a surface interpretation, while rejecting the reconstructed reading. The results further suggested an adult preference for the surface interpretation, which was confirmed in Experiment 6. Thus while children's preference for surface structure interpretations was constant across Experiments 4 and 5, adults showed a preference for the reconstructed interpretation in Experiment 4, while favoring the surface interpretation in Experiment 5.

A variety of theoretical proposals were considered to account for this pattern of results. In the end, a combination of these analyses was shown to best account for the data. Heycock's (1995) account of obligatory reconstruction of nonreferential items provides a compelling explanation for both children's and adults' performance with respect to moved predicates, which are nonreferential. Previous studies have demonstrated children's awareness of the referential/nonreferential distinction at an early age, lending support to the idea that they use this distinction when computing reconstruction possibilities. However, with respect to moved arguments, which being referential are not required to be interpreted in their reconstructed position, Heycock's adoption of Lebeaux's analysis was found to fall short of providing an explanatory account of the current results. Part of the difficulty in applying Lebeaux's account to this set of experiments lies in the uncertainty surrounding whether PP's contained in picture-

NP's are arguments or adjuncts. Though even if such a distinction were easier to establish, Lebeaux's account would be forced to explain the difference between children and adults in Experiment 4 as a difference in preference for inserting adjuncts into the syntactic structure early versus late (or in preferentially analyzing the PP's as arguments versus adjuncts). In either case, there seem to be little reason why children and adults would systematically differ along such lines (although some possibilities will be entertained in Chapter 4).

While Heycock's account nicely predicts children's and adults' obligatory reconstruction of moved predicates, it does not as easily extend to their interpretations of moved arguments. For these, a processing approach was shown to best account for the data. Specifically, children have a clear preference for surface structure in both Experiments 4 and 5. Previous psycholinguistic studies of preschool aged children (Trueswell, Sekerina, Hill, & Logrip, 1999) have shown that they have difficulty revising their initial parse of a sentence. It seems likely that children's initial parse would closely mirror their input, and therefore reflect surface structure, allowing items to be interpreted where they are pronounced. Thus children's preference for surface structure in Experiments 4-5 may be explained as the result of their limited ability to revise their initial parse of a sentence: once they have a grammatical initial parse, this is the interpretation they will persist with.

Adults, on the other hand, were shown to prefer the reconstructed interpretation in Experiment 4, while preferring the surface interpretation in Experiment 5. An economy principle along the lines of Chomsky's Preference Principle predicts that adults will

prefer the reconstructed reading and interpret the lower copy, as they do in Experiment 4. Crucially this economy consideration may be overridden, as adults interpret the higher copy and assign a surface interpretation about a quarter of the time in this experiment as well. Their preference for interpreting the lower copy is more consistently overridden in Experiments 5 and 6, where adults preferred the surface interpretation. In this case, their preference for interpreting the higher copy may be attributed to a parsing strategy that aims to resolve anaphoric dependencies as quickly as possible. Because binding by the matrix subject may be established as soon as the anaphor is encountered, adults prefer resolving the anaphor to this antecedent, which is the relation reflected in the surface structure of the sentence. Children are simply a more extreme version of adults: they too may be said to have economy and the Preference Principle, but their parsing preference for surface structure is strong enough that it is consistently overridden. In short, children's parsing strategy masks their adult-like knowledge of reconstruction.

The above results reveal quite a complex system of knowledge for children to have acquired by age 4. In Chapter 4, questions of children's learning will be addressed. The results of a corpus study examining the linguistic input children receive will be reported, concentrating on evidence for reconstruction. It will be shown that children receive almost no input of the type that might reveal reconstruction. Therefore, given the current results, hypotheses about how children might acquire reconstruction in the absence of input for it will be discussed. Chapter 4 further aims to shed light on how children eventually come to have adult-like knowledge of this abstract system.

CHAPTER 4

While the studies above serve to establish children's knowledge of reconstruction, they do not directly address the question of how children acquire this knowledge. What the studies do reveal is that children have reconstruction by age 4, and furthermore that they will obligatorily assign a reconstructed interpretation when their grammar requires it. The studies further show that children can distinguish argument questions versus predicate questions, and use this distinction when computing reconstruction possibilities. Finally, this series of experiments demonstrates that children have a strong preference for the non-reconstructed, surface interpretation when it is licensed by their grammar.

Chapter 3 outlined various theoretical accounts of reconstruction and movement, settling on a combination of analyses to capture children's behavior. Their obligatory reconstruction of moved predicates (in contrast to moved arguments) was shown to be best explained by Heycock's (1995) referentiality account, which asserts that reconstruction is obligatory for nonreferential items, like wh-predicates. Previous studies have demonstrated children's knowledge of referentiality by age 4 (Armon-Lotem & Avram, 2005; Schaeffer, 1997; Thornton, 1995) lending support to this analysis. Their preference for surface structure, however, was attributed not to their grammatical knowledge, but rather to parsing strategy. Psycholinguistic studies of preschool-aged

children have shown they have a difficult time revising their initial parse of a sentence (Trueswell, Sekerina, Hill, & Logrip, 1999). It is plausible that children's initial parse would closely mirror their input, and that children would interpret items where they were pronounced. In other words, children's initial parse corresponds to the surface structure of the sentence. If that parse is grammatical, children will persist with that interpretation, as they have difficulty revising it. While this account nicely captures the results obtained in Experiments 1-6, the question remains: how do children develop this system?

4.1. Corpus Study

One way to approach this question is to examine the input children receive that may provide evidence for reconstruction. As mentioned at the outset of this dissertation and demonstrated in the current set of experiments, one means by which reconstruction may be revealed is in questions subject to binding theory. As questions are extremely common in child-directed speech, perhaps children also commonly hear questions where the wh-phrase contains an anahpor, pronoun, or R-expression whose interpretation interacts with another NP in the question. As these structures reveal reconstruction, they would be very useful to language-learners acquiring the system demonstrated in Experiments 1-5.

These experiments further demonstrated children's knowledge of distinct reconstruction requirements for moved arguments versus predicates. Examining children's input may show whether it is plausible to assume children learn this asymmetry by observing instances where wh-arguments are interpreted in their surface

position, as opposed to wh-predicates, which never are. It may also help establish whether this asymmetry falls out as the result of other knowledge (e.g. knowledge of referentiality), or whether it directly reflects the input on wh-questions that children have received.

4.1.1. Method

A corpus study using the CHILDES database (MacWhinney, 2000) was conducted to determine how much of children's knowledge of reconstruction could have been gleaned from their input. Only those databases containing interactions between parents (mothers in the databases consulted) and children under age 5 (roughly the age at which they were tested in Experiments 1-5) were included in the study. Going in alphabetical order through the corpora contained in CHILDES, the first 10,000 wh-questions uttered by parents in interactions with their children were analyzed, representing 12 databases (Bates-Free 20, Bates-Free 28, Bates-Snack 20, Bates-Snack 28, Bates-Story 28, Bernstein, Bliss, Bloom 70, Bloom 73, Bohannon-Bax, Bohannon-Nat, and Brent). Embedded wh-questions were analyzed along with matrix wh-questions. In total, input to 75 children was analyzed, from 318 transcribed sessions.

Each wh-question uttered by mothers in the database was evaluated according to several criteria. First, it was categorized either as a predicate question (e.g. "How old are you?") or an argument question (e.g. "What did you see?"). Predicate items were easily identified, and only those questions that involved movement of a subject or object of the verb were considered argument questions. For questions involving moved constituents that were more difficult to clearly classify as objects, the "do so" test, which assumes the

phrase “do so” may replace a verb and its complements to the exclusion of adjunct modifiers (and crucially cannot replace the verb without its complements) was used to verify the status of the wh-phrase. Those questions that were not predicate or argument questions were categorized together. Most were either adjunct questions (e.g. “What time should we eat lunch?”), or were considered indeterminate, as with questions consisting of a lone wh-phrase that lacked enough syntax to determine its status (e.g. “What?” or “Which one?”). Questions were also categorized according to the complexity of the wh-phrase, since only questions with complex wh-phrases, or those that contain more than the wh-word itself (e.g. “Which book do you want to read?”) may potentially provide evidence for reconstruction. Questions with complex wh-phrases were further categorized for those containing an anaphor, pronoun, or name. Finally, the complex wh-phrases containing an anaphor, pronoun, or name, were examined to see if any also had a potential antecedent in the sentence. These would be the crucial examples that could help children learn about reconstruction on the basis of their input.

4.1.2. Results

The results show that wh-questions are not as frequent in child-directed speech as may be expected: it took 132,679 conversational turns from the mother to yield 10,000 wh-questions. This figure may be surprising, but bear in mind that many of the mother’s turns consisted of a single word (e.g. to answer a child’s question, or to draw the child’s attention to some object), and many were also yes-no questions. While no data on this point was tracked, it seems likely that of the full sentences children hear, a relatively high percentage are questions.

Within the wh-question data collected, a little less than half were argument questions, while predicate questions were much less common, comprising less than 1% of the questions analyzed. Furthermore, about 7% of the wh-questions examined had complex wh-phrases. Of these complex wh-questions, however, not a single one contained an anaphor, pronoun, or name. Thus children appear to receive very little input of the type that might reveal reconstruction, if they receive any at all.

Question Type	**Number of Examples**	**Percentage of Total Questions**
Argument	4,273	42.7
Predicate	73	.7
Adjunct or Indeterminate	5,654	56.6
TOTAL	**10,000**	**100**
Complex Wh-Phrase	667	6.7
Complex containing anaphor, pronoun, name	0	0
Complex containing, anaphor, pronoun, name and with potential antecedent in sentence	0	0

Table 2. Corpus search results reported as raw numbers and percentages.

While no instances of questions that clearly reveal reconstruction (like the questions tested in Experiments 1-5) were found in this data set, clearly it is possible that children may encounter such questions at some point. However, the fact that not even a single wh-phrase containing an anaphor, pronoun, or name was found (not to mention no such questions with a potential antecedent also in the sentence) makes it highly unlikely that children learn about reconstruction directly from their input. Likewise, the small number

of predicate questions found, coupled with the fact that none of these predicate questions contained anaphors, pronouns, or names in the wh-phrase, further suggests children do not learn about obligatory reconstruction for moved predicates by directly observing such questions in the input. Given this lack of input, it seems their knowledge of reconstruction, and the predicate/argument asymmetry, must arise as the result of learning about other aspects of grammar, some of which may be argued to be innately specified. Possibilities for this learning process are discussed in the following section.

4.2. Discussion of Learning

The corpus study described above reveals that children receive virtually no input of the type that might reveal reconstruction. Therefore the question remains of how children acquire the system observed in Experiments 1-5, where reconstruction is clearly shown to be part of their grammar, and an asymmetry between reconstruction of moved predicates and moved arguments is observed. Learning about reconstruction necessarily involves learning about movement, as reconstruction is defined by interpreting a moved item in a pre-movement position. Thus the first challenge for children in establishing their knowledge of reconstruction is to learn about movement.

4.2.1. Movement

The study of language acquisition has generated a large literature on how children acquire what must be a first step towards learning more complex syntactic structures: the acquisition of argument structure (Bowerman, 1990; Fisher, 1996; Gleitman, 1990; Pinker 1984, 1989; Tomasello, 1992; among many others). While debate about exactly

how this acquisition takes places continues, it is well established that children have knowledge of argument structure quite early on. Indeed, even children as young as 16 months have been shown to be sensitive to semantic differences between subjects and objects (Hirsch-Pasek, et al, 1985), demonstrating knowledge of the distinct relationship various types of noun phrase may have with the verb. By age 2, children are likewise sensitive to the number of participants in a given event and how this is linguistically encoded, deriving meanings of novel verbs on this basis (Naigles, 1990). More recently it has been argued that children early and selectively use statistical information on the number of noun phrases occurring with verbs as a derivative cue to the meanings of verbs (Lidz, Gleitman, & Gleitman, 2003; Lidz & Gleitman, 2004). There have been many other studies conducted that establish children's early acquisition of argument structure. Suffice to say, it is not entirely surprising that such knowledge would be acquired early on; as the verbal complex forms the basis of sentence structure, knowing about the relationship between a verb and its arguments would be minimally required before learning about almost any other syntactic structure.

Armed with knowledge of argument structure, children are in a favorable position to learn about syntactic movement. If a language-learner knows to expect arguments to appear in a certain position with a certain verb, any violation of this arrangement will be apparent. Furthermore, if this violation systematically co-occurs with the presence of a wh-phrase at the beginning of the sentence, that can be taken as a cue that there is a relation between the lack of an expected argument and the presence of the wh-phrase. Upon encountering a variety of such structures in the input, the child may notice the

relation between the wh-phrase and the position where the missing argument should appear, and specifically may notice that the wh-phrase may be interpreted as a question about that argument. Thus the challenge for language learners mentioned in Chapter 1, that they must learn that the wh-phrase is associated with two structural positions (its surface position, and the position it would normally occupy as an argument of the verb), falls out naturally as a result of their knowledge of argument structure. Once the child recognizes this relation as syntactic movement, the properties associated with such movement may fall out from Universal Grammar (UG).

An example will help illustrate. Consider a child being faced with the following sentence:

(78) What did you see?

Knowing that the verb "see" is typically followed by a direct object, that is, the thing that is seen, a language learner may take note of its absence in (78). At the same time, they notice the wh-phrase "what" occurring at the beginning of the sentence. Children may have learned at this point about the rising intonational pattern associated with questions, providing a clue that this sentence is a question. But even if they have not, learning the association between the wh-phrase and the position where an argument is expected over many questions like (78) may be enough for children to begin positing a relationship between these two items. After learning more about the meanings of various wh-phases, this relationship should be well established: children can now figure out, in this example, that "what" is asking for the missing argument of "see." The wh-phrase may thus be interpreted as the missing argument. Through their knowledge of argument structure,

children may learn that items pronounced in one position may be linked to another; specifically, that a wh-phrase, while overtly appearing in a position at the beginning of the sentence, may simultaneously be interpreted in another position, as an argument of the verb. Of course, the nature of this relation is quite complex, as movement structures are subject to various syntactic constraints that are unlikely to be learned from input. Therefore once children recognize the relationship between a moved element and its underlying position, and specifically recognize this relation as syntactic movement, knowledge of the properties of movement falls out as a consequence of UG.

One of the properties of movement likely specified by UG is the nature of its syntactic representation, specifically, the structure represented at the underlying position of the moved element. There is some evidence suggesting children's representation of this position. Before discussing this evidence, however, a return to the discussion of the copy theory of movement is warranted. As mentioned earlier, the copy theory is the theory of movement generally accepted in current theoretical linguistics, and is likewise assumed in this dissertation. One of the principal advantages of this theory is its conceptual simplicity: what remains in the underlying position of the moved item is simply a copy of that item itself. No additional elements, like the traces of movement assumed in earlier syntactic theories, must therefore be learned by children (or accounted for in a theoretical framework). Given its generality and simplicity, the copy theory of movement certainly seems like a good candidate for being part of UG. However, even if it were learned, it represents the simplest solution for children to the problem of how to

relate the two structural positions associated with a moved item: simply posit a copy of the item in each.

Evidence that children indeed represent a copy of the moved item in the position(s) it occupies in its path of extraction comes from several sources. First, as mentioned earlier, children have been shown to make errors repeating the wh-phrase in a medial position it moves through on its way to the beginning of the sentence, as below (de Villiers, Roeper, & Vainikka, 1990; McDaniel, Chiu, & Maxfield, 1995; Thornton 1990, 1995; Thornton & Crain, 1993):

(79) Who do you think <u>who</u> is in the box?

Repeating the wh-phrase in this medial position may be taken as evidence that children's representations do include copies. After all, a copy of the moved phrase is actually pronounced in this case, and since this structure is ungrammatical for adults, children could not have learned this structure from their input. Nevertheless, it has been shown that children never make errors in pronouncing the wh-phrase in its original underlying position (Klee, 1985; Stromswold, 1990, 1995; Tyack & Ingram, 1977). Such evidence is actually inconclusive with respect to the copy theory, however; simply because children do not make errors of this type does not mean they do not represent a copy of the moved item in this position. Indeed, adults are thought to have a full copy in the original position of the moved item, and they never pronounce the wh-phrase there either. While the researchers above propose different means of accounting for the fact that children do not make this error, on its own it does not rule out the copy theory of movement.

Furthermore, the fact that children have been shown in the current study to be able to interpret moved items in their original underlying position lends support to the copy theory of movement. Indeed, an added advantage of this theory is how it clearly predicts children to have reconstruction as part of their grammar, as has been observed. On this account, reconstruction is a by-product of movement: as long as there is movement, there is always a lower copy of the moved item available for interpretation. Thus the copy theory of movement simplifies children's learning problem even further. As long as they know about movement, they have reconstruction. Their challenge is reduced to figuring out when the higher copy versus the lower copy should be left for interpretation or deleted, depending on the particular copy theory analysis. On this point, children's parsing preferences also apparently have an influence, predicting their preference for interpreting the higher (pronounced) copy when that structure is licensed by their grammar. In any case, the fact that children have been shown to have access to reconstructed interpretations at such an early age lends support to the copy theory of movement. As the copy theory is assumed by many to hold for adults, this is a desirable result, since it allows for continuity between the child and adult grammars.

4.2.2. Reconstruction

As mentioned above, assuming they have the copy theory of movement, children face the challenge of learning which copy to interpret in which syntactic environment. Experiments 4 and 5 revealed an asymmetry between children's interpretation of the lower copy for predicates versus arguments; while they consistently interpreted the lower copy of moved predicates (like adults), they interpreted the higher copy of moved

arguments (unlike adults). Therefore what children and adults both have in common is a preference for the reconstructed interpretation of moved predicates. It was shown in the previous chapter that Heycock's (1995) referentiality-based analysis provides a clear account of these results. On this view, nonreferential items are obligatorily interpreted in their reconstructed position. As wh-predicates quantify over degrees and not entities, they are nonreferential, and therefore are required to be interpreted in their reconstructed position. It has been noted that nonreferential items always take narrow scope, that is, they must be interpreted within VP (Dobrovie-Sorin, 1992). This fact is part of what it means to be nonreferential; as long as an item is interpreted as nonreferential, it is interpreted as having narrow scope. Therefore the obligatory reconstruction of moved predicates falls out from their being nonreferential. As long as children know about nonreferentiality, and know nonreferential items must take narrow scope, they will obligatorily interpret moved predicates in their reconstructed position, just as adults do.

It was discussed in Chapter 3 that children have been shown to have the referential/nonreferential distinction in place by age 4, and to use this distinction when constructing wh-questions (Thornton, 1995). For example, children consistently made errors in repeating the medial wh-phrase when extracting a nonreferential wh-phrase from an embedded clause (as in (64)), but rarely made them when extracting a referential wh-phrase (if they did, the medial wh-phrase was not an exact copy, as it was for the nonreferential items):

(64) Who do you think <u>who</u> the cat chased?

Thornton likewise demonstrated that children show evidence of obligatory movement of the auxiliary to the complementizer position when there is a nonreferential wh-phrase in [Spec, CP], but that this movement appears optional when the wh-phrase is referential. These results demonstrate that the referential/nonreferential distinction is in place at a young age, but do not address the question of how children come to have this knowledge.

The corpus study above shows that children hear relatively few predicate questions, although they may get more input about other types of nonreferential wh-phrases that were not considered. A more detailed search in CHILDES may help establish what children might learn about referentiality on the basis of the input they receive. However, it seems unlikely, although it is not impossible, that children would get enough input of the appropriate type to successfully deduce that nonreferential items must be interpreted with narrow scope. More likely, the relationship between referentiality and syntactic position is specified as part of UG, so children do not have to learn about it from their input. Indeed, in order to learn about referentiality, children would have to be fairly confident about what the speaker intended (with respect to a referential versus nonreferential interpretation). This is likely quite beyond children's pragmatic abilities. If it is the case that their grammatical architecture forces nonreferential items to be interpreted within VP, then children actually have nothing to learn with respect to the relationship between referentiality and syntactic position.

Thornton suggests that knowledge about extraction of referential versus nonreferential wh-phrases may likewise be part of UG. This argument is based on the similarity of the child data to patterns of wh-movement shown in the adult grammar of

Chamorro. Chung (1994) shows that Chamorro distinguishes referential from nonreferential wh-phrases through wh-agreement markers that are triggered by successive cyclic movement. Specifically, nonreferential and referential wh-phrases display different agreement patterns: for nonreferential wh-phrases, successive cyclic movement is obligatory, and the agreement morphemes obligatorily appear, as below (from Chung 1994):

(80) Hafa malago'-mu [t u-mafa'maolik t]
what wh-obl.want-agr wh-nom.agr-be.fixed
What do you want to be fixed?

With movement of the nonreferential wh-phrase "hafa" ("what") above, the wh-agreement morpheme appears on each clause in the path of extraction. In contrast, for referential wh-phrases, the above pattern is possible, but not required; it is not obligatory to mark the higher clause with the agreement marker.

This pattern parallels children's errors for wh-movement in English. Children show evidence for obligatory successive cyclic movement in repeating the wh-phrase at each landing site for nonreferential wh-phrases, but do not insert a medial wh-phrase for moved referential items (or else insert a non-referential wh-phrase in the medial position, instead of repeating the referential phrase exactly). Heycock considers the similarity between the movement pattern in Chamorro and children's errors in English as evidence that the referential/nonreferential distinction is part of UG. In both cases, there is evidence for successive cyclic movement of nonreferential wh-phrases (in contrast to referential wh-phrases, where successive cyclic movement is said to be optional), and in both cases this movement is marked by wh-elements along the path of extraction.

Thornton's reasoning is that children do not make errors that conflict with UG. Therefore the English child grammar reveals an aspect of UG that the adult grammar does not. The referential/nonreferential distinction is part of UG, as children reveal through their different error patterns across these two types of wh-phrase. If they have this distinction in place, and use it when forming wh-questions, it is likely that they know the meanings associated with referentiality and nonreferentiality. They would thus be predicted to know that part of the meaning of nonreferentiality is that nonreferential items take narrow scope, and therefore the lower copy of a nonreferential wh-phrase must be the copy that is interpreted, resulting in obligatory reconstruction of moved predicates.

With respect to moved arguments, Experiments 1-5 demonstrated that children prefer a non-reconstructed interpretation. If it is correct that children exploit the referential/nonreferential distinction when interpreting nonreferential items, then they must also use it to inform their interpretation of referential items, like the moved arguments tested in these experiments. But while this analysis posits that their grammar restricts the interpretation of nonreferential wh-phrases, it does not restrict the interpretation of referential ones: they may either be interpreted in their reconstructed position (as adults do in Experiments 1 and 4, and as children do in Experiment 1), or in their surface position (as children do in Experiments 4 and 5). Therefore, children may be said to know that referential items may be interpreted either in their surface or underlying position as part of knowing the referential/nonreferential distinction. It is also possible, however, that all children know about this distinction is that nonreferential items are obligatorily interpreted in their reconstructed position, and the distinction tells

them nothing about the interpretation of referential items. Either way, the result is the same: children must use some other constraint to determine when the higher versus lower copies of a referential wh-phrase are interpreted.

Recall that in Experiment 4, which tested matrix questions subject to Principle C, adults were shown to prefer a reconstructed interpretation, while children preferred the coreferential, surface interpretation:

(37) Which painting of Miss Cruella did she put up?

While children start out with a surface interpretation preference, they must somehow learn to change this preference as they converge on an adult grammar. The adult preference for interpreting the moved element in its underlying position in this case was explained in Chapter 3 as arising due to economy concerns. In particular, Chomsky's (1993) Preference Principle associated with the copy theory of movement predicts just this preference. On Chomsky's approach only one copy is left for interpretation at LF and it is economical to interpret the lower copy, in accordance with the Preference Principle. On the other hand, it is considered non-economical to interpret the higher copy, although this is precisely the interpretation that children favor.

To reconcile the children's and adults' results, it must be claimed that children either lack economy, or they have it but allow other preferences to override it. Chomsky's Preference Principle analysis was shown in Chapter 3 to be amenable to the latter approach, which posits various competing constraints that interact with the parser. The former approach, that children lack economy and must somehow learn it seems unlikely; it is difficult to imagine how economy might be learned, or what type of input

may reveal it. More likely children have the Preference Principle in place, but their parsing preferences mask this knowledge. If economy serves to make certain readings highly preferred or dispreferred (Tunstall, 1998), then children are actually not much different than adults: indeed, Experiment 4 showed even adults to disobey economy some of the time. Children may thus be thought to have a parsing preference for economy that they simply disobey in favor of their preference for surface structure at a young age. As their computational resources grow with maturation, they are less likely to persist with their initial surface parse, and are able to demonstrate knowledge of economy. What is clear is that on this view, while adults generally obey economy, children often disobey it, as has been found in previous work (Syrett & Lidz, 2005).

On the analysis presented thus far, children begin to recognize movement structures as a consequence of having learned about argument structure. Once movement is recognized, UG specifies its properties, one of which is the syntactic representation posited in the underlying position of the moved element: specifically, the copy theory of movement. Children must also know about the distinction between the movement of referential versus nonreferential wh-phrases, which is also likely innately specified. Being aware of this distinction, children may use it to calculate reconstruction possibilities: in other words, knowing that nonreferential items must be interpreted with narrow scope results in children obligatorily assigning the reconstructed interpretation to moved predicates. Referential wh-phrases, on the other hand, face no such restriction. Children most likely have in place the economy mechanism adults employ that results in a preference for the reconstructed interpretation, but their parsing strategy masks this

knowledge. Indeed, as referential items may be interpreted in either their surface or reconstructed position, children persist with their initial surface structure parse, upon finding that reading grammatical.

An alternative to this analysis, mentioned in Chapter 3, is that children's and adults' interpretations of referential wh-phrases may be explained by Lebeaux's (1988, 1990, 1991) argument/adjunct asymmetry. While there were problems with this analysis, most significantly that it seems to predict more regularity in the pattern of adult responses in Experiment 4 than was observed (with either certain adults preferring late insertion of an adjunct most of the time, or most adults preferring it for certain items, neither of which was found), it is not possible to rule it out entirely on the basis of this data. Recall that on this account, adjuncts may be inserted late into a structure, avoiding reconstruction, while arguments must be inserted early. Thus the argument/predicate distinction would arise due to the PP's in predicates being treated unambiguously as arguments (and therefore obligatorily reconstructing), while the PP's contained in picture-NP's are ambiguous between arguments and adjuncts, and on an adjunct analysis, may avoid reconstruction through late insertion. When analyzed as an argument, however, the PP is always inserted early and therefore interpreted in its underlying position. A slight variation on this analysis might assume that these PP's are not ambiguous, but rather are always adjuncts. Recall that adjuncts on this analysis may be inserted early *or* late, but the only way to avoid reconstruction is to be inserted late. Therefore children and adults may be said to vary in their preferences for when the adjunct is inserted: children must have a preference for inserting it late, while adults have a preference for inserting it early. On

this analysis, the learning challenge for children becomes either how to figure out that what they thought was unambiguously an adjunct is actually ambiguous between being an argument or an adjunct, or how to change their preference for early insertion to a preference for late insertion.

A first step in any analysis relying on the argument/adjunct distinction must be to assume children are able to distinguish arguments from adjuncts, and know that arguments are inserted early on. While both of these claims will be further discussed below, assuming this is the case, children must either start out assuming adjuncts are always inserted late (since they always interpret them in their surface position), or know they may be inserted early or late and prefer inserting them late. Given the lack of input children receive with respect to reconstruction (which would provide a clear means for discovering that adjuncts may also be inserted early), it seems most likely children are restrictive only in their insertion of arguments; in other words, they know arguments have to be inserted early, but in the absence of any restriction on adjuncts, allow them to be inserted either early or late. Their preference, however, is for late insertion. This preference may be thought to arise from children's surface structure preference: only through late insertion may the adjunct be interpreted in its surface position.

Given children's knowledge of argument structure, it certainly seems likely that they would likewise know arguments must be inserted early. After all, if children are thought to learn about movement by observing the wh-phrase in its surface position along with an "empty" argument position, it stands to reason that in positing a relationship between these two positions they are in effect inserting the argument early. Specifically,

if they know that a certain verb selects for an argument which does not appear in its canonical position, in finding a wh-phrase, they will always establish a relationship between the wh-phrase and this position (and never allow the wh-phrase to not be associated with it). In a sense, this is what early insertion must be: the obligatory creation of relationship between a moved item and its underlying position, where the moved item is always interpreted in the underlying position. For adjuncts, establishing such a relationship is simply not obligatory. Therefore, children's obligatory reconstruction of moved predicates may be explained as resulting from their knowledge that the PP's contained in predicates are arguments and not adjuncts.

It is not immediately clear how children may acquire this knowledge, however. There are no adjectives in English that take obligatory complements, making it much more difficult to use instances of co-occurrence of the adjective and a PP to infer an argument relation, as children may do for verbs. Of course, knowing the meaning of the adjective in question, for example, "proud," may prompt children to analyze the PP as an argument. Since the meaning of "proud" typically requires the experiencer to be proud of something, the PP is in a sense obligatory, as it is always understood even if not pronounced. If children use semantic knowledge like this to establish argument relations, then it may just be a matter of learning the meaning of the adjective.

However, this logic is much less straightforward when applied to nouns. As with adjectives, there are no nouns that obligatorily take complements in English that may provide a means of learning about the structure of NP. Using meaning to infer that a particular item is an argument likewise leads to questionable results. While the nouns

used in the picture-NP's in the current experiment may in some sense be thought to select for complements (e.g., the meaning of "article" requires that the article be about something), there is debate over the status of the PP contained in the picture-NP "article about Mr. Giraffe:" it is not clearly an argument or an adjunct. It seems children's default assumption must be that any phrase attached to a noun is an adjunct. This makes sense if children know that adjuncts serve as modifiers, as phrases attached to the noun generally may be understood as such. This assumption likewise predicts the pattern observed in the current data, that children apparently consistently analyze the PP's contained in picture-NP's as adjuncts. The problem then becomes how they ever learn that some nouns may take complements. One possibility is that they notice similarities between nouns related to verbs, as in "belief" and "believe." Knowing the verb takes a complement may lead learners to posit that a similar phrase attached to the noun is likewise a complement. This knowledge may then be extended to other nouns that are not related to verbs, but seem to have similar relationships with CP's or PP's attached to them. A corpus study examining the acquisition trajectory of these types of nouns and verbs may shed light on the likelihood of children following such a learning process.

Assuming that children are able to differentiate arguments and adjuncts, one possible explanation for the difference between children and adults in Experiment 4 (where children are shown to prefer the surface interpretation, while adults prefer a reconstructed reading) is that the PP's contained in picture-NP's are ambiguous between arguments and adjuncts for adults, but are unambiguously adjuncts for children. When adults analyze the PP as an argument, as they more often do, reconstruction is obligatory,

but when they analyze it as an adjunct, they are able to access a surface interpretation. Children, on the other hand, always assign a surface interpretation. Given that children consistently avoid reconstruction, they must analyze the PP as an adjunct inserted late into the structure. To become adult-like, children must learn that the PP they thought was unambiguously an adjunct is actually ambiguous. Assuming their default analysis for any phrase contained in the NP is an adjunct analysis, perhaps in the course of learning that nouns may also take arguments, this ambiguity would fall out. In other words, as they learn that nouns may take either arguments or adjuncts, they may notice that the PP's contained in picture-NP's have characteristics of both, and decide the PP is ambiguous. The only problem with this analysis is in its predictions for adults. Adults were shown to prefer the reconstructed, argument analysis, but also allow for an adjunct analysis. However, this preference was not consistent across items or across subjects. To maintain this account, adults would have to be said to assign an argument or adjunct analysis to any given item on the fly each time. While it remains a possibility, such an approach does not seem very likely.

An alternative view also described in Chapter 3 is that that both children and adults analyze PP's contained in picture-NP's as adjuncts, varying only in their preference for either early or late insertion. This allows for a certain continuity between these two groups: children are never faced with the problem of learning that the relevant PP's are actually ambiguous. On this view, children's preference for interpreting items where they are pronounced would be said to result in their inserting adjuncts into the structure late. As they mature and lose their surface structure preference, children must

then learn that it is actually preferable to insert adjuncts early. To accommodate this trajectory, a somewhat revised version of economy would be required: adults would have to be said to prefer inserting adjuncts early in order to be economical and interpret the lower copy of the wh-phrase. In other words, the adjunct is inserted early so that the adult may then make an economical decision and interpret it down low. Such an analysis makes little intuitive sense. It actually seems less economical to insert an adjunct early when this insertion is not required: why create a lower copy when you do not have to? Thus it is primarily in applying the argument/adjunct analysis to the adult results that problems arise. While children's obligatory reconstruction of wh-predicates and preference for the surface structure interpretation of wh-arguments may be accommodated on this account, it seems to break down when applied to the adult data.

As shown above, the argument/adjunct analysis alone is unlikely to provide an explanatory account of the data from Experiments 1-5. However, this distinction retains much support in the theoretical syntax literature, and it does remain a possibility that it may play some role in the current results. Further experiments would be needed to more fully establish whether it may, in combination with other mechanisms, account for children's and adults' preferences with respect to reconstruction.

4.3. Summary

The results reported in Chapters 2 and 3 demonstrated that children and adults had conflicting preferences with respect to reconstruction in certain environments. Both groups were shown to obligatorily assign a reconstructed interpretation to moved

predicates, and both preferred the surface interpretation for embedded questions subject to Principle A (Experiments 5 and 6). However, for matrix questions subject to Principle C, adults preferred the reconstructed interpretation, while children again preferred the surface interpretation. The current chapter placed these results in a learning context, addressing the question of how children may have acquired this complex system. A corpus study using the CHILDES database examined child-directed speech for instances of wh-questions that may have allowed children to learn about reconstruction and the constraints associated with it. Of 10,000 wh-questions analyzed, not a single one was of the type that might have revealed reconstruction. Given this result, children's behavior was even more remarkable: they managed to acquire a system of highly abstract and complex knowledge even in the absence of input that might reveal it.

The remainder of the chapter discussed possibilities for how children might develop this system in the absence of direct input. Previous studies have shown that children learn about verbal argument structure quite early on. This knowledge provides a useful means for beginning to learn about syntactic movement. Once children know that certain verbs select for complements, upon noticing the systematic co-occurrence of a wh-phrase at the beginning of the sentence and a lack of complement in its expected position, children may posit a relationship between these two structural positions. Upon recognizing this relationship as syntactic movement, the properties of movement, and specifically the copy theory, fall out as a consequence of UG. Children likewise demonstrate evidence of having the copy theory in place: they have been shown to repeat wh-phrases in medial positions they occupy in their path of extraction, and the current

study shows they are also able to interpret items contained in the wh-phrase in their original position.

The copy theory of movement has the added advantage of clearly predicting reconstruction effects, as the existence of a lower or reconstructed copy is part of the movement operation. Any time an item moves, there is a possibility that its lower copy may be interpreted. Thus reconstruction is a logical by-product of the copy theory. On this view, as long as children know about movement, they also know about reconstruction. The challenge that remains is learning when to interpret one copy over another (or, when to interpret both copies or delete one copy, depending on the specific analysis of copy theory assumed). The current series of experiments shows children prefer the surface interpretation of questions when it is available. Therefore children may be said to have a preference for interpreting a moved item where it is pronounced, and that is encoded in their initial hypothesis for the LF structure of the sentence. As previous studies have shown children to have a difficult time revising their initial parse of a sentence, once children have found the surface structure to be grammatical, that is the interpretation they persist with. Nevertheless, children most likely also have the economy mechanism, namely the Preference Principle, that guides adults towards a preference for the reconstructed interpretation. As they mature and become better able to revise their initial parse of a sentence, this economy preference may emerge.

Despite their preference for surface structure, children are also shown to obligatorily assign a reconstructed interpretation to moved predicates, like adults. While an analysis based on Lebeaux's argument/adjunct asymmetry remains a possibility for

accommodating these child results, it was shown to encounter significant problems when applied to the adult data. Therefore, an account based on Heycock's (1995) referentiality analysis seems to be a superior approach. This account rests on the observation that nonreferential items must be interpreted with narrow scope. Thus a non-referential wh-phrase, like the moved predicates tested in the current experiments, must be interpreted in its reconstructed position. Previous studies have shown children to have knowledge of the referential/nonreferential distinction, and make use of it when forming wh-questions (Thornton, 1995). Therefore it seems plausible that children would also make use of this distinction when deciding which of two copies must be interpreted. Furthermore, this account assumes that being interpreted with narrow scope is part of the meaning of nonreferentiality. As long as children know this meaning, they should also know that nonreferential items obligatorily reconstruct.

Thus even in the absence of input revealing reconstruction, it is not difficult to seehow children may come to have knowledge of it. Building on their acquisition of simpler grammatical structures, for example, the relation between a verb and its arguments, children are able to learn about movement. Once they have learned about movement, assuming the copy theory, knowledge of reconstruction is the logical result. Children's parsing preferences mask their knowledge of economy mechanisms that favor reconstructed interpretations, and they instead show a preference for surface structure readings of moved arguments. However, they are still adult-like in obligatorily assigning the reconstructed reading to moved predicates, exploiting their knowledge of

referentiality. The trajectory outlined above thus suggests that direct evidence of reconstruction is actually not necessary for children to learn this system. It may be fully acquired via knowledge of other various aspects of grammar.

CHAPTER 5

This dissertation began by noting one of the central concerns of theoretical linguistics: how children so rapidly develop a grammar encompassing knowledge of sentence types that they are unlikely to have been exposed to. In line with this question, it was asked how children come to have knowledge of abstract syntactic representations and manipulations of these representations that are not apparent given the surface forms of sentences that children receive as input. The current set of studies provide evidence that by the age of 4, children have developed a highly complex system of knowledge with respect to one syntactic operation: reconstruction. It thus adds to the literature that demonstrates children indeed develop knowledge of abstract representations with virtually no direct input about them. Finally, various mechanisms for how such learning may take place in the absence of such input were proposed. It was shown that the system children have developed is the logical result of having acquired various simpler grammatical structures, supplemented with some innately specified rules of grammar.

The early experiments in this series concentrate on establishing children's knowledge of reconstruction with respect to binding theory. Wh-questions were the movement structure selected for study, as children are highly familiar with them, and they are the prototypical examples of syntactic movement. Movement structures provide an interesting challenge for children, in that their interpretation often depends on two

structural positions. As noted in Chapter 1, in the case of wh-questions, the wh-phrase is associated first with its surface position, where the wh-operator is interpreted, taking scope over the rest of the sentence. However, wh-arguments are also interpreted in their underlying position, as arguments of the verb they are associated with. Further evidence for interpretation in this underlying position comes from the interaction of movement with binding theory. By interpreting a moved anaphor, pronoun, or R-expression in its original position, various effects of binding theory are predicted, revealing reconstruction effects. Thus for children to demonstrate knowledge of reconstruction requires them to put together knowledge from two distinct domains: knowledge of syntactic movement, and knowledge of binding theory.

Experiments 1-4 provide clear evidence that children have the principles of binding theory in place, and that they furthermore have reconstruction as part of their grammar. Like adults, children obligatorily interpret moved anaphors and R-expressions in their reconstructed positions when required to by their grammar. In Experiment 1, this requirement is due to the anaphor contained in the wh-phrase needing to be bound by an antecedent in accordance with Principle A. In Experiment 3, the requirement is due to predicates obligatorily being reconstructed to their original position, because, as Heycock (1995) shows, all nonreferential wh-phrases must reconstruct. Children are likewise shown to pattern with adults in Experiments 2-3, where their interpretations of sentences subject to Principle B are likewise consistent with knowledge of reconstruction. However, Experiment 4 reveals an asymmetry between children and adults. While adults

prefer a disjoint, reconstructed interpretation of sentences like (37), children prefer a coreferential, surface intepretation:

(37) Which painting of Miss Cruella did she put up?

While children consistently assign the reconstructed interpretation to questions when reconstruction is obligatory, they have a clear preference for the surface structure interpretation when reconstruction is not required.

Children's surface structure preference is underscored by their interpretation of embedded questions containing anaphors, as examined in Experiment 5. For sentences like (42), children consistently access an interpretation where the anaphor is bound by the matrix subject antecedent, rejecting a reading where it is bound by the embedded subject antecedent:

(42) Miss Cruella knew which painting of herself Janie put up.

Surprisingly, in contrast to the preference for reconstruction adults demonstrated in Experiment 4, they were shown in Experiments 5 and 6 to also have a preference for binding of the reflexive by the matrix antecedent, as consistent with the surface reading. In this case, adults' preference is nicely accounted for by a processing strategy that aims to resolve anaphoric dependencies as quickly as possible. Because binding by the matrix subject may be established as soon as the anaphor is encountered, that is the reading adults prefer. Of course, they also have little problem revising this initial parse and establishing binding by the embedded subject instead.

Children, on the other hand, have been shown in previous studies to have a difficult time revising their initial parse of a sentence (Trueswell, Sekerina, Hill, &

Logrip, 1999). It is quite plausible that children's initial parse would be the simplest one available, that is, one where items are interpreted where they are pronounced. In this way, children's initial parse corresponds as closely as possible to the input they receive. If children find this initial parse to be grammatical, as it is when reconstruction is not obligatory, that is the interpretation they will persist with. Therefore in the case of items like (42) above, children will settle on the matrix subject antecedent, upon finding that LF to be grammatical. Because they have a limited ability to revise this initial parse, they reject the alternative reading where the anaphor is bound by the embedded subject. Children's parsing strategy therefore effectively masks their adult-like knowledge of reconstruction in this experiment.

Likewise, children's inability to revise their initial parse is reflected in their interpretation of questions subject to Principle C, as in (37). In this case, as reconstruction is not obligatory for referential moved arguments, children find the coreferential surface parse to be grammatical, and persist with this reading. Adults, on the other hand, are shown to favor reconstruction in this environment. This result is best predicted by economy principles associated with the copy theory of movement. Chomsky's (1993) Preference Principle predicts a preference for interpreting the lower copy of the wh-restrictor as the economical choice. Thus economy considerations result in adults' preference for reconstruction. While children likely have economy principles in place as well, their preference for surface structure again masks this knowledge, and they consistently override economy in favor of generating a surface structure

interpretation. That children disobey economy has likewise been demonstrated in previous work (Syrett & Lidz, 2005).

In short, Heycock's referentiality-based analysis of reconstruction, combined with economy considerations associated with the copy theory of movement, and the parsing preferences of both children and adults, are shown to provide a comprehensive account of the current results. While a corpus study revealed that children receive virtually no input of the type that might reveal reconstruction, not to mention input that might reveal the asymmetry between reconstruction requirements for moved arguments versus moved predicates, they nevertheless have developed this rather complex system of knowledge.

A possible trajectory for this acquisition in the absence of direct input proposes that upon learning about argument structure, which children are shown to do at quite a young age, they are also in a position to recognize the relation between an "empty" argument position and a wh-element at the beginning of the sentence, or in other words, movement. Once they recognize such a relationship as movement, its syntactic properties may fall out from UG. It is likely that one of these properties of movement is its correspondence to the copy theory, which posits a full copy of the moved item in its underlying position. However, children's preference for surface structure masks their knowledge of the economy principles that adults use to guide when each copy must be interpreted. In short, children instead consistently interpret the moved item where it is pronounced, but only when that reading is grammatical, as in the case of referential wh-phrases. For nonreferential wh-phrases, which are required to be interpreted in their reconstructed position, children are adult-like in consistently assigning the reconstructed

interpretation. Given that previous studies show children to be aware of the referential/nonreferential distinction and use it when building wh-movement structures, it is likely that they also use this distinction when computing reconstruction possibilities. Finally, Experiments 1-4 replicate previous results showing children to have the principles of binding theory in place, and through their application of these principles children are able to demonstrate knowledge of reconstruction.

The above analysis assumes a close interaction between the grammar and parser. It relies on several constraints that are more readily attributed to the parser, like a preference for interpreting items where they are pronounced, and a preference for quickly establishing an antecedent for anaphors. For constraints typically assumed to be part of the grammar, it assumes binding theory, the obligatory reconstruction of nonreferential moved items, and the copy theory of movement. However, one crucial constraint that is assumed along with the copy theory is the economy preference for interpreting the lower copy of a moved item. While this economy preference is typically discussed as being part of the grammar, it actually has some of the characteristics of a parsing constraint. Unlike the grammatical rules mentioned above, it does not serve to distinguish grammatical versus ungrammatical structures, but rather outlines a preference for choosing between convergent LF's. It is also violable, unlike typical grammatical rules. The fact that it is so closely intertwined with the parser blurs the line between parser and grammar; in effect, economy chooses the preferred parse of a sentence.

One way to formally implement this would be to say economy is actually part of the parser, instead of part of the grammar. With respect to the current data, it would

interact with the other parsing constraints (establish an antecedent, interpret items where pronounced) to explain children's and adults' preferences. For the Principle C data, where adults prefer reconstruction but children prefer surface structure, the weight of the economy preference would be said to be greater for adults than children. Children's preference for surface structure overrides the other parsing constraints, while adults have a more strongly weighted economy preference. The Principle A embedded questions reveal that the "find an antecedent" constraint is actually weighted more heavily for adults, as they override their economy preference in favor of it. For children, the "find an antecedent" and surface structure preference constraints converge in this case, and combined with their limited ability to revise an initial parse, result in their rejection of the reconstructed reading. In both cases, the weight of children's parsing constraints serves to obscure their grammatical knowledge: they have reconstruction as part of their grammar, although it is only revealed when reconstruction is the sole grammatical option.

It is left for future work whether positing that economy is in the parser as opposed to the grammar is on the right track. However, the above analysis does show that even if it is assumed to be part of the grammar, it is a part of grammar that interacts quite closely with the parser: the parser, and constraints operating as part of the parser, clearly interact with economy. Further examination of other structures subject to economy may lead to identifying additional parsing constraints that interact with it. In the end, it may be that the strict division between grammar and parser that has traditionally been assumed is not such a clear division after all.

The current study demonstrates children in general to be quite successful in

accomplishing the task mentioned at the outset: they aptly combine knowledge of binding theory along with knowledge of syntactic movement to demonstrate their command of reconstruction. Thus one contribution of this dissertation is to show that children indeed have the full range of grammatical knowledge with respect to reconstruction that adults have. Moreover, in cases where children appear to differ from adults, these differences may be attributed to the relative weights of parsing constraints and economy. As there is very little work that attempts to model an LF parser, the results of the current study may provide an initial basis with which to approach this important question: perhaps by looking at children we may be able to take some initial steps towards a more general theory of LF parsing.

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APPENDICES

A. Experiment 1 Test Sentences and Fillers

Experiment 1 Test Sentences

Predicate Items

(1) a. Every hippo was very/a little proud of herself.
b. How proud of herself was every hippo?

(2) a. Every butterfly was very/a little pleased with herself.
b. How pleased with herself was every butterfly?

(3) a. Every whale was very/a little confident in himself.
b. How confident in himself was every whale?

(4) a. Every boy was very/a little impressed with himself.
b. How impressed with himself was every boy?

Argument Items

(5) a. Every dancer put up the red/white painting of herself.
b. Which painting of herself did every dancer put up?

(6) a. Every video chose the pink, birthday/yellow, summer vacation video about herself.
b. Which video about herself did every girl choose?

(7) a. Every dinosaur saved the long/short article about himself.
b. Which article about himself did every dinosaur save?

(8) a. Every beetle put the baby/grown-up picture of himself in the album.
b. Which picture of himself did every beetle put in the album?

Experiment 1 Filler Sentences

(1) a. Every hippo pushed the rock past the finish line/stopped pushing the rock before the finish line.
b. How far did every hippo push the rock?

(2) a. Every butterfly drove all the way to the fence/stopped driving before reaching the fence.
b. How far did every butterfly drive?

(3) a. Every whale balanced the ball all the way across the pool/only partway across the pool.
b. How far did every whale balance the ball?

(4) a. Every boy jumped over the couch/onto the couch.
b. How far did every boy jump?

(5) a. Every dancer hid behind her wall/hid behind the mirror.
b. Where did every dancer hide?

(6) a. Every girl sat on the couch/sat on the bed.
b. Where did every girl sit?

(7) a. Every dinosaur put the saved articles on the bulletin board/on the table.
b. Where did every dinosaur put the saved articles?

(8) a. Every beetle pasted pictures in the yellow album/the red album.
b. Which album did every beetle paste pictures in?

B. Experiment 2 Test Sentences and Fillers

Experiment 2 Test Sentences

Predicate Items

(1) a. Every hippo was very/a little proud of her.
b. How proud of her was every hippo?

(2) a. Every butterfly was very/a little pleased with her.
b. How pleased with her was every butterfly?

(3) a. Every whale was very/a little confident in him.
b. How confident in him was every whale?

(4) a. Every boy was very/a little impressed with him.
b. How impressed with him was every boy?

Argument Items

(5) a. Every dancer put up the red/white painting of her.
b. Which painting of her did every dancer put up?

(6) a. Every video chose the pink, birthday/yellow, summer vacation video about her.
b. Which video about her did every girl choose?

(7) a. Every dinosaur saved the long/short article about him.
b. Which article about him did every dinosaur save?

(8) a. Every beetle put the baby/grown-up picture of him in the album.
b. Which picture of him did every beetle put in the album?

Experiment 2 Filler Sentences

(1) a. Every hippo pushed the rock past the finish line/stopped pushing the rock before the finish line.
b. How far did every hippo push the rock?

(2) a. Every butterfly drove all the way to the fence/stopped driving before reaching the fence.
b. How far did every butterfly drive?

(3) a. Every whale balanced the ball all the way across the pool/only partway across the pool.
b. How far did every whale balance the ball?

(4) a. Every boy jumped over the couch/onto the couch.
b. How far did every boy jump?

(5) a. Every dancer hid behind her wall/hid behind the mirror.
b. Where did every dancer hide?

(6) a. Every girl sat on the couch/sat on the bed.
b. Where did every girl sit?

(7) a. Every dinosaur put the saved articles on the bulletin board/on the table.
b. Where did every dinosaur put the saved articles?

(8) a. Every beetle pasted pictures in the yellow album/the red album.
b. Which album did every beetle paste pictures in?

C. Experiment 3 Test Sentences and Fillers

Experiment 3 Test Sentences

(1) How proud of her/herself was every hippo?

(2) How pleased with her/herself was every butterfly?

(2) How confident in him/himself was every whale?

(4) How impressed with him/himself was every brother?

Experiment 3 Fillers

(1) Miss Cow pushed the rock past the finish line/stopped pushing the rock before the finish line.

(2) Alice drove all the way to the fence/stopped driving before reaching the fence.

(3) Every whale balanced the ball all the way across the pool/stopped balancing the ball before reaching the end of the pool.

(4) Every brother jumped over the couch/onto the couch.

(5) a. How far did every dinosaur carry the wood?
b. Every dinosaur was very/a little happy with him/himself.

(6) a. How high did Miss Kitty jump?
b. Every dancer was very/a little surprised at her/herself.

D. Experiment 4 Test Sentences and Fillers

Experiment 4 Test Sentences

Predicate Items

(1) a. She was very/a little proud of Miss Hippo.
b. How proud of Miss Hippo was she?

(2) a. She was very/a little pleased with Alice.
b. How pleased with Alice was she?

(3) a. He was very/a little confident in Mr. Whale.
b. How confident in Mr. Whale was he?

(4) a. He was very/a little impressed with Andy.
b. How impressed with Andy was he?

Argument Items

(5) a. She put up the red/white painting of Miss Cruella.
b. Which painting of Miss Cruella did she put up?

(6) a. She chose the yellow, summer vacation/pink, birthday video about Mary.
b. Which video about Mary did she choose?

(7) a. He saved the short/long article about Mr. Giraffe.
b. Which article about Mr. Giraffe did he save?

(8) a. He put the grown-up/baby picture of Mr. Frog in the album.
b. Which picture of Mr. Frog did he put in the album?

Experiment 4 Fillers

(1) a. Miss Hippo balanced the ball past the finish line/stopped balancing the ball before the finish line.
b. How far did Miss Hippo balance the ball?

(2) a. Alice drove the car all the way to the fence/past the boulder.
b. How far did Alice drive?

(3) a. Mr. Whale balanced the ball all the way across the pool/balanced the ball past the line.
b. How far did Mr. Whale balance the ball?

(4) a. Andy jumped over the couch/onto the couch.
b. How far did Andy jump?

(5) a. Janie and Miss Cruella hung the paintings down low/up high on the wall.
b. Where did Janie and Miss Cruella hang the paintings on the wall?

(6) a. Mary and Miss Troll sat on the bed/couch.
b. Where did Mary and Miss Troll sit?

(7) a. Mr. Giraffe and Mr. Dinosaur put the saved articles on the bulletin board/table.
b. Where did Mr. Giraffe and Mr. Dinosaur put the saved articles?

(8) a. Mr. Beetle and Mr. Frog pasted the pictures in the red/yellow album.
b. Which album did Mr. Beetle and Mr. Frog paste pictures in?

E. Experiment 5 Test Sentences and Fillers

Experiment 5 Test Sentences

Predicate Items

(1) Miss Cow figured out how proud of herself Miss Hippo was.

(2) Alice remembered how pleased with herself Miss Butterfly was.

(3) Mr. Whale knew how happy with himself Mr. Walrus was.

(4) Mr. Monkey forgot how impressed with himself Andy was.

Argument Items

(5) Miss Cruella knew which painting of herself Janie put up.

(6) Miss Troll forgot which video about herself Mary chose.

(7) Mr. Giraffe remembered which article about himself Mr. Dinosaur saved.

(8) Mr. Frog figured out which picture of himself Mr. Beetle put in the album.

Experiment 5 Fillers

(1) Miss Cow pushed her rock past the finish line/stopped pushing her rock before the finish line.

(2) Miss Butterfly drove all the way to the fence/only drove a little ways.

(3) Mr. Whale balanced his ball all the way across the pool/only balanced his ball a little ways.

(4) Mr. Monkey jumped over the couch/jumped onto the couch.

(5) Mr. Lion hung the paintings down low/up high on the wall.

(6) Mr. Dog sat on the couch/sat on the bed.

(7) The saved articles were on the bulletin board/on the table.

(8) Ariel put pictures in the red/yellow album.

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