QUANTIFICATION AND DEFINITENESS IN CHILD GRAMMAR

by

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Abstract

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This study investigates children's understanding of definite pronouns in English. I propose that several well-known phenomena (and some interesting new ones) in children's grammars can be explained in terms of children's difficulty in determining which NPs in English can be [-definite]. Children's apparent violations of Principle B of the binding theory, some interpretations of pronouns in VP ellipsis contexts, and an unbound distributive interpretation of the definite pronoun **him** can all be attributed to a misclassification of English definite pronouns as [-definite].

This can account for why some children accept apparent Principle B violations. If children allow definite pronouns to have an indefinite interpretation, then nothing prevents coreference in situations where coindexation is ruled out: "John hit someone" is not identical to "John hit himself", but **someone** may corefer with **John**. This extends to quantificational sentences: "Every boy hit someone" is consistent with a situation in which each boy hit himself. Therefore, this account of Principle B violations predicts no differences between quantified and non-quantified antecedents. Experimental evidence is provided to support this prediction.

Children give other evidence of treating pronouns as [-definite]. Thornton & Wexler (1993) show that children who appear to violate Principle B of the binding theory in VP ellipsis constructions also accept sentences like (1) with the interpretation that different people were captured.

(1) John captured him and Bill did too.

This interpretation duplicates one possible adult interpretation of (2).

(2) John captured someone and Bill did too.

I provide additional evidence that children will accept an unbound distributive interpretation of **him** (i.e., an interpretation in which **him** varies in reference when it is <u>not</u> a bound variable).

I also relate these results to quantifier spreading, and provide an analysis based on resumptive quantification and exhaustiveness. This also accounts for acceptance of a one-to-one mapping interpretation of sentences with two universal quantifiers.

Finally, some of the children who give evidence of [-definite] **him** and who quantifier spread accept quantifier spreading onto pronouns.

By providing new data and reinterpreting previous results, this thesis contributes to a greater understanding of the acquisition of the logical properties of pronouns.

Metaphors of a Magnifico
by Wallace Stevens

Twenty men crossing a bridge,
Into a village,
Are twenty men crossing twenty bridges,
Into twenty villages,
Or one man
Crossing a single bridge into a village.

This is old song
That will not declare itself...

Twenty men crossing a bridge,
Into a village,
Are
Twenty men crossing a bridge
Into a village.

That will not declare itself
Yet is certain as meaning...

The boots of the men clump
On the boards of the bridge.
The first white wall of the village
Rises through fruit-trees.
Of what was it I was thinking?
So the meaning escapes.

The first white wall of the village...
The fruit-trees....

[from The Collected Poems of Wallace Stevens, Vintage Books Edition, 1990]

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CHAPTER 1: INTRODUCTION

When children learn a language, they have to learn if that language distinguishes between definite and indefinite noun phrases (NPs) and how that distinction is made. The distribution of definite and indefinite NPs differs widely in various constructions cross-linguistically.[1] In the English of adult speakers, indefinites have certain interesting properties. For example, in sentences as in (1), the indefinite **a cat**[2] can have two different interpretations,[3] while the definite **the cat** can only have one interpretation.

(1) a. Every boy saw a cat.
    b. Every boy saw the cat.

(1a) can either mean that each of the boys saw the same cat, or that each boy saw a different cat. (1b) can only mean that each boy saw the same cat.

In VP ellipsis sentences as in (2), an indefinite such as **a cat**

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[1]For some discussion, see Reuland & ter Meulen (1987).

[2]For present purposes at least, I will present the relevant data in as theory-neutral a way as possible, using "indefinite" as a descriptive term only. I am not taking a stand on whether such expressions should be treated as existential quantifiers or as variables. For discussion of indefinites as existential quantifiers, see, e.g., Cooper (1979) and Evans (1980). For discussion of indefinites as variables, see, e.g., Heim (1982). For more recent discussion, see Heim (1990) and Kadmon (1987). For a distinction between referential and quantifier interpretations of indefinites, see Fodor & Sag (1982).

[3]For the present I am also setting aside the question of whether **a cat** in (1) should be taken as specific. For discussion of the relationship between definiteness and specificity, see Enç (1991).

The distinction I am concerned with here is a singular vs. multiple interpretation of the indefinite in (1). The singular interpretation could be referential or a wide scope interpretation of **a cat**, while the multiple interpretation is the quantificational interpretation in which **every boy** has wide scope.

has more than one interpretation, while a definite has only one interpretation.

(2) a. John saw a cat and Bill did too.
    b. John saw the cat and Bill did too.

In (2a), John and Bill may have both seen the same cat, or John may have seen one cat and Bill another. In (2b), the only interpretation is the one in which John and Bill both saw the same cat. This difference is even clearer with a quantificational antecedent, as in (3).

(3) a. Every boy saw a cat and Mary did too.
    b. Every boy saw the cat and Mary did too.

In (3a), every boy may have seen the same cat, in which case Mary also saw that cat, or every boy may have seen a different cat, in which case Mary saw still another cat. In (3b), on the other hand, the only interpretation is the one in which all the boys saw the same cat, and Mary also saw that same cat.

Binding theory determines when two definite NPs must be coindexed or may not be coindexed, and some additional restrictions determine when two noncoindexed NPs may corefer (for discussion see section **1.4** below). Binding theory also applies to indefinite NPs (so in "Someone saw himself", **someone** and **himself** must be coindexed, and in "Someone saw him" or "He saw someone", the pronoun and **someone** may not be coindexed), but the additional restrictions are different for indefinite NPs. For example, it is not part of the meaning of (4a) that John praised himself (i.e., **John** and **someone** are not coindexed); however, that interpretation is not ruled out. Similarly, if John is a student, then (4b) is not incompatible with John having praised himself. (4b) does not require such an interpretation, but such an interpretation is permitted.

However, (4c), with the definite pronoun **him**, is ruled out by Principle B of the binding theory, and unless special circumstances are invoked, coreference of **John** and **him** is not permitted.[4]

(4) a. John praised someone.
b. John praised a student.
c. John praised him.

For a sentence such as (5a), various interpretations are possible.

(5) a. John praised someone and Bill did too.
b. John praised him and Bill did too.

(5a) does not exclude the possibility that John praised himself and Bill praised himself, or that John praised Bill and Bill praised himself, or that John praised himself and Bill praised John, or that both of them praised some particular third person, or that John praised one person (not himself or Bill) and Bill praised another person (not himself or John), etc. Use of the indefinite leaves open several possibilities of interpretation. In contrast, for (5b), the definite pronoun **him** cannot refer to John, and John and Bill must have praised the same person.[5] However we account for the way in which the interpretation of indefinites is derived, it is different from the way in which the interpretation of definites is derived. One important difference is that indefinites (but not definites) can be taken as varying in reference when they are not bound variables.

Learning the distinction between definite and indefinite pronouns in English may be complicated by the fact that definite pronouns like

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[4]For some discussion of what such special circumstances could be, see Evans (1980).

[5]For further discussion of VP ellipsis, see section 1.3 below. There we will see that some children allow interpretations for sentences like (5b) which are not allowed by the adult grammar.

him and indefinite pronouns like **one** or **someone** can either be "intended" to refer to a particular individual, or not. How do children sort out all these subtle distinctions of meaning?

Here I will propose that several well-known phenomena (and some interesting new ones) in the grammars of children learning English can be explained in terms of a difficulty in determining under what circumstances various NPs in English can be or must be indefinite. To be specific, I will suggest that children's apparent violations of Principle B of the binding theory, some interpretations of pronouns in VP ellipsis contexts, and an unbound distributive interpretation of the third person singular definite pronoun can all be attributed to a misclassification of English pronouns as [-definite].[6]

Discussion of the interpretation of definite and indefinite NPs will require the notion of syntactic identity. In order to apply the binding theory or the rules governing coreference, we need to know under what conditions syntactic expressions are the same or different. Binding theory requires some notion of indexical identity, while explanations of VP ellipsis rely on notions such as identity of predication (e.g., Sag, 1976 and Williams, 1977) or identity of indexical dependency (Fiengo & May, 1994).

Research has begun to distinguish between the symmetrical notion of **identity** and the asymmetrical notion of **dependence** in syntax (Evans,

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[6]This does not necessarily entail that these pronouns are not also accepted as [+definite]; children who make these errors could be treating pronouns like the articleless NPs in Latin (see Heim, 1982), i.e. treating them as ambiguous between definite and indefinite NPs. Alternatively, we could argue that children are not making a distinction between definite and indefinite NPs.

1980; Higginbotham, 1983, 1985; Montalbetti, 1984; Montalbetti & Wexler, 1985; for two recent, but very different, discussions, see Fiengo & May, 1994 and Williams, 1994). Some researchers have begun to investigate this distinction between identity and dependence in child grammar (notably Thornton & Wexler, 1993). In this dissertation I will extend this investigation of the status of syntactic identity in child grammar, and try to explain children's non-adult interpretations of sentences as the result of misclassification of NPs in terms of definiteness. This will require extended discussion of the distinction between binding and coreference. In addition, I will include discussion of pronominal number, which interacts in interesting ways with identity and definiteness.

In this chapter I will begin with discussion of definiteness in section **1.1**, and discussion of definiteness in child grammar in section **1.2**. Then I will turn to discussion of some different types of syntactic identity and dependence, and what is known about their role in child grammar. I will begin in section **1.3** with a discussion of VP ellipsis, based primarily on the work of Thornton & Wexler (1993). In section **1.4** I will turn to the binding principles and the distinction between binding and coreference. Finally, in section **1.5** I will describe the contents of subsequent chapters.

1.1 Definiteness

In her seminal work on definite and indefinite NPs, Heim (1982) crossclassifies NPs as in (6):

(6)

		Quantifying no:	Quantifying yes:
Definite	no:	a cat	every cat no cat
Definite	yes:	the cat it	

In this crossclassification, indefinite NPs like **a cat** and definite pronouns like **it** are both distinguished from quantifiers by the fact that they are not quantifying; instead, in Heim's system, indefinite and definite NPs are translated as variables. NPs like **a cat** and definite pronouns such as **it** are distinguished from each other in terms of definiteness.

Heim begins by distinguishing between definites and indefinites on the basis of three properties. Heim describes these three properties as follows: (i) definites do not undergo the construal rule of Operator Indexing[7]; (ii) definites are not subject to the Novelty Condition[8]; and (iii) definites presuppose their descriptive content (if any). Indefinites are characterized by the opposite property in each of these cases.

Heim further suggests that there may be some NPs which are ambiguous between definites and indefinites:

> In languages other than English, say Latin, we seem to

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[7]Selection indices are numerical subscripts which appear on quantifiers; a quantifier binds all and only those variables whose referential indices match one of the quantifier's selection indices. Operator Indexing is an obligatory rule of construal which requires the referential index of an indefinite NP to be copied as a selection index onto the lowest c-commanding quantifier (Heim, 1982, pp.145-146).

[8]The Novelty Condition requires that an indefinite carry a "new" referential index, one that has not yet been used as the referential index of any other NP earlier in the same text (Heim, 1982, p.151).

> have a third option: articleless NPs that may function as either definite or indefinite. If we include this third option, we are still far from the full range of conceivable possibilities. So suppose we were to hypothesize that every (non-quantifying) NP that exists in a natural language falls into one of these three groups:
>
> (a) definites = those that exhibit (i), (ii), and (iii);
>
> (b) indefinites = those that exhibit the opposites of (i) through (iii);
>
> (c) "ambiguous" = those which have definite as well as indefinite occurrences, i.e. occurrences that have all of (i) through (iii) and occurrences with all of these three opposite properties.
>
> This would be a hypothesis about a substantive language universal. (Heim, 1982, pp.267-268).

After introducing File Change Semantics, Heim unifies these three properties of definites with the Extended-Novelty-Familiarity-Condition, given in (7), which is a condition on the felicity of an utterance in a given context or File.

(7) Extended-Novelty-Familiarity-Condition

For ϕ to be felicitous w.r.t. F it is required for every NP_i in ϕ that:

(i) if NP_i is [-definite], then $i \notin$ Dom (F);

(ii) if NP_i is [+definite], then
(a) $i \in$ Dom (F), and
(b) if NP_i is a formula, F entails NP_i.
(Heim, 1982, pp.369-370)

This requires that a definite NP must be associated with an already established, "familiar" card in the File (i.e., $i \in$ Dom (F)), and that the descriptive content of the definite also be "familiar" (i.e., if NP_i is a formula, F entails NP_i). An indefinite, on the other hand, must be "new" (i.e., $i \notin$ Dom (F)).

Roberts (1986) paraphrases this clearly:

> This condition places two different requirements on the felicitous use of a definite NP. The first is

> that a definite NP must be anaphoric; that is, in terms of Files or DRs [Discourse Representations], it is only felicitous in a discourse when it corresponds to a discourse referent that has already been introduced. The second condition is that the context in which it is uttered already presupposes its descriptive content, if it has any. (Roberts, 1986, pp.332-333).

Roberts further argues that English third person pronouns have no inherent content (and thus presuppose no descriptive content): "any features, including number and gender, serve only to guide the hearer in determining an appropriate antecedent" (Roberts, 1986, p.332).

Another important notion related to definiteness and indefiniteness will be of concern to us here. For Russell (1905), the notion of uniqueness distinguishes between definites and indefinites. Russell argues that definite NPs (e.g., **the king of France**) carry a uniqueness implication (so there is only one king of France).[9] For plurals, uniqueness can be equated with maximality. For example, if we say **the flowers**, we are referring to <u>all</u> of the flowers in some pragmatically specified domain.[10] Definites must be unique (unless they are bound variables pronouns, in which case they must be unique-per-referent in some domain). If children have not fully determined which expressions are definite and which expressions are indefinite, it would

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[9]Chierchia & McConnell-Ginet (1990, p.112), give (ii) as the Russellian rendering of (i).

> (i) The present queen of England is tall.
> (ii) $\exists$ x [PQE (x) ^ $\forall$ y [PQE (y) <-> y = x] ^ tall (x)]

The point to notice is the universal quantifier. This requires that if anyone is the present queen of England, then every queen of England is identical with her; there can't be two present queens of England.

[10]For discussion of uniqueness and maximality, see Kadmon (1987).

be expected that definites may sometimes be taken as varying in reference (even when they are not bound variable pronouns) and indefinites may be required to be unique. An example of the first case (definites interpreted as varying in reference) will be the cases of what I will call the unbound distributive **him**, discussed in Chapter 5. As I will discuss further in Chapter 3, the phenomenon of quantifier spreading appears to be an example of the second (indefinites with a uniqueness requirement).

1.2 Children's Understanding of Definiteness

Studies of children's acquisition of the definite/indefinite distinction, beginning with Brown (1973) and Maratsos (1974, 1976), have focused primarily on articles in English and children's ability to keep track of a listener's referential knowledge. For example, Maratsos (1974, 1976) and Warden (1976) found that initially children's expressions are predominantly definite; the difficulty for children seems to be in simultaneously establishing specific reference and taking the point of view of the listener into account.[11]

There have been a few studies testing definiteness with pronouns. Chipman & de Dardel (1974) and Tanz (1977) tested children's interpretations of **it** and **some**.

Chipman & de Dardel (1974) tested forty-two English-speaking

[11]Emslie & Stevenson (1981), however, argue that children do not have such difficulties, and that previous findings resulted from problems with the tasks used.

children between the ages of 3;3 and 7;0.[12] Chipman and de Dardel's experimental materials included a lump of clay, a box containing five marbles, a box containing twenty marbles, an empty box, and a tray containing a bar of chocolate and various bits of chocolate. Children were tested with a comprehension task, a production task, and a repetition task.[13]

In the comprehension task, children were given the instructions in (8):

(8) a. There is clay there. Give it to me.
b. There is a box with five marbles. Give it to me.
c. There are twenty marbles in the box. Give it to me.
d. There is chocolate there. Give it to me.

Children were considered correct with (a) if they gave the whole lump of clay. The correct response for (b) and for (c) was to give the box plus the marbles. Finally, the correct answer for (d) was to give all of the chocolate. Children's correct responses are shown in (9).

(9) Correct Responses on Chipman & de Dardel's Comprehension Task

age	3 yrs.		4 yrs.		5 yrs.		6 yrs.	
materials								
clay	3	30%	9	75%	5	50%	9	90%
box of 5 marbles	1	10%	6	50%	5	50%	9	90%
box of 20 marbles	0		5	40%	4	40%	5	50%
chocolate	0		0		1	10%	1	10%

Chipman and de Dardel found a hierarchy of success for these items. At all ages, the collective noun item (the clay) was the easiest, followed

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[12]There were four age groups: ten children age 3;3 to 3;11 (mean age 3;7); twelve children age 4;1 to 4;11 (mean age 4;6); ten children age 5;2 to 5;7 (mean age 5;5); and ten children age 6;6 to 7;0 (mean age 6;9).

[13]The repetition task involved only 6-year-old subjects. These subjects were asked to repeat the experimenter's instruction sentence after they had carried out their action in the comprehension task. I will not discuss the repetition task further here.

by the two count noun items (the boxes of marbles)(with the small collection of marbles easier than the large one), and finally the collective or count noun item (chocolate).

For the clay item, the usual error consisted of the children giving a piece of the clay which they broke off. For the box of five marbles, the youngest children gave one marble, the 4- and 5-year-olds gave several but not all the marbles, and the oldest children gave all the marbles but not the box. For the box of twenty marbles, very few children gave one marble only. Most children gave several but not all the marbles; the oldest children gave all the marbles, but not the box. For the chocolate item, the youngest children gave one small piece of chocolate, while the 4- and 5-year-olds gave more than one piece of chocolate. Only two subjects (out of forty-two) ever gave all the chocolate.

For the production task, the children were asked to describe actions carried out by two experimenters. These actions again involved the clay, the marbles, and the chocolate. For example, for the clay, one experimenter gave the other experimenter a small piece of clay, a larger piece of clay, or all of the clay.

Chipman and de Dardel found that no 3-year-old child ever spontaneously produced *it* in the production task. Chipman and de Dardel note several different correct productions, but also note several grammatical errors. For the clay item, many children gave the expression **one**, even for the whole clay item. A "striking and frequent" result was the response "took some marbles and gave it to her"; this type of error was produced by 5- and 6-year-olds.

Chipman and de Dardel conclude that there are three stages in the acquisition of **it**. First, around age 3 to 4, **it** seems to mean "a piece" or "one piece", and is correctly used to refer to one separate object indicated by a count noun. However, "if only a continuous quantity is present, the idea of 'it' being **one piece** is so strong that the child breaks off a piece" (Chipman & de Dardel, 1974, pp.97-98).

At the second stage, **it** is no longer used to refer to one piece, but is still not used to refer to the whole (e.g., the entire lump of clay or the box of marbles). Instead, **it** is extended to a bigger quantity than just one piece (e.g., a bigger piece of clay, or more than one marble).

Finally, around age 6, children begin to have a fully adult-like understanding of **it**.

Chipman and de Dardel note that

> The behavior of breaking off a small piece of clay to act out the instruction **There is clay there, give it to me** and that of giving only one marble for the marble instructions (both apparently respecting the feature "singular" but not the feature "totality") seems very peculiar indeed. Similarly, the transition in response type from giving one element to several elements but not all (respecting neither singularity nor totality) is also mysterious.
>
> (Chipman & de Dardel, 1974, p.98)

Tanz (1977) points out, however, that Chipman and de Dardel's results are less mysterious than they at first appear. Tanz suggests that the youngest children in Chipman and de Dardel's study responded "as if the pronoun in the instructions were the indefinite pronoun **some** rather than the definite pronoun **it**" (Tanz, 1977, p.227).

Tanz (1977) attempted to replicate and extend the results of

Chipman & de Dardel (1974) by testing children on definite NPs, definite pronouns, and the indefinite pronoun **some**. Tanz tested sixty-one children between the ages of 3;1 and 5;2. For the replication part of her study, Tanz's experimental procedure and materials were essentially the same as those for the Chipman and de Dardel comprehension task. However, subjects were placed in one of three conditions: the IT condition, the THE condition, and the SOME condition. The form of instructions for each condition is given in (10)a, b, and c, respectively.

(10) a. There is playdough on the table. Give it to me.
b. There is playdough on the table. Give me the playdough.
c. There is playdough on the table. Give me some.

In addition to materials like those in the Chipman and de Dardel study, Tanz's study also included a "plural/singular" part and a "plural" part. In the "plural/singular" part, there were three items. One item consisted of a set of four dolls representing a family plus a different type of doll. Instructions were, "There is a family on the table. Give it to me" or "Give me the family".[14] A second item consisted of four pieces of furniture; instructions for each of the three conditions were, "There is furniture on the table. Give it to me", etc. The third item consisted of four pieces of paper plus four pieces of string; instructions for each of the three conditions were, "There is paper and string on the table. Give it to me", etc.

There were also three items in the "plural" part. Here, however, instead of using the pronoun **it** for the IT condition, the pronoun **them**

[14]The SOME condition was excluded for this item since it would be inappropriate to say, "There is a family. Give me some."

was used. The first item consisted of four plastic flowers; the instructions were, "There are flowers on the table. Give them to me", etc. The instructions were similar for the second plural item, which consisted of four toy animals, and the third plural item, which consisted of four green blocks.

Tanz did not replicate Chipman and de Dardel's results. When the children in the IT condition were told, "There is playdough on the table. Give it to me", all twenty-one subjects handed over the whole chunk of playdough, not just a piece of it. For the items with cups and marbles, all of the subjects gave the cup and all its contents. For the chocolate item, 18 out of 21 subjects gave all of the chocolate, while the other three subjects gave one piece only. Tanz has no explanation for the differences between her results and those of Chipman and de Dardel.[15]

Tanz compared the two definite conditions in her study, the IT condition and the THE condition, with the indefinite SOME condition. For the definite conditions, the correct response was to give all of the item (e.g., all of the playdough or all of the marbles), while for the indefinite condition the correct response was to give less than all of the item. Across age groups and categories of materials, children gave all of the item significantly more often in the definite conditions than in the indefinite condition.[16] Comparing the categories of items, Tanz

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[15]Tanz does note that, "One conspicuous difference between the two experiments is that the Chipman & de Dardel study was conducted with English-speaking subjects in Geneva" (Tanz, 1977, p.230). However, Tanz does not discuss further how this would account for the different results.

[16]$F(2,49) = 59$, $p < .0001$.

found the percentage of responses in which all of the item was given was highest in the replication part of the experiment, somewhat lower in the "plural" part, and lowest in the "plural/singular" part.[17]

Tanz also compared the IT condition with the THE condition. She found that the full NP carries an implication of "all" a little more clearly than the pronoun in the "plural" category[18] (but not significantly in either the replication or the "singular/plural" category). This means, for example, that **the flowers** was interpreted as "all the flowers" more often than **them** was. This result was linked to age; "The youngest children responded to the definite pronoun **them** as they do to the indefinite pronoun **some**. The oldest children treat it as they do a definite noun phrase" (Tanz, 1977, p.232).

These studies suggest that at least some children between the ages of 3 and 6 may have difficulties with the definiteness of pronouns.

1.3 Syntactic Identity and Dependence in VP Ellipsis

The VP ellipsis structures which we are concerned with here are coordinate structures in which the VP of the second conjunct is elided, and replaced (in English) with **did too** or similar expressions. The two conjuncts of such sentences are reconstructions of each other, in the sense of Fiengo & May (1994), i.e. there must be both lexical identity and structural identity of the two conjuncts. These types of structures are straightforward when they don't contain pronouns (e.g., "Max left, and Oscar did too"), but become more complex when the elided material

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[17] $F(2,98) = 30$, $p<.0001$.

[18] $t = 2.48$, $df=39$, $p<.01$.

includes pronouns. For example, Thornton & Wexler (1993) discuss the example in (11).

> (11) John cleaned his car and Bill did too.
> John cleaned his car and Bill <cleaned his car> too.[19]

The complexity arises when we try to interpret the pronoun in the elided VP. There are two different types of interpretations, traditionally called the "strict identity" interpretation and the "sloppy identity" interpretation. On the strict identity interpretation, the pronoun is used independently (i.e., the pronoun is independent of other occurrences with the same index; the reference of the pronoun is established with respect to a referent, either through the discourse or deictically). Thornton and Wexler point out that there are two possible strict interpretations for (11), what they call the "inside referent strict interpretation" and the "outside referent strict interpretation". These are illustrated by (12a) and (12b), respectively.

> (12) a. John$_i$ cleaned his$_i$ car and Bill$_j$ <cleaned his$_i$ car> too.
>
> b. John$_i$ cleaned his$_k$ car and Bill$_j$ <cleaned his$_k$ car> too.

(12a) is the interpretation in which John cleaned John's car and Bill also cleaned John's car. (12b) is the interpretation in which John cleaned the car belonging to a third person (say Fred), and Bill also cleaned the car belonging to that third person (Fred).

The sloppy identity interpretation is illustrated by (13).

> (13) John$_i$ cleaned his$_i$ car and Bill$_j$ <cleaned his$_j$ car> too.

(13) is the interpretation in which John cleaned John's car and Bill

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[19]Angle brackets are used to indicate the elided VP.

cleaned Bill's car.

As Thornton and Wexler note, the strict and the sloppy interpretations are the <u>only</u> possible interpretations for VP ellipsis; it is not legitimate to randomly index the (explicit and implicit) pronouns in the two conjuncts (Sag, 1976; Fiengo & May, 1994). For instance, the representation in (14) is not a possible grammatical representation; the sentence cannot mean that John cleaned the car belonging a third person (say Fred), and Bill cleaned the car belonging to a fourth person (say Al).

(14) John$_i$ cleaned his$_k$ car and Bill$_j$ <cleaned his$_l$ car> too.

This is a basic requirement for VP ellipsis with definite pronouns. Children must somehow come to know that indexical identity is required for VP ellipsis.

According to the theory developed by Fiengo and May, the occurrences of pronominal indices are of two types: dependent and independent. A dependent (beta) occurrence of an index requires a coindexed (alpha) occurrence in the same phrase marker. Each dependent occurrence is replaced by an independent occurrence of the same index (all of the beta occurrences are "discharged" by being replaced with alpha occurrences, for which a value can be assigned). Only alpha occurrences are provided with values. The dependency described is fully syntactic; there is no <u>semantic</u> notion of referential dependency involved here (see Fiengo & May, 1994, p.72).

The two conjuncts of this kind of VP ellipsis sentence are reconstructions of each other. Reconstruction requires that the independent/dependent distinction be preserved. In the case of strict and sloppy representations, structurally each preserves the occurrence type (independent or dependent) of the index of the pronoun in the first clause. In addition, reconstruction requires identity of indices or dependencies (syntactic parallelism). So, for the strict interpretations shown in (12), what is reconstructed in the ellipsis site is the independent occurrence of the index on **his** (either **i** for the inside referent case, or **k** for the outside referent case). For the sloppy interpretation (13), what is reconstructed is the dependent occurrence of the index on **his**. The differences between strict and sloppy representations for VP ellipsis sentences stem from differences in what counts as identity for independent and dependent occurrences of indices. For independent occurrences, identity requires identity of the index. For dependent occurrences, identity requires identity of structural descriptions (i-copies); in other words, the identity requires a certain kind of structural parallelism.

Thornton and Wexler formulate these restrictions on VP ellipsis in terms of an Indexing Rule.

(15) Indexing Rule

> If an occurrence of an index is independent, an alpha-occurrence, copy the occurrence itself; if the occurrence is dependent, a beta-occurrence, copy the dependency itself. (Thornton & Wexler, 1993, p.17, based on Fiengo & May, 1994)[10]

Thornton & Wexler "modularize" the Indexing Rule, breaking it down into Dependence Matching and Independent Index Copying, which are defined in

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[10]In Fiengo & May (1994), reconstruction is a symmetric notion and independent of ellipsis. In Thornton & Wexler (1993), the related notions (e.g., "copy") are asymmetric. This distinction, though significant, is not relevant here.

(16) to (18).

(16) a. If the occurrence of an index is an independent occurrence, then the **dependence value** of the index is **independent**.

b. If the occurrence of an index is a dependent occurrence, then the **dependence value** of the index is **dependent**.

(17) **Dependence Matching**: Copy the dependence value of the index.

(18) **Independent Index Copying**: If the dependence value of an index is independent, copy the index. (Thornton & Wexler, 1993, p.19)

Thornton and Wexler maintain that the distribution of strict versus sloppy interpretations is predicted by the principle of Dependence Matching, while the impossibility of a completely free referent in the elided conjunct is predicted by Independent Index Copying. However, (16) through (18) leave out one part of the Indexing Rule. (18) determines the result if the dependence value of an index is independent, but there is no discussion of what representation is derived if the dependence value of an index is dependent. For completeness, Thornton and Wexler would need some kind of a explicit principle of Dependency Copying.

Thornton and Wexler state that "Dependence Matching seems to have to do with the parallelness in the relations exhibited in the two conjuncts"[21] (Thornton & Wexler, 1993, p.19), and that Dependence

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[21]Actually, as they've stated it, Dependence Matching is only about whether the indices of the conjuncts are both dependent or both independent. The indexing rule is not what determines the parallelism between the two conjuncts; that parallelism is a result of more general requirements about what can be reconstructed or deleted. For sloppy identity interpretations, this parallelism is further constrained; dependencies must be i-copies, i.e., they must have the same structural descriptions. See Fiengo & May (1994, pp.95 & 104).

Matching thus seems to be a syntactic notion. On the other hand, they suggest that Independent Index Copying is at least partly a pragmatic notion; Independent Index Copying "seems to have to do with a restriction on the referential capacity of the pronoun in the second conjunct; it must somehow be grounded, and the reference of the pronoun in the first conjunct is the obvious way" (Thornton & Wexler, 1993, p.19). It is not clear how this makes Independent Index Copying pragmatic; the indices are syntactic, even though they are involved in determining the reference of an NP. Like the binding theory, which restricts the distribution of indices, Independent Index Copying restricts what indices can be reconstructed in VP ellipsis. Independent Index Copying requires that two indices (one in the antecedent clause and one in its reconstruction) be identical; this seems no more pragmatic than the identity condition on the reconstruction of the verb in the elided clause, or Principle A of the binding theory, which requires identity of indices under certain conditions.

Thornton and Wexler's main focus is on the application of the binding principles (especially Principle B) to the conjuncts in VP ellipsis sentences. I will discuss this in detail in section **2.1.5**. For now, I will focus on the more basic problem of identity in ellipsis. Thornton and Wexler tested three sentences which were meant to be VP ellipsis controls. These are shown in (19) through (21).

(19) The cave man kissed the dinosaur and Fozzy Bear did too.

(20) The Incredible Hulk brushed his hair and every troll did too.

(21) The Indian with a spear captured him and the Indian on a horse did too.

Sentence (19) tested the basic requirement of reconstruction of the VP; the elided VP for (19) has to be "kissed the dinosaur". All of the children in Thornton and Wexler's study[22] always correctly accepted sentence (19) when Fozzy Bear kissed the dinosaur, and always correctly rejected this sentence when Fozzy Bear kissed his own hand. This suggests that the grammar of children of this age includes this requirement for reconstruction (supporting the idea that this requirement for reconstruction may be innate).

Sentence (20) was designed to test Dependence Matching. In the situation associated with (20), the Incredible Hulk brushed Rock Star's hair, while every troll brushed his own hair. (20) would then have the improper indexing shown in (22).

(22) *The Incredible Hulk$_i$ brushed his$_j$ hair and
every troll$_k$ <brushed his$_k$ hair> too.

While the index on **his** in the first conjunct is independent, the index on **his** in the second conjunct must be dependent[23], so this violates Dependence Matching. Only 3% of Thornton and Wexler's subjects accepted (20) in this situation, which suggests that Dependence Matching is a part of children's grammar at this age (again supporting the idea that this requirement is innate).

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[22]Thornton and Wexler tested nineteen children, ages 4;0 to 5;1 (mean age 4;8) using a truth value judgment task.

[23]The index on **his** in the second conjunct must be dependent if it is given the distributive interpretation in which each troll brushed his own hair. According to Fiengo & May (1994, p.76), "A lexical pronoun can only be a bound variable pronoun insofar as it can be realized as a variable, and this is only possible if the pronoun bears a beta-occurrence." However, under certain conditions alpha-occurrences may be anaphoric to quantified phrases (see Fiengo & May, 1994, pp.77-78, esp. fn.23 and fn. 24, for discussion).

Sentence (21) was designed to test Independent Index Copying. In the situation associated with (21), the Indian with a spear captured the green alien, while the Indian on a horse captured Darth Vader. (21) would then have the improper indexing in (23) (where each NP has a different index).

(23) *The [Indian with a spear]$_i$ captured him$_j$ and the [Indian on a horse]$_k$ <captured him$_l$> too.

Here the index on **him** in the first clause is independent, but this index is not copied to **him** in the second conjunct, thus violating Independent Index Copying. In this situation, (21) was (incorrectly) accepted by 21% of Thornton and Wexler's subjects.

Thornton and Wexler suggest that "this pattern of knowledge of syntactic principles [the reconstruction requirement and Dependence Matching] but lack of knowledge of (some) pragmatic principles [Independent Index Copying] is an instance of a more general pattern" (Thornton & Wexler, 1993, p.21). However, as discussed above, Independent Index Copying seems no more pragmatic than Dependence Matching or other conditions on identity of indices. It seems too easy to attribute all of the differences between adult and child behavior to pragmatics.

If children make mistakes in circumstances that require Independent Index Copying, what does this tell us about the role of indexical identity in their grammars? Independent Index Copying seems straightforward, but what knowledge is necessary for its application?

I will return to discussion of VP ellipsis constructions in section 2.1 below, focusing on the application of Principle B of the binding theory to the conjuncts in VP ellipsis sentences. I turn now to the role of syntactic identity in binding theory.

1.4 Syntactic Identity and Non-identity in Binding Theory

One module of grammar which requires some notion of syntactic identity is the binding theory. A binding theory is a theory of the distribution of indices in syntactic structures (see Fiengo & May, 1994). Binding theory regulates when two expressions may or may not be coindexed.

What do children need to know in order for them to obey the binding principles? Let's begin with a simple statement of the binding theory. The binding conditions proposed in Chomsky (1981) are as follows:

> (A) An anaphor is bound in its governing category.
> (B) A pronominal is free in its governing category.
> (C) An R-expression is free.
> (Chomsky, 1981, p.188)

An element **a** is bound by **b** if and only if **a** and **b** are coindexed, **b** c-commands **a**, and **b** is in an argument position; an element is free if it is not bound (Chomsky, 1981, pp.184-185). Various definitions of c-command and governing category have been proposed. One common definition of c-command is the simplified definition of Reinhart: "Node A c(constituent)-commands node B iff the branching node most immediately dominating A also dominates B" (Reinhart, 1983, p.18; cf. Saito, 1984). Chomsky (1981, p.188) defines governing category: "**a** is the governing category for **b** if and only if **a** is the minimal category containing **b** and a governor of **b**, where **a** = NP or S".

1.4.1 Problems with Principle B

Several studies have shown that children have greater difficulty with pronouns than with reflexives; they seem to develop Principle A before Principle B (although it is less clear when knowledge of Principle C is demonstrated, relative to the other two principles)[74]. For English, the finding that Principle B is delayed relative to Principle A is robust, and has been reported by Jakubowicz (1984), Wexler & Chien (1985), Chien & Wexler (1987, 1988, 1990), and McDaniel, Cairns & Hsu (1990), among several others. For discussion and reviews of this literature see Grimshaw & Rosen (1990), McKee (1992), and Foster-Cohen (1994). Similar results have been found for several other languages, including for Dutch (Deutsch, Koster & Koster, 1986), Icelandic (Hyams & Sigurjonsdottir, 1990), and Russian (Avrutin & Wexler, 1992); for discussion of the crosslinguistic data, see Hyams & Sigurjonsdottir (1990) and Sigurjonsdottir & Hyams (1992). The notable exception to this finding is in languages with pronominal clitics (see McKee, 1992 for discussion of Italian, and Solan & Ortiz, 1982 for discussion of Spanish).[75]

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[74]For early discussion of children's knowledge of Principle C, which seemed to show that mastery of the binding conditions of R-expressions is fairly late (after age 5), see, for example, C. Chomsky (1969), Lust (1981), and Solan (1983). For more recent studies, which seem to suggest that children as young as age 3 respect Principle C, see Crain & McKee (1985) and McDaniel, Cairns & Hsu (1990). For discussion, see Lasnik & Crain (1985), McDaniel, Cairns & Hsu (1990), and McKee (1992).

[75]McKee found good performance for both pronouns and reflexives in Italian. Solan and Ortiz found better performance for pronouns than for reflexives in Spanish. It is not clear whether it is correct to characterize this difference as a result of the pronominals in these languages being clitics; an alternative would be to characterize these elements as weak pronouns. For discussion see Avrutin & Wexler (1992, pp.274-280).

Principle B of the binding theory has come to be a focus of language acquisition research because of these differences and because of arguments from the poverty of stimulus. Given the widely held assumption that no negative evidence is available to children, then Principle B per se can not be learnable, since it prohibits the existence of certain indexical patterns, requiring that a given pair of NPs not be coindexed. As a result, Principle B is assumed to be an innate part of children's grammars, and some other explanation for apparent violations of Principle B must be found. Here I will focus on reformulations of Principle B which attempt to account for these apparent violations.

1.4.2 Reformulation of Principle B

There have been several attempts to reformulate the binding theory in terms of bound variable anaphora, to the exclusion of coreference anaphora (e.g, Reinhart, 1983), and this reformulation of the binding theory has been used to explain the differences between the acquisition of pronouns and reflexives. In this section I discuss two attempts to frame the Principle B problem in terms of the reformulation of binding theory. I will describe two different types of theories (one relying on a pragmatic principle, and the other depending on rules of interpretation and processing difficulties). Later, in Chapter 2, I will turn to the experimental evidence for these theories.

1.4.2.1 Principle P

Montalbetti & Wexler (1985) tried to unify binding around the notion of referential dependency, and subsequent papers by Wexler and Chien (to be discussed in section **2.2.1.1**) relate this reformulation of binding theory to children's acquisition of binding.

To represent referential dependencies, Montalbetti and Wexler made use of the linking device developed in Higginbotham (1983). Higginbotham argued that indexing loses information in comparison with the direct assignment of antecedence that linking permits. Indexing abstracts from the particular choice of antecedents giving rise to the indexed structure, and from the direction in which the relation was assigned; this is the information which linking is meant to represent (Higginbotham, 1983, p.401).

As Montalbetti (1984) pointed out, Higginbotham's linking has three important features which differ from the standard features of coindexing: (a) linking is a directional (asymmetric) relation; (b) linking relates two (and only two) positions in a given structure; and (c) linking is not a transitive relation.

Montalbetti and Wexler defined anaphors in terms of linking. If **a** ranges over referentially dependent elements, and L is the linking relation, then (24) holds:

(24) **a** is an anaphor iff there is some **y** such that L(a,y) and **y** is in **a**'s governing category (Montalbetti & Wexler, 1985, p.234).

In addition, Montalbetti and Wexler modified Higginbotham's theory with the following two conditions on linking:

(25) L (x,y) only if **y** c-commands **x**.

(26) If **x** is a pronoun, then L(x,y) only if, for some z, L(y,z) (Montalbetti & Wexler, 1985, p.229).

(25) restricts linking to cases of c-command[26], while (26) restricts the linking of pronouns so that they can only be linked to antecedents which are themselves referentially dependent, thus forcing Quantifier Raising.

In this system, anaphors and variables are referentially dependent (and are differentiated with respect to the different structural positions of their antecedents), and names are inherently referentially independent, and therefore lie outside of binding theory. A pronoun falls under the binding theory only if it becomes a bound variable by linking at LF, and only becomes a bound variable if it is referentially dependent on a quantificational antecedent, as in (27).

(27) [nobody] [t] thought that [he] came late

In (27) the pronoun is linked to the trace left by the operator raising of the quantifier **nobody**. The coreferential possibilities of pronouns which are not linked to quantified antecedents do not fall under this binding theory, but are instead subject to pragmatic constraints.

In earlier binding theory terms, Montalbetti and Wexler collapsed Principles A and B, restricting B to the class of referentially dependent pronouns. The residue of Principle B, that is, the set of pronouns that are not linked, is considered to be in the domain of pragmatics. Names also do not fall under Montalbetti and Wexler's theory, since they are referentially independent (i.e., they are not linked to anything), and so presumably Principle C effects are also in the domain of pragmatics. Since Montalbetti and Wexler's binding theory

[26]As pointed out by Kaufman (1988), this differs from the theory presented in Montalbetti (1984). Montalbetti (1984) claimed that linking is independent of c-command. Montalbetti & Wexler (1985) do not discuss the motivation for this revision of Montalbetti's earlier theory.

is a theory of referential dependencies, then "Binding is a theory of anaphors, variables, and bound pronouns; and of nothing else" (Montalbetti & Wexler, 1985, p.234).

Montalbetti and Wexler's modifications of binding theory make several predictions with respect to acquisition. Assuming the Lexical Learning Hypothesis, Montalbetti and Wexler predicted that as soon as children can identify reflexives and pronouns as such, they will obey the binding principles. However, children may be delayed in using the pragmatic principles which rule out local binding of pronouns when the pronouns are not variables. Montalbetti and Wexler made a clear prediction: "If the pronoun is a bound variable, then children at age 6 (when they perform well on anaphors) shouldn't show violations of Principle B. The violations should only appear when the pronoun is referential (that is, when the pronoun doesn't link)" (Montalbetti & Wexler, 1985, p.242).

Tests of this reformulation of binding theory have come to dominate the study of children's understanding of pronouns and anaphors, beginning with discussion in Wexler & Chien (1985) and Chien & Wexler (1987). Chien & Wexler (1988) was the first work to attempt to test this reformulation of Principle B directly, and Chien & Wexler (1990) made the first attempt to describe the pragmatic principle involved in coreference.

When children appear to violate Principle B, they accept sentences such as (28), which is ungrammatical with the indexing in (29). However, according to Chien and Wexler, what children are actually accepting is the indexing in (30); children know Principle B, but don't know the pragmatic principle, Principle P, which disallows coreference for i and **j** in (30).

(28) Mama Bear is washing her.

(29) Mama $Bear_i$ is washing her_i.

(30) Mama $Bear_i$ is washing her_j.

This led Chien and Wexler to the hypothesis that children would accept a pronoun as being coreferential with a local c-commanding antecedent, but would not allow a pronoun to be a bound variable when it had a local c-commanding antecedent.

More recent work has articulated Principle P further. Avrutin & Wexler (1992, p.264, fn.8) discuss the possibility that the pragmatic conditions that govern coreference possibilities for contraindexed NPs may be heavily situation-dependent and thus not formulable into a single pragmatic principle. However, they suggest that even if this were the case, instead of saying that children do not know Principle P, they could say that children instead do not know the diverse set of situational conditions that govern coreference for contraindexed NPs. Avrutin and Wexler further suggest that this may explain how Principle P develops, since then "the crucial learning (or maturational) events involve a theory of the learning (or maturation) of the knowledge of situational conditions, something that we know very little about." However, in spite of the claim that Principle P must be learned, Avrutin and Wexler assume (without further discussion) "that both the syntactic part of the theory (in this case Binding Principles) and its pragmatic part (Principle P) are universal" (Avrutin & Wexler, 1992, p.268).

Avrutin (1994), on the other hand, suggests that children (and aphasics who also appear to violate Principle B) "fail to make appropriate inferences about other speakers' representations of discourse and allow the deictic use of definite NPs without pointing" (Avrutin, 1994, p.67).

1.4.2.2 Rule I

Grodzinsky & Reinhart (1993), in responding to Grimshaw & Rosen (1990), propose an alternative version of the reformulated Principle B. While in many respects Grodzinsky and Reinhart's analysis is similar to that of Wexler and Chien, it differs with respect to the pragmatic principle which Wexler and Chien discuss. While Wexler and Chien propose Principle P, a pragmatic principle which does not allow two differently-indexed NPs in the same clause to corefer, Grodzinsky and Reinhart propose Rule I, an inference rule which says that if a structure could allow bound variable anaphora, coreference is preferred only if it is distinguishable from bound anaphora. We will return to this in more detail below.

Grodzinsky and Reinhart, following Reinhart (1983), argue that coreference and binding are not governed by the same module, and that binding is innate while coreference develops. In the case of pronouns, anaphora can mean two different things. One is (intended) identity of reference (coreference), which is possible only when the antecedent is a referential NP; the other is the interpretation of a pronoun as a bound variable. Reinhart (1983) argues that the binding theory regulates only bound variable anaphora, and not coreference.[77] Intrasentential coreference options are regulated by an inference rule, shown in (31).

> (31) Rule I: Intrasentential Coreference
>
> NP A cannot corefer with NP B if replacing A with C, C a variable A-bound by B, yields an indistinguishable interpretation (Grodzinsky & Reinhart, 1993, p.79).[78]

Rule I is characterized as a rule of interpretation for both speakers and hearers. According to Rule I, the most explicit way to express coreference is by use of binding. So, unless a speaker has some reason to avoid bound variable anaphora, if the speaker does not intend coreference, he or she will use a pronoun; if the speaker does intend coreference, he or she will use a reflexive. Hearers interpret sentences based on Rule I, so that if a pronoun is used, the hearer will assume that coreference was not intended.

Grodzinsky and Reinhart assume that Rule I, like the binding theory, is innate. For them, children's difficulties arise in the execution of Rule I.

> The innate Rule I now requires children to do the following: While still holding the sentence under processing in memory, they must construct two representations, one for the binding option, and another for the alternative coreference reading. Next

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[77] Grodzinsky and Reinhart note that "pronouns may be bound variables in all and only the environments where the binding conditions allow them to be syntactically bound, regardless of the semantics of their antecedent" (Grodzinsky & Reinhart, 1993, p.74). Pronouns may be bound variables without having quantificational antecedents.

[78] Grodzinsky and Reinhart give the following, more precise formulation of Rule I in a footnote:

> NP A cannot corefer with NP B if A **could not be bound by B**, and replacing A, at LF, with a variable bound by the trace of B yields an indistinguishable interpretation.
> (Grodzinsky & Reinhart, 1993, p.81, fn.13)

> they must compare the two representations, relative to their context, in order to decide whether they are distinguishable. If they are, coreference is allowed; if they are not, it is ruled out (Grodzinsky & Reinhart, 1993, p. 88).

Grodzinsky and Reinhart argue that none of the steps in this process requires knowledge that surpasses children's innate endowment. Instead, the problem is with children's processing ability. For certain structures, children need to hold and compare two representations, which puts too much of a burden on working memory. Grodzinsky and Reinhart suggest that when children get stuck in the execution of Rule I, the children give up and guess.[19]

Grodzinsky and Reinhart compare their proposal to that of Chien and Wexler. They argue that Chien and Wexler's proposal, which claims that children do not know the principle governing coreference, has several difficulties:

> Apart from encountering several theoretical problems (e.g., learnability, coverage of processing results), it makes a wrong prediction, which must lead to its abandonment: if children and aphasics do not know Rule I, they should accept as grammatical every sentence that this principle rules out. The data, however, show very clearly that in the judgment experiments, both populations perform at chance levels on these sentences (i.e., they guess) rather than below chance (i.e., consistent acceptance rather than rejection), as this account would predict (Grodzinsky & Reinhart, 1993, pp.90-91).

The main distinction between these two proposals, then, is that Chien

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[19] Grodzinsky et al. (1993), using the same materials as Chien & Wexler (1990), experiment 4 (see section 2.2.1.1 below), also provide evidence that agrammatic aphasics succeed in binding tasks and fail in coreference tasks just like children. Grodzinsky et al. claim that this shows that agrammatic aphasics suffer from the same processing difficulty as children, which results from an inability to hold two representations in memory and compare them to context.

and Wexler propose that children have not yet learned the principle governing coreference, while Grodzinsky and Reinhart argue that children have this principle but, because of processing limitations, are unable to use it.

However, there are two important problems with Rule I itself. First, Rule I is transderivational; in order to evaluate one sentence (the one containing NP A) with respect to Rule I, we need to compare that sentence to another sentence (the one containing the variable C).[30] Second, the Rule I approach predicts that children will only have difficulty with cases in which a bound interpretation is possible (since the difficulty stems from the processing load created by having to decide whether the coreferential and bound cases are distinguishable).

Avrutin (1994) argues that there is empirical evidence that this prediction is incorrect. Avrutin discusses an experiment involving Russian subjunctive clauses. The pronoun in the subject position of a subjunctive clause in Russian cannot be coindexed with the matrix subject. In addition, a reflexive in this position is also ungrammatical, as in (32).

(32) *Ivan xočet ctoby on/sebja prygnul.
Ivan wants that he/himself jumped.

Since there is no way to use a bound variable in this case, according to the Rule I approach, children should not have any problem with these constructions. However, in the experiment that Avrutin reports, Russian-speaking children exhibited the same type of pattern as in other sentences with pronouns. Avrutin explains

[30]For related discussion, see Fiengo & May (1994, pp.13-14).

> Such a result is not predicted in Grodzinsky and Reinhart's theory because, in their view, the problem arises only when there are two competing representations, and subjects are lost while trying to figure out whether one of them is allowed. When there is no ambiguity (as in the case of subjunctive constructions), there should be no deficit (Avrutin, 1994, p.24).

As pointed out by Sigurjónsdóttir & Hyams (1992, p.399, fn.33), implicit in both Principle P and Rule I is the claim that disjoint reference between two noncoindexed NPs is the default. Coreference requires licensing either by context (for Principle P) or by speakers' intention to mean something distinct from a bound variable reading (for Rule I). Since only bound variable pronouns may get variable interpretations in these theories, noncoindexation also has a uniqueness requirement.

1.5 Description of Chapters

In Chapter 2 I will return to different aspects of identity and dependency in child grammar, and will review the literature in more detail. I will return to a discussion of VP ellipsis in child grammar in Section 2.1. Most of these studies of VP ellipsis have used VP ellipsis as a way of testing children's knowledge of binding. I will turn to pronouns in child grammar in Section 2.2, and focus on quantifier-bound pronouns. In Section 2.3 I will discuss quantification in child grammar more generally, focusing on scope relations and the phenomenon known as "quantifier spreading".

In Chapter 3, I will discuss in more detail some proposals relating these different aspects of child grammar. I will summarize the review of the literature, and discuss the findings in the literature in relation to definiteness and the claim that children are treating definite pronouns as indefinites. In addition, I will present in more detail the role of uniqueness in quantifier spreading.

In Chapter 4, I will describe the design of an experimental study of pronouns and quantification. Then in Chapter 5 I will discuss the results of this study. Among other findings, I will claim that contrary to studies in the literature, some children appear to accept locally bound distributive interpretations of plural pronouns in apparent violation of Principle B of the binding theory. In addition, those children who appear to violate Principle B show the unbound distributive interpretation of singular pronouns, allowing a sentence such as "Every bear is spraying him" to refer to a situation in which each bear is spraying a different animal.[31]

In Chapter 6, I will discuss these results in relation to previous results and in relation to the proposals of Chapter 3, draw conclusions, and discuss directions for further research.

[31]This relationship between acceptance of the bound distributive interpretation and acceptance of the unbound distributive **him** does not appear to depend on age. See section 5.2.7.

CHAPTER 2: SYNTACTIC IDENTITY AND DEPENDENCY IN CHILD GRAMMAR

In this chapter I will discuss three types of phenomena which are relevant to syntactic identity and dependency. In section 2.1 I will return to discussion of VP ellipsis, focusing here on VP ellipsis in relation to binding theory. In section 2.2 I will look at binding theory more directly, focusing on quantifier-bound pronouns and plural pronouns with distributive interpretations. Finally, in section 2.3 I will discuss quantification in child grammar, focusing on scope relations and quantifier spreading.

2.1 VP Ellipsis

Here I will return to the discussion of VP ellipsis which was begun in section 1.3. Here, however, I will focus on VP ellipsis as a source of information about children's understanding of binding. VP ellipsis is of particular interest because the interpretation of an elided VP is constrained by the binding principles, but since the elided VP is absent in the input, it is unlikely that children could learn from experience how binding principles apply to it. Therefore, children's demonstration of knowledge of binding principles in these cases would be evidence for the innateness of the principles.

2.1.1 Foley, del Prado, Barbier & Lust (1992)

Foley, del Prado, Barbier & Lust (1992a, 1992b) studied children's understanding of VP ellipsis sentences containing the possessive pronoun **his** with both an act-out task and a truth value judgment task, using sentences such as (1).

(1) Scooter scratches his arm and Ernie does too.

In the act-out task, there were eighty-six children in three age groups: twenty-eight children between 3;0 and 3;11 (mean age 3;4), twenty-five children between 4;0 and 4;11 (mean age 4;9), and twenty-five children between 5;0 and 5;11 (mean age 5;3), and eight children between 6;0 and 7;11 (mean age 6;7).

For control sentences with simple VP ellipsis (sentences without pronouns, such as "Big Bird jumps up and down and Ernie does too"), children in the youngest group averaged about 67% correct answers, while children in the three older groups averaged 93%, 91%, and 91% correct answers, respectively. This suggests that before age 4;0, children's grammar does not necessarily include the requirement for reconstruction of the elided VP (though it is not clear from the data presented by Foley, et al. whether this result is due to individual children or poor performance across the entire age group). As Thornton and Wexler found, children above age 4;0 do seem to have this requirement.

In the VP ellipsis sentences with the pronoun **his**, children preferred the sloppy interpretation, but also demonstrated the strict interpretation[1]; across all age groups, 59% of the children demonstrated only the sloppy interpretation, 7% demonstrated only the strict interpretation, and 31% demonstrated both interpretations (with the remaining 3% giving "other" interpretations). The (inferred) patterns of coindexation for strict and "other" interpretations are given in (2)

[1]For explanation of the sloppy and strict interpretations, see section 1.3 above.

and (3) (respectively).

(2) Scooter scratches his arm and Ernie <scratches his arm>.
(a) Scooter$_i$ Scooter$_i$'s Ernie$_j$ Scooter$_i$'s
(b) Scooter$_i$ Ernie$_j$'s Ernie$_j$ Ernie$_j$'s
(c) Scooter$_i$ Bert$_k$'s Ernie$_j$ Bert$_k$'s

(3) Scooter scratches his arm and Ernie <scratches his arm>.
(a) *Scooter$_i$ Scooter$_i$'s Ernie$_j$ Bert$_k$'s
(b) *Scooter$_i$ Ernie$_j$'s Ernie$_j$ Scooter$_i$'s
(c) *Scooter$_i$ Ernie$_j$'s Ernie$_j$ Bert$_k$'s
(d) *Scooter$_i$ Bert$_k$'s Ernie$_j$ Scooter$_i$'s
(e) *Scooter$_i$ Bert$_k$'s Ernie$_j$ Ernie$_j$'s

Of the strict interpretations which children demonstrated, 77% had the indexation pattern "i i j i" (2a), 16% had the pattern "i j j j" (2b), and 7% had the pattern "i k j k" (2c). (2a) is what Thornton and Wexler called the "inside referent strict identity interpretation" and (2c) is the "outside referent strict interpretation" (see section 1.3). The "other" interpretations mentioned above were incorrect interpretations with the indexation patterns "i i j k" (3a), "i j j i" (3b), "i j j k" (3c), "i k j i" (3d), and "i k j j" (3e).[7]

In the picture judgment task, there were thirty-five children in four age groups: eight children between ages 3;1 and 3;11 (mean age 3;2), nine children between ages 4;1 and 4;11 (mean age 4;3), eleven children between ages 5;0 and 5;11 (mean age 5;4), and seven children between ages 6;1 and 7;11 (mean age 6;7). There were sixteen false picture-sentence pairs and sixteen true picture-sentence pairs. The children correctly accepted about 83% of the true sentences and incorrectly accepted about 11% of the false sentences. As with the act-

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[7]These figures are from Foley et al. (1992a), and so are based on fewer subjects than the other percentages given. The handout for Foley et al. (1992b) does not provide this breakdown by indexation pattern.

out task, there was a predominance of sloppy over strict interpretations accepted. Nine children (26%) did better than chance (said "yes" to more than 4/8 of the true pictures in this condition[3]) on sloppy interpretations only; no children did better than chance on strict interpretations alone; and twenty-six children (74%) did better than chance on both the strict and sloppy conditions.

While the results from Foley et al. are not informative with respect to binding theory, they do demonstrate the early preference for the sloppy interpretation. As we will see below, this preference is quite common, and recurs in several different experimental situations.

2.1.2 Thornton (1990)

In a study of children's use of complex **wh**-questions, Thornton (1990) used a truth value judgment task to test two types of structures to control for children's knowledge of bound variables. The first of these she referred to as Bound Pronoun questions, while the second were VP ellipsis structures.

Thornton tested the Bound Pronoun questions with sentences such as (4).

(4) I know who said/thinks he has the best food.[4]

The Bound Pronoun questions were tested in both ambiguous contexts and

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[3]Note that this is not the best way to talk about performance above chance. While acceptance of 4/8 tokens of a question is performance <u>at chance</u>, performance significantly above chance (at the .05 level) would require acceptance of 6 or more tokens, based on a binomial distribution of "yes" and "no" responses.

[4]Thornton noted that in production, children seemed to prefer a plural pronoun as a bound variable (Thornton, 1990, fn.81, p.165). However, in this task, only singular pronouns were tested.

unambiguous contexts. In unambiguous contexts, the sentence was given a multiple reference interpretation. For example, in the story for (4), two characters (e.g., Grover and Yogi Bear) would have each said, "I have the best food". A puppet would have described the story with, "I know who said he has the best food. Grover and Yogi Bear" and children should have responded with "yes".

In ambiguous stories, either a multiple reference or a deictic interpretation was possible. In the story for (4), two characters (Grover and Yogi again) would each say, "I have the best food", and a third character (e.g., the Joker) would say to a fourth character (e.g., the Ninja Turtle), "You have the best food." Then the puppet would again describe the story with, "I know who said he has the best food. Grover and Yogi Bear" (the multiple reference interpretation). In these cases, according to Thornton, children's responses indicated a preference for either a bound or deictic interpretation of the sentence. If children said "yes", they were accepting the bound interpretation; if children said "no", they had a preference for the deictic interpretation.[5]

Thornton also included a control trial which required a deictic response. In other words, one character (e.g., the Joker) would say to another character (e.g., the Ninja Turtle), "You have the best food." Then the puppet would describe the story with, "I know who said he has the best food. The Joker." Children should then have given a "yes"

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[5]Note that this suggests that the truth-value judgment task tests <u>preferences</u>. If it tested grammaticality judgments, children should accept both the multiple reference response and the deictic response (since both were made possible by the story).

response.

Thornton tested twelve children, ages 3;7 to 4;8 (mean age 4;2). For the unambiguous Bound Pronoun Questions, the multiple reference interpretation was the only available interpretation; in these cases, children correctly accepted the multiple reference interpretation 87% of the time (26/30 times). In the control trial, the only available interpretation was the deictic interpretation; in this case, all of the children correctly accepted the deictic interpretation. For the ambiguous context, both the multiple reference interpretation and the deictic interpretation were available. However, children were only asked to judge the multiple reference interpretation. In these cases, children accepted the multiple reference interpretation 50% of the time. Since the acceptance of the multiple reference interpretation is less in the ambiguous context than in the unambiguous context (50% vs. 87%), either some children have a preference for the deictic interpretation, and so reject the multiple reference interpretation, or the ambiguous context was just too complicated for children to keep track of who was being referred to.

The second type of structure which Thornton tested, the one most relevant here, involved VP ellipsis sentences. These sentences were first presented to a child in contexts which made only the strict reading true. If the child gave a "no" response, this was thought to show that the child had a preference for the sloppy reading.[6] This sentence was then followed by another context and a sentence which was

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[6]Thornton seems to have been assuming that a preference for the sloppy reading might be strong enough to block acceptance of the strict reading.

true only on the sloppy reading, and should have evoked a "yes" response from the child. If the child initially responded "yes" (to the strict interpretation), then the expected response to the sloppy context was "no".[7]

A sample protocol for Thornton's experiment is given in (5).

> (5) Experimenter: Snoopy, Mickey Mouse and Donald Duck are all dressed up. Snoopy is feeling very pleased with himself, because he's wearing a bow tie, a vest, and a fancy top hat. So he (Snoopy) goes up to Mickey Mouse and says, "Don't you think I've got the best hat? I really think my hat is the best." Mickey Mouse says, "Well, it's true that my hat's not very good. It's too small and it keeps falling off my big ears. Yeah, Snoopy, I think you have the best hat." Donald Duck doesn't agree with that, and he says, "Wait a minute now! I have the best hat, you guys."
>
> (a) Kermit: I know what happened. **Snoopy said he had the best hat and so did Mickey Mouse.**
>
> Child: < Yes or No >
>
> (b) Kermit: What if I said this? **Snoopy said he had the best hat and so did Donald Duck.**
>
> Child: < Yes or No > (Thornton, 1990, p.178)

Here (a) is the test of the strict reading, and (b) is the test of the sloppy reading.[8] Thornton found these sentences evoked a strong preference for the sloppy reading. When children were presented with VP ellipsis sentences in contexts appropriate to the strict interpretation (a), they were rejected 86% of the time (by 9 out of 11 children). When the children were presented with VP ellipsis sentences in contexts

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[7]Again, this clearly suggests that the truth value judgment task measures preferences, not grammaticality judgments.

[8]Both (a) and (b) were true in this context. However, if children were only willing to accept the sloppy reading, they would reject (a), and if children were only willing to accept the strict reading, they would reject (b).

appropriate to the sloppy interpretation (b) instead, the children accepted the sentences 91% of the time. Only one child rejected the sloppy interpretation of VP ellipsis sentences entirely.

Again, for most children we see a strong preference for the sloppy interpretation of VP ellipsis sentences.[9] However, we still do not have data about binding in VP ellipsis structures. I will turn to such data in the following sections.

2.1.3 Boster (1991)

Boster (1991) (also discussed below in section 2.2.1.8) tested some of the predictions of the reformulated Principle B, discussed in section 1.4.2 above. According to proponents of the reformulated Principle B, children should only accept locally bound pronouns when they have referential antecedents; children should reject locally bound pronouns with quantificational antecedents. In addition, according to this view, children should reject sloppy readings for VP ellipsis sentences with a locally bound pronoun in the first clause.

Contrary to predictions, Boster found that the children who (incorrectly) accepted coreferential interpretations of sentences such as (6) (in which Snoopy washed Snoopy) also (incorrectly) accepted sloppy readings for VP ellipsis sentences such as (7), with coreference in the first clause (i.e, in (7), children accepted an interpretation in which Snoopy washed Snoopy and Donald washed Donald).

(6) Snoopy washed him.

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[9] I suspect that in this context adults would also prefer a sloppy interpretation. Unfortunately, no adult subjects were included.

(7) Snoopy washed him and Donald did too.

Boster tested ten children age 4;6 to 6;0 (mean age 5;4) on sentences such as (6) and (7) using a truth value judgment task. In the task, for sentences like (6), the character (e.g., Snoopy) performed the action on himself; for sentences like (7), the first character (e.g., Snoopy) performed the action on himself, then the second character (e.g., Donald) performed the action on himself (after asking the first character to do it, and being refused).

Boster found that the children incorrectly accepted coreference for sentences like (6) about 38% of the time. A sloppy interpretation was incorrectly accepted for sentences like (7) 55% of the time. Two children rejected the apparent Principle B violations of (6). When the results for these two children were excluded, Boster found that the remaining eight children accepted coreference in sentences like (6) 50% of the time, and accepted a sloppy reading of sentences like (7) 70% of the time.

It should be the case that all of the children who accepted (7) with a sloppy interpretation also accepted (6) with coreference. If children are accepting a sloppy interpretation of (7), then they must be interpreting it as "Snoopy$_i$ washed him$_i$ and Donald$_j$ <washed him$_j$> too", copying the indexical relationship of the first clause onto the second clause. Within (7), then, they are accepting "Snoopy$_i$ washed him$_i$", and so should also accept (6). From Boster's data, it is not clear that this is true. Children accepted (7) a greater percentage of the time than they accepted (6). Of the two children who Boster excluded above (who had rejected (6)), one accepted 1/4 cases of (7) with the sloppy interpretation. All other children accepted at least some cases of both (6) and (7). Other factors must be involved in the acceptance of (7), and these need to be examined further if we are to draw any conclusions about the relationship between children's understanding of VP ellipsis and their understanding of Principle B.

What other factors could be involved in the acceptance of (7)? One possibility is that the preference for the sloppy interpretation encourages the Principle B violation. Another possibility is that since (7) is longer and more difficult than (6), children are more inclined to make errors (or to guess when they don't understand).[10]

In the same experiment, Boster tested children on sentences such as (8) and (9).

(8) I know who washed him-- Snoopy.

(9) I know who painted her-- Sister Bear and Dorothy.

Boster predicted that the children would disallow coreference in (8) because the only possible interpretation in which **him** and **Snoopy** could intentionally corefer requires variable binding, (roughly) as in (10).[11]

(10) I know [(for which x) λ x (x washed x)] (Snoopy)

This prediction turned out to be true; Boster found only a 4% acceptance rate for coreference in these sentences. However, this result, as Boster notes (p.35) is problematic. Children may have had other reasons for rejecting these sentences. For example, unlike the other Principle B test sentences, in these sentences there is no lexical antecedent preceding the pronoun. Since **Snoopy** in (8) follows rather than precedes

[10]Both of these possibilities were suggested to me by Janet Fodor.

[11]This formula is Boster's (10a).

him, it may be more likely that a referent for **him** will be found in the preceding discourse when the **wh**-bound reading is not adopted. The last-mentioned character in the discourse was not **Snoopy**, so if there is a tendency for a child to pick up a pronoun's referent from the preceding discourse, this would favor a noncoreferential reading more strongly in this type of sentence than in the sentences where a possible referent preceded the pronoun in the sentence.[17]

Some of Boster's results are unclear. However, she found that children will accept a sloppy reading of a VP ellipsis sentence with a locally coreferential pronoun in the first clause, thus contradicting the predictions of the reformulated binding theories.

2.1.4 Koster (1992, 1993)

Koster (1992, 1993) reports work on children's interpretations of VP ellipsis in Dutch. Koster conducted two experiments. The first included six four-year-olds and six six-year-olds. The second included ten four-year-olds, eleven six-year-olds, and ten eight-year-olds. In both experiments, the experimental task was an act-out task. The children listened to a sentence, repeated it, and then acted it out. The first experiment included six sentences each of the type (11a, b, c) and fifteen filler sentences. The second experiment included three sentences each of type (12a and b), four each of (13a and b), and three each of (14a and b), along with twenty-two fillers. The test sentence verbs were **prikken** (prick), **wijzen** (point), and **schieten** (shoot). The

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[17]See section **2.2.1.5** below for discussion of this type of construction in Russian.

props used in the act-out task were color coordinated, so that it was clear who owned what.

(11) a. Hier heb je Ernie, Pipo en Bert...
Here's Ernie, Pipo and Bert...
Bert wijst naar zichzelf en Ernie ook.
Bert points at himself and Ernie (does) too.

b. Hier heb je Ernie, Pipo en Bert...
Here's Ernie, Pipo and Bert...
Bert wijst naar hem en Ernie ook.
Bert points at him and Ernie (does) too.

c. Hier heb je Ernie, Pipo en Bert...
Here's Ernie, Pipo and Bert...
Bert wijst naar zijn auto en Ernie ook.
Bert points at his car and Ernie (does) too.

(12) a. Bert wijst met Pipo's stokje naar zichzelf en Ernie ook.
Bert points with Pipo's stick at himself and Ernie (does) too.

b. Bert wijst met Pipo's stokje naar hem en Ernie ook.
Bert points with Pipo's stick at him and Ernie (does) too.

(13) a. Pipo zegt dat Bert naar zichzelf moet wijzen en Ernie ook.
Pipo says that Bert should point at himself and Ernie (should) too.

b. Pipo zegt dat Bert naar hem moet wijzen en Ernie ook.
Pipo says that Bert should point at him and Ernie (should) too.

(14) a. Pipo zegt dat iemand naar zichzelf moet wijzen en Ernie ook.
Pipo says that someone should point at himself and Ernie (should) too.

b. Pipo zegt dat iemand naar hem moet wijzen en Ernie ook.
Pipo says that someone should point at him and Ernie (should) too.

The results with sentences such as (11c), with the possessive pronoun **zijn** (his), showed that Dutch children were able to understand

VP ellipsis constructions, and realized that the structures with possessives were ambiguous. Children acted out both strict and sloppy interpretations of the second conjunct of these sentences, but showed a preference for the sloppy interpretation. In addition, the children did not allow these sentences to have completely free readings, but obeyed constraints against impossible interpretations (i.e., in Thornton and Wexler's terms, they obeyed Independent Index Copying). These results replicate the findings of Foley, del Prado, Barbier & Lust (1992) (see section 2.1.1 above) for English-speaking children between age 4;0 and 7;11.

Koster discussed the results for sentences with the reflexive **zichzelf** (himself) or the pronoun **hem** (him) in terms of reflexive and nonreflexive interpretations for each conjunct of the VP ellipsis sentence. These responses are shown in (15).[13]

(15) Percentages of responses in first and second conjuncts of the sentence, per age group and per sentence type (Koster 1993, p.119)

response 1st:	reflex			nonrefl			reflex			nonrefl		
2nd:	reflex			nonrefl			nonrefl			reflex		
age group:	4	6	8	4	6	8	4	6	8	4	6	8
sentence:												
11a-himself	100%	100%	--	0%	0%	--	0%	0%	--	0%	0%	--
12a-himself	83%	85%	93%	7%	3%	7%	3%	12%	0%	0%	0%	0%
13a-himself	88%	84%	90%	10%	4%	7%	0%	8%	4%	0%	4%	0%
11b-him	50%	63%	--	38%	36%	--	0%	0%	--	0%	0%	--
12b-him	53%	18%	40%	47%	64%	57%	0%	6%	3%	0%	3%	0%
13b-him	33%	14%	5%	58%	75%	90%	3%	5%	0%	5%	5%	5%

[13]Results for (14) will be discussed separately below. Koster argued that the results for (14) are not directly comparable to the results given in (15). For (11) to (13) (sentences with definite NPs), children were quite successful at repeating the sentences. However, for (14) (sentences with quantified NPs), children made many repetition errors.

For the reflexive pronouns (11a, 12a, and 13a), the correct response should have been a reflexive-reflexive interpretation, and this is what most of the children acted out most of the time. For the pronominal sentences (the cases in 11b, 12b, and 13b), the only correct response was nonreflexive-nonreflexive. As the table shows, for the youngest group, the correct response amounts were about equal to the incorrect responses, at about 50%. This response pattern resembles the usual pattern for pronouns; the correct pronominal performance lagged behind that of reflexives.

How do these results fit in with the reformulated Principle B? The reformulated binding theory applies only to bound variable interpretations. In VP ellipsis sentences, therefore, there should be no pronominal sentences which get the reflexive-reflexive interpretation, since this would mean that children were interpreting the pronominal as reflexive and giving it a bound variable interpretation in the second conjunct (thus indicating binding, and not just coreference, in the first conjunct). However, as the table shows, the error responses for pronominal VP ellipsis sentences with definite NPs were exactly the kind of response that should not be possible, based on the reformulated binding theory. The children regularly gave pronominals a bound variable, reflexive interpretation over both parts of the VP ellipsis sentences. In fact, the children almost never acted out the reflexive-nonreflexive interpretation, i.e. first interpreted the pronominal as a reflexive and then let the object of the second half of the sentence corefer with the object of the first half (the pragmatic coreference solution). Instead, they preferred the coindexed sloppy identity reading.

Koster's Dutch results differ from those of Thornton & Wexler (1991) for English.[14] Since the principles involved in these interpretations are thought to be universal, we would expect similar results for Dutch and English; if the reformulated Principle B holds for English, it should hold for Dutch, too. Direct comparisons can only be made with respect to four-year-olds, since this was the only age group tested by both Koster and Thornton and Wexler. As we will see in section 2.1.5 below, the results of Thornton and Wexler seem to support the reformulated Principle B,[15] while the results of Koster seem to disconfirm the reformulation.

One way in which these studies differed was in the tasks used; Thornton and Wexler used a truth value judgment task, while Koster used an act-out task. Act-out tasks have been criticized as only showing children's preferences for a particular interpretation of a sentence. However, as we saw in discussion of Thornton (1990) (see section 2.1.2 above), the truth value judgment task also shows children's preferences, although those preferences are more strongly influenced by context. I know of no study which compares these two tasks, so it is difficult to determine which of these studies gives a truer picture of children's understanding of binding.

Koster suggests that the differences may have to do with the role of quantified NPs in the experimental sentences. Her Dutch study

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[14]For discussion of Thornton & Wexler (1991) and Thornton & Wexler (1993), see section 2.1.5 below.

[15]With some reservations; see discussion of Independent Index Copying in section 2.1.5.

included sentences with a quantified NP as the local c-commanding NP in the first conjunct [(14), repeated here as (16)]. Results for these sentences are given in (17).

(16) a. Pipo zegt dat iemand naar hem moet wijzen en Ernie ook.
Pipo says that someone should point at him and Ernie (should) too.

b. Pipo zegt dat iemand naar zichzelf moet wijzen en Ernie ook.
Pipo says that someone should point at himself and Ernie (should) too.

(17) Percentages of responses in first and second conjuncts of the sentence, per age group and per sentence type, for (16)

response 1st:	reflex			nonrefl		
2nd:	reflex			nonrefl		
age group:	4	6	8	4	6	8
sentence:						
16a-him	26%	6%	3%	53%	73%	90%
16b-himself	67%	76%	83%	20%	9%	13%

The results for (16a) are much more similar to those predicted by the reformulated binding theory than Koster's other results, since children often gave correct nonreflexive/nonreflexive responses. The responses to (16b) also differed from Koster's other results; children had fewer correct reflexive/reflexive responses. However, Koster suggests that these results should be interpreted with caution; they are not directly comparable to the results in table (15), since other factors are involved here.

Koster's experiment included having the children repeat the sentences before acting them out. She found that children were surprisingly successful in repeating the test sentences with definite NPs, but made more mistakes when repeating the sentences with quantified

NPs. For example, children[16] repeated (16) as (18).

(18) Pipo zegt dat hij naar iemand moet wijzen en Ernie ook.
Pipo says that he should point at someone and Ernie (should) too.

Children changed (16) into (18) by putting the quantified NP in the object position and eliminating the object reflexive or pronominal. With sentence (18) in mind, the child would act out a nonreflexive/nonreflexive scene (which, with the pronoun, would appear to be the correct response), regardless of whether the original sentence was reflexive or pronominal. This strategy then artificially reduces the error chances for the quantified-NP pronominal sentences, and also reduces the success chances for the quantified NP-reflexive sentences.

Koster also found that, with the quantified NP sentences (but not the definite NP sentences), children sometimes interpreted the second conjunct as meaning "and Ernie says...too" instead of "and Ernie points...too", acting the sentences out as if two people were saying that one other person should point to **himself/him** two times.[17] Koster says that, "During the practice session the children had been steered away from this interpretation, and the intonation of the test sentences was also against this interpretation" (Koster, 1993, p.127); however, this is a legitimate interpretation for these sentences. Koster does note, however, that this interpretation only occurred with the quantified NP sentences (16), but not the comparable definite NP

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[16]Koster does not specify how often this occurred.

[17]Janet Fodor (p.c.) suggests that the intended meaning of "Pipo says someone should point at himself and Ernie should too" is quite strange; the sentence that Pipo utters, "Someone should point at himself and Ernie should too" presupposes that Ernie isn't someone.

sentences (13) (the Dutch equivalent of "Pipo says that Bert should point at him/himself and Ernie (should) too").

Koster argued that these two facts suggest that children prefer a parallelism of the NP subject constructions in the two conjuncts. When these are not identical, as in (16), the children restructure the test sentence and act out a scene which matches their restructured version of the original test sentence. As Koster notes,

> What the exact difficulty is here and why the children have the tendency to reconstruct these quantified NP sentences is beyond the scope of this chapter, but it does give reason to doubt the validity of the results on the quantified NP sentences, at least in the Dutch study. It also gives reason to wonder about the effects of quantified NPs in the English study (Koster, 1993, p.127).

Reviewing several previous studies, Koster argues that quantifiers are problematic: "A surprising result is that in almost all of these sentences, the children resist having the pronominal be bound by a quantified antecedent, whether this is the correct binding solution or not" (Koster, 1993, p.130).[18]

These results suggest to Koster that the VP ellipsis results found in Thornton and Wexler's study may be explained as a result of an experimental artifact. In the Thornton & Wexler (1991) study, the correct rejection of an incorrect bound variable interpretation was best for sentences with quantified NPs and pronominals (90%), while for referential NPs and pronominals, the incorrect bound variable interpretation had a correct rejection of 78%, and the incorrect coreference interpretation had a correct rejection of 57%. Koster

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[18]For related conclusions, see discussion of Sano (1992) in section 2.2.1.9 below.

points out that in all cases, the correct response was rejection, and this was most successful for quantified NP sentences. Koster suggests that this result could be attributed to the nonavailability of a bound variable interpretation with quantified antecedents.

Koster concludes with a summary of arguments against the reformulation of the binding theory. First, there is not consistent experimental proof of the necessity of such a reformulation. Second, children demonstrate difficulties with quantified NPs; before attributing some of the more supportive results to a reformulated Principle B, it's appropriate to investigate children's general understanding of quantified expressions and the role they play in children's understanding of pronominal antecedent relations. As Koster asks, "Is it possible that quantifiers do somehow affect pronoun binding but in a way that is not central to Binding Theory issues?" (Koster, 1993, p.129).[19]

As we will see below, some of these problems have been addressed in subsequent research. However, it is clear that in order to evaluate binding in children's grammar, we need to have a better understanding of quantification in children's grammar.

2.1.5 Thornton & Wexler (1991, 1993)

The most extensive work on VP ellipsis in child grammar is the

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[19]Koster also argues that there are syntactic arguments against the reformulation of the binding theory, since it is not always necessary to have a c-command relation in order to get a bound variable interpretation for a pronoun.

work of Thornton & Wexler (1993)[20]. Thornton and Wexler attempt to use evidence from children's understanding of VP ellipsis as the basis for an argument for the reformulated binding theory, which says that children who appear to violate Principle B of the binding theory in fact have Principle B innately, but do not have the pragmatic principle, Principle P, which prohibits contraindexed expressions from coreferring. Thornton and Wexler's main claim is that children who accept pronouns which have locally c-commanding coreferential NPs do **not** accept sloppy interpretations of elided pronouns when Principle B would rule them out.[21]

As discussed in section 1.3, Thornton and Wexler discuss VP ellipsis in terms of an Indexing Rule, repeated here as (19).

(19) Indexing Rule

> If an occurrence of an index is independent, an alpha-occurrence, copy the occurrence itself; if the occurrence is dependent, a beta-occurrence, copy the dependency itself (Thornton & Wexler, 1993, p.17, based on Fiengo & May, 1994).

Also as discussed in section 1.3, Thornton & Wexler "modularize" the Indexing Rule, breaking it down into Dependence Matching and Independent Index Copying, repeated in (20) to (22).

(20) a. If the occurrence of an index is an independent occurrence, then the **dependence value** of the index is **independent**.

b. If the occurrence of an index is a dependent occurrence, then the **dependence value** of the index is **dependent**.

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[20]Thornton & Wexler (1991) was an early version of the work presented in Thornton & Wexler (1993).

[21]Note that this is contrary to the results of Boster (1991). See section 2.1.3 above.

(21) **Dependence Matching**: Copy the dependence value of the index.

(22) **Independent Index Copying**: If the dependence value of an index is independent, copy the index. (Thornton & Wexler, 1993, p.19)

VP ellipsis provides evidence for dependent reference without involving quantification. For example, in (23) the pronoun has a definite NP antecedent.

(23) Mama Bear washed her and Sister Bear did too.

The interpretation of (23) which we are most concerned with is the case in which there is coreference in the first clause and a sloppy interpretation of the second clause, so that Mama Bear washed herself and Sister Bear washed herself. Sloppy identity requires Dependence Matching. This is why this case is crucial; if children are not coindexing **Mama Bear** and **her** in the first clause, but allowing them to corefer, in violation of Principle P, then the relationship between **Mama Bear** and **her** is not dependent. So, if children have Dependence Matching, the relationship between **Sister Bear** and the pronoun in the elided VP should also not be dependent, so that the sloppy identity interpretation should not be available. However, if children truly did not have Principle B, then the relationship between **Mama Bear** and **her** could be one of dependence, in which case the sloppy identity interpretation should be available. So this case is crucial evidence for the idea that children have Principle B, but do not have the pragmatic Principle P. It is particularly crucial since it does not involve quantification, which may have been interfering in some of the other studies discussed above.

Thornton and Wexler predicted that children would not accept a sloppy interpretation of sentences like (23). They also predicted that children would reject a sloppy interpretation of (24) (i.e., an interpretation in which Batman cleaned himself and each turtle cleaned himself), with a quantified NP in the second conjunct.

(24) Batman cleaned him and every turtle did too.

The reasons for rejecting (24) should be identical to those for rejecting (23). However, the quantified NP in the second clause precludes the possibility of noncoindexation in the second clause (which becomes important if children do not demonstrate Independent Index Copying). I will return to discussion of this below.

Thornton and Wexler tested these predictions with nineteen children, age 4;0 to 5;1 (mean age 4;8), using the truth value judgment task. As discussed in section 1.3, Thornton and Wexler found that these children did appear to know the basic requirement of VP ellipsis: the elided VP must be a reconstruction of the VP in the first conjunct. In addition, the children seemed to demonstrate Dependence Matching, rejecting sentences in which the pronoun in the first conjunct was independent but the pronoun in the second conjunct was dependent. However, Thornton and Wexler found some evidence that children did not always obey Independent Index Copying.[11] I will return to discussion of this below.

In addition to testing for the different parts of the Indexing Rule, Thornton and Wexler tested their subjects with simple (one clause)

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[11]It doesn't seem that these sentences testing the basic requirements of VP ellipsis were treated as a pretest; data from the six children who disobeyed Independent Index Copying seem to have been included in further analysis.

"binding control" sentences. For these sentences, Thornton and Wexler found a 58% (incorrect) acceptance rate for sentences like (25a) (Principle P infelicity), but only an 8% (incorrect) acceptance rate for Principle B violations like (25b).

(25) a. Bert brushed him. [where Bert brushed himself]
b. Every reindeer brushed him. [where each reindeer brushed himself]

The individual subject data showed that when the antecedent for the pronoun was a referential NP, (25a), of the nineteen children, eight children accepted 3/4 or 4/4 trials, seven children accepted 2/4 trials, one child accepted 1/4 trials, and three children responded as adults. When the antecedent was a quantified NP, (25b), only one child accepted the bound interpretation (accepting all four trials). This child also accepted all of the referential trials.

The children in this study correctly accepted reflexive sentences like (26) 88% of the time, and accepted coreference with **every Cabbage Patch boy** (correctly) 50% of the time in sentences such as (27).

(26) Every reindeer$_i$ brushed himself$_i$.

(27) Every Cabbage Patch boy$_i$ said Superman likes him$_i$.

Thornton and Wexler included sentences such as (27) as

> ... controls to provide additional information regarding children's ability to compute bound variable representations. In contrast to the pronoun in [(25a)], the pronoun in this two clause structure can be given a bound variable interpretation. By showing that children could assign bound variable interpretations to pronouns, we aimed to lend extra credibility to our test of Principle B in [(25a)], which rested on the possibility of interpreting **him** as a bound variable (Thornton & Wexler, 1993, pp.43-44).

For (27), in the story acted out, two Cabbage Patch boys say Superman likes them, and not another character, Y, while the third Cabbage Patch boy says that Superman likes him and Y. It is not clear why subjects accepted this sentence only half of the time, since with reflexives with a quantified antecedent, such as (26), subjects had an acceptance rate of 88%. Thornton and Wexler suggest that 50% should be the expected acceptance rate for (26), since (26) is ambiguous. This suggests, once again, that the truth value judgment task is not measuring judgments of grammaticality; "children will often choose one reading and respond in some way, possibly reflecting preferences" (Thornton & Wexler, 1993, p.65).

Finally, for the sentences involving VP ellipsis and Principle B, Thornton and Wexler's results appear to agree with their predictions. For sentences without overt quantifiers, Thornton and Wexler predicted that children would accept the sloppy interpretation for sentences with possessive pronouns like (28a) and for sentences with reflexives (28b), but would reject sentences like (28c), which include a violation of Principle B. In fact, the children accepted (28a) 82% of the time, accepted (28b) 100% of the time, and accepted the Principle B violation of (28c) (where Gonzo covered himself, and Snuffy covered himself) 22% of the time.

(28) a. Mr. Dog_i brushed his_i teeth and every $dinosaur_j$ did <...his_j teeth> too.

b. $Bert_i$ covered $himself_i$ with sand and $Snuffy_j$ did <..$self_j$> too.

c. $Gonzo_i$ covered him_i with sunblock and $Snuffy_j$ did <..him_j> too.

Again, it is not clear what a percentage of 22% means; looking at individual subject data may be useful. Ten of the nineteen subjects accepted sentences like (28c) at least once, in apparent violation of

Principle B. Three subjects accepted sentences like (28c) 1 out of 4 times; seven subjects accepted sentences like (28c) 2 out of 4 times; no subjects accepted sentences like (28c) more than half of the time. Within subjects, then, there is quite a lot of variability in acceptance of these items.[21]

Thornton and Wexler also predicted that children would accept only a strict interpretation for VP ellipsis sentences like (29) (i.e., when Bert lassoed himself). Principle B requires that **Bert** and **him** have different indices; if coreference is accepted for the first clause of (29), it must be due to a Principle P infelicity. Thus, **Bert** and **him** would have different indices, but would corefer. If **Bert** and **him** have different indices, the index on **him** must be independent. If the index on **him** is independent, then by Dependency Matching the index on the elided pronoun must also be independent, resulting in strict identity. In fact, the children accepted the sentence in (29), in which **him**$_j$ referred to Bert, 43% of the time.

(29) Bert$_i$ lassoed him$_j$ and the Tin Man did <..him$_j$> too. [where i=j]

(30) Bert$_i$ brushed him$_j$. [where i=j]

More specifically, Thornton and Wexler predicted that only children who accepted (25a) [repeated here as (30)], in violation of

[21]The verbs used for these sentences were **clean**, **cover with**, **serve** and **squirt**. Data are not provided for each verb, so it is not clear if predicate type had any effect here. We might expect that it would; (i), with a sloppy reading, does not seem so bad, especially compared to (ii).

(i) I'm gonna cover me with sunblock and Snuffy is too.
(ii) I'm gonna hit me and Snuffy is too.

Note, however, that (i) is much easier to get with a first person pronoun than with a third person pronoun.

Principle P, would accept (29). Dividing subjects into two groups, those who rejected (30) on every one of the four trials (three subjects), and those who accepted (30) on at least one trial (sixteen subjects), Thornton and Wexler found that all of the children in the first group, who always rejected (30), also always rejected (29). The children in the second group, who accepted (30) at least once, also accepted (29) an average of 52% of the time, thus confirming Thornton and Wexler's prediction.[24]

For sentences with an overt quantifier, Thornton and Wexler predicted that the children would accept sentences with reflexives, and reject sentences with pronouns. (31) had an acceptance rate of 95%, while (32), a Principle B violation, had an acceptance rate of only 10%.

(31) Spiderman$_i$ tickled himself$_i$ and every horse$_j$ did <..self$_j$> too.

(32) Batman$_i$ cleaned him$_i$ and every turtle$_j$ did <..him$_j$> too.

Here (32) had the interpretation in which Batman cleaned himself and each turtle cleaned himself. (32) is easiest to understand if we begin with the second conjunct: since we are taking the distributive interpretation of **him** in the second conjunct (each turtle cleaned himself), **him** in the second conjunct must be bound to (and thus coindexed with) **every turtle**. In this case, the relationship in the

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[24]Another way of examining individual data would be to see what percentage of children accepted both of these sentence types at least once. Thornton and Wexler's prediction is that if children reject (30), then they must also have rejected (29); this is confirmed, but based only on three children (the children who were basically adult-like). A stronger prediction would be that children who accept (30) should also accept (29). Sixteen children accepted (30) at least once; of these sixteen children, twelve also accepted (29) at least once (75%). There should be some explanation for why this is not true for the other 25%. What are the other reasons why children might reject (29)?

second conjunct is dependent. Because of Dependence Matching, this means that the relationship in the first conjunct must also have been dependent; in other words, **Batman** and **him** in the first clause must also have been coindexed. As a result, both the first clause and the second clause contain Principle B violations.

It is useful to compare (32), the sloppy interpretation with a quantified antecedent, with (28c) [repeated here as (33)], the sloppy interpretation with a referential NP antecedent.

> (33) Gonzo$_i$ covered him$_i$ with sunblock and Snuffy$_j$ did <..him$_j$> too.

(33) was accepted 22% of the time, while (32), as noted above, was accepted only 10% of the time. Why is there a difference in the acceptance rates of these two sentences?[25] Both involve sloppy readings which require violation of Principle B, so both should be rejected. Thornton and Wexler argue that the elevated acceptance rate of (33) is a result of some children lacking both Principle P and the Independent Index Copying clause of the Indexing Rule. According to Thornton and Wexler, these children assign a structure to (33) with four different indices on the four relevant NPs (**Gonzo**, **him**, **Snuffy**, and the elided **him**), and then allowed two pairs of indices to corefer, as in (34).

> (34) Gonzo$_i$ covered him$_j$ with sunblock and Snuffy$_k$ did <..him$_l$> too. [where i=j and k=l]

Thornton and Wexler argue

> it is likely that Independent Index Copying follows from a general family of interpretive/pragmatic considerations. We already know that another such consideration, Principle P, is delayed in children.

[25]Thornton and Wexler do not say if this difference is statistically significant.

> Therefore...it is not totally surprising that Independent Index Copying might be somewhat delayed (Thornton & Wexler, 1993, p.72).

While it may not be surprising that Independent Index Copying is delayed, it is highly problematic for Thornton and Wexler's theory. If children allow pairs of indices to corefer, then there is no way to distinguish between binding and coreference for these children. If children allow an interpretation of sentences like (34) which is logically equivalent to the sloppy identity interpretation but without having to coindex the relevant NPs, it eviscerates the relevance of ellipsis for Thornton and Wexler's purpose, which is to determine whether children obey Principle B.[26]

In order to further investigate the cases in which it appeared that children don't know the Independent Index Copying part of the Indexing Rule, Thornton and Wexler added a follow-up study. Sentences like "Gonzo covered him with sunblock and Snuffy did too" were originally designed to test a representation that would violate Principle B; the context for this sentence showed Gonzo covering himself and Snuffy covering himself, but neither covering a third character, Porky Pig. A child (with Independent Index Copying) responding "no" to this sentence would have to be taking the pronoun **him** to respond to the outside referent, Porky Pig. However, children lacking Principle P would have the additional possibility of allowing an inside referent. Based on their results, Thornton and Wexler assumed that children who lack Principle P have a preference for assigning coreference relations

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[26]This point is due to Bob Fiengo.

sentence internally, everything else being equal.[17] If this is the case, it would have been difficult for children lacking Principle P to allow **him** to refer to Porky Pig. Thornton and Wexler imagined that, hearing this sentence, a child might automatically attempt to make the pronoun coreferential with Gonzo, contraindexing the NPs in the first conjunct but allowing them to corefer. Then, if the pronoun in the second conjunct is reconstructed according to the Indexing Rule, the sentence can only have the interpretation that "Gonzo covered himself and Snuffy covered Gonzo", with the representation in (35).

(35) Gonzo_i covered him_j and Snuffy_k <covered him_j> too.
[$\text{Gonzo}_i = \text{him}_j$]

In the original experiment, the strict internal referent interpretation was not the interpretation that was made available in the story. A child lacking Principle P who had a preference for this interpretation would have had to backtrack in order to reassign the pronoun reference outside the sentence, which may have caused a processing overload, resulting in guessing. To avoid this problem, Thornton and Wexler used sentences such as (36).

(36) Kermit's friend wiped him and Big Bird did too.

This sentence is grammatical when the pronoun is coreferential with **Kermit**, so coreference in the first conjunct does not entail a violation of Principle B. However, according to Thornton and Wexler, a sloppy interpretation is ruled out because coindexing in the second conjunct

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[17]However, McDaniel et al. (1990) found that children who appeared to violate Principle B preferred reference internal to the sentence in complex sentences (such as "Grover thinks that Cookie Monster is touching him" or "Cookie Monster wants Grover to wash him"), but usually rejected internal reference for simple sentences (e.g., "Grover is washing him").

violates Principle B; the sentence cannot mean that Kermit's friend wiped Kermit, and Big Bird wiped himself.

According to Thornton and Wexler, if children have the entire Indexing Rule, then those children will assign sentence internal reference to the first **him**, and therefore will not have to back up and reassign reference in processing the sentence. This eliminates the processing problem that existed with the "grammatical but false" reading of (35). If children lacked Principle P and lacked Independent Index Copying, they could assign (36) the representation in (37).

(37) Kermit$_i$'s friend wiped him$_j$ and Big Bird$_k$ <wiped him$_i$> too.

If children do not have Independent Index Copying, there is no requirement on a strict reading to copy over the index from the first conjunct. These children could accept a reading in which Kermit's friend wipes Kermit and Big Bird wipes Big Bird. Thornton and Wexler thus created a situation in which children can say "yes" if they don't know Independent Index Copying, but must say "no" if they do know Independent Index Copying.

Thornton and Wexler tested sixteen children in their follow-up study, between the ages of 3;9 and 5;10 (mean age 4;5). The follow-up included sentences like (36), reflexive sentences with a sloppy interpretation (i.e., "X brushed himself and Y did too") and Principle P cases (i.e., "X brushed him"). The tests for Principle P were (incorrectly) accepted 41% of the time. The reflexive sentences were (correctly) accepted 66% of the time, and the target sentences, like (36), were accepted 28% of the time. However, for Thornton and Wexler, just those children who accepted both of these sentence types (i.e., those children who accepted a sloppy interpretation and accepted Principle P violations) were relevant. Of the original sixteen children, only six children accepted both sentence types. Among these children, there were 11/24 acceptances of the interpretation in which Kermit's friend wipes Kermit and Big Bird wipes himself. This led Thornton and Wexler to reject the idea that a flaw in the experimental stimuli led to the findings in the main study. Instead, they suggest that some children do not have Principle P <u>or</u> Independent Index Copying.

There is another possible way for children to get the interpretation in which Kermit's friend wipes Kermit and Big Bird wipes Big Bird. As noted in section 1.3, Thornton and Wexler's modular indexing rule is incomplete: they leave out a rule for situations in which the dependency value in the first clause is dependent. When the value of the index is dependent, the dependency itself is copied; let's call this Dependency Copying. This requires a certain type of structural identity between the first and second clauses. This structural identity is lacking in (36).[18] Compare the sentence in (38).

(38) Kermit's friend wiped his face and Big Bird did too.

With the possessive pronoun, no Principle B violation arises in the second conjunct. A sloppy interpretation is available, but only if **his** in the first clause refers to Kermit's friend, not to Kermit; this sentence cannot mean that Kermit's friend wiped Kermit's face and Big Bird wiped Big Bird's face. Because of Dependency Copying, the indexing

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[18]Structural identity is lacking in (36) because in the first conjunct the NP with the copied index is **Kermit**, which is not the subject but is inside the NP **Kermit's friend**; in the second conjunct, the subject NP **Big Bird** is the only NP available.

in (39) is no good.

> (39) *[Kermit$_i$'s friend]$_j$ wiped his$_i$ face and Big Bird$_k$ <wiped his$_k$ face> too.

Returning to Thornton and Wexler's example, instead of the indexical pattern in (37) [repeated here as (40)], perhaps children are allowing the indexical pattern in (41). If that were the case, then children would be missing Dependency Copying and Principle B.

> (40) Kermit$_i$'s friend wiped him$_j$ and Big Bird$_k$ <wiped him$_i$> too.

> (41) Kermit$_i$'s friend wiped him$_i$ and Big Bird$_k$ <wiped him$_k$> too.

This may seem unlikely, but keep in mind that we have seen that children seem to have a very strong preference for sloppy interpretations. We need to find some way to rule out this possibility, i.e., to test for Dependency Copying.

In summary, Thornton and Wexler found that while all children adhered to Dependence Matching, a few children seemed to lack knowledge of Independent Index Copying. Thornton and Wexler claim that their results show children obeying Principle B in elided VPs, but not always obeying Principle P. However, their own findings with respect to Independent Index Copying bring into question the relevance of these results. For children who lack knowledge of Independent Index Copying, who can freely index NPs and then freely allow those different indices to corefer, we cannot determine whether they obey Principle B or not.

2.2 Pronouns

Three types of evidence have been provided for the theory that children who appear to violate Principle B have the reformulated Principle B innately, but either lack a pragmatic principle (Principle P) which prohibits contraindexed expressions from coreferring, or are unable to process sentences which require execution of a rule of interpretation (Rule I)(for discussion see section 1.4.2). In section 2.1 we have already discussed VP ellipsis with respect to the reformulated binding theory. Here I will turn to pronouns in child grammar, and discuss two other types of evidence which have been provided to support the reformulated binding theory. First, in section 2.2.1, I will discuss children's behavior with quantifier-bound pronouns, as compared to their behavior with pronouns with referential antecedents. Second, in section 2.2.2, I will discuss children's understanding of the distributive interpretation of plural pronouns.

2.2.1 Quantifier-bound pronouns

Is there evidence that young children understand quantification in the same way as adults? In addition to the studies of bound variable pronouns, a few recent studies have examined children's understanding of quantifiers and it is not clear that children's understanding of quantification is identical to that of adults (see section 2.3 below). If children interpret quantification and scope differently from adults, how will this affect their interpretation of the sentences used to test children's understanding of the binding principles?

In this section I will first discuss some of the evidence for the reformulated binding principles presented in Chien & Wexler (1988, 1990), and then turn to some apparent counterevidence (Lombardi & Sarma, 1989, and Kaufman 1987, 1988). Next I will review some other evidence for children's bound variable interpretation of pronouns (Chien & Wexler, 1991), some evidence from Russian (Avrutin & Wexler, 1992), some evidence from Icelandic (Sigurjónsdóttir & Hyams, 1992), and some evidence from Dutch (Philip & Coopmans, 1995b). Finally, I will end this review of studies of quantifier-bound pronouns with two explanations based on lexical acquisition (Boster, 1991 and Sano, 1992).

2.2.1.1 Chien & Wexler (1988, 1990)

Some of the most influential work on children's understanding of bound variable pronouns has been the work of Chien & Wexler (1988, 1990). Chien & Wexler (1988) was the first study to directly test the reformulation of Principle B. Chien and Wexler tested 177 children between the ages of 2;6 and 7;0 on a yes/no judgment task; in addition, they tested twenty adults.[29] In the task, the subject was presented with a cartoon picture, an introductory sentence (e.g., "This is Goldilocks; these are the bears"), and a question related to the picture (e.g., "Is every bear washing her?").

Chien and Wexler found that children at age 5 and older clearly demonstrated knowledge of Principle A of the binding theory, with percentages correct higher than 90%. However, the percentage of children's correct responses to quantifier-reflexive questions was

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[29] I am reporting here the data from Experiment 4 of Chien & Wexler (1990). The experiment described there is the final version of the work-in-progress described in Chien & Wexler (1988).

systematically lower than the percentage of their responses to name-reflexive questions.[30] Chien and Wexler explained this result as a consequence of children not demonstrating clear knowledge of the concepts of quantified NPs until the age of 5. However, as we will see, Chien and Wexler did not provide clear evidence of children understanding quantification even after age 5.

With respect to pronouns, Chien and Wexler found that 2- and 3-year-old children seem to know that a nonreflexive pronoun can refer to a definite NP outside the sentence. However, even in the age range of 5 to 6, children did not know that a pronoun must not refer to a local c-commanding NP. For sentences such as "Is Mama Bear touching her?", where **her** referred to Mama Bear, children younger than 4 years incorrectly answered "yes" about 70% of the time, children between 4 and 5 incorrectly answered "yes" about 60% of the time, children between 5 and 6 incorrectly answered "yes" about 50% of the time, and children between 6 and 7 incorrectly answered "yes" about 24% of the time.

In contrast to this, Chien and Wexler found that children in the age range of 5 to 6 know Principle B for bound variable cases. When the question matched the picture, children in this age range correctly answered "yes" more than 90% of the time. When there was a mismatch, children between 5 and 6 correctly answered "no" about 84% of the time, while children older than 6 correctly answered "no" about 87% of the time. Chien and Wexler took these results to indicate that children know the binding theory but lack the necessary pragmatic principle. The

[30]Adults gave almost perfect responses to both kinds of reflexive questions.

reinterpreted Principle B states that only pronouns as bound variables are subject to binding theory (Chien & Wexler, 1988), while Principle P governs the choice of reference in a clause so that two different indices do not refer to the same thing (Chien & Wexler, 1990).

Two difficulties for this account arise at this point. First, Chien and Wexler have shifted the burden of explanation to a pragmatic rule without defining it precisely or explaining how it is acquired. Furthermore, and perhaps more problematic for their position, the only evidence Chien & Wexler (1988, 1990) supplied supporting their claim that children have Principle B is the fact that they reject "Is **every** bear touching her?" to describe the picture with three female bears and a girl, where each bear is touching herself and the girl is not being touched. Given that these same children accept "Is **Mama Bear** touching her?" to describe the picture with a female bear and a girl, where the bear is touching herself and the girl is not being touched, it might be the case that children simply prefer not to accept pronouns coindexed with quantifiers, for reasons independent of Principle B, for example because they do not yet understand how quantifiers work. Chien and Wexler try to respond to this potential objection by showing that children understand the quantifiers **all** and **every** in the adult way; however, they only used sentences such as "Is every bear touching Goldilocks?", which crucially did not involve pronouns. Another possibility is that children do not allow <u>singular</u> pronouns to be bound by **every** because of semantic number disagreement between **every bear** (which denotes a plurality) and **her** (which is singular). We will return to and clarify some of these issues in discussion of some of the studies described below. In particular, Chien & Wexler (1991) responded to some criticisms of their earlier work by investigating children's interpretation of complex sentences involving quantified antecedents (see section 2.2.1.4 below).

2.2.1.2 Some Conflicting Results: Lombardi & Sarma (1989)

A few studies have obtained results which contradict those of Chien & Wexler (1988, 1990). Lombardi & Sarma (1989) attempted to test the hypothesis that children's performance on Principle B can be accounted for by Chien and Wexler's reformulation of Principle B, using different tasks and different sentence types. Lombardi and Sarma's experiment had two parts, each of which consisted of a truth value judgment task and an act-out task; however, their truth value judgment task had too few trials, so only results from the act-out task are reported.

Lombardi and Sarma tested nineteen children, aged 4;0 to 6;2. Of these, the data of four were discarded because of inattention or no understanding of the task. In Part 1, the children were asked to act out sentences like (42). In Part 2, they were asked to act out sentences like (43). Ten children were given Part 1 first, and five were given Part 2 first.

(42) Monkey wants Bert to give him a present.

(43) Monkey wants every puppet to give him a present.

All of these sentences contained the dative verbs **give**, **get**, **feed**, or **find**. Previous work such as Chien and Wexler's had used verbs such as **wash**, which can be used either transitively or intransitively and may have had a bias towards a reflexive interpretation since they have a reflexive meaning when used without an object.

Lombardi and Sarma did not find better performance on Principle B for bound variable pronouns than for referential pronouns. The children had about 42% correct responses for bound variables, and about 48% correct responses for referential pronouns. In addition, none of their subjects performed better on Principle B for bound variables than for referential pronouns. Results from control sentences such as (44) suggest that some of the children did not understand the meaning of **every**.

(44) Monkey wants every puppet to give Raccoon a toy.

Four of the fifteen subjects consistently used only one puppet in these trials, even though these sentences did not involve any binding principles and should have been easy. These subjects did not show any consistent response pattern for the other sentences tested.

Lombardi and Sarma suggest, following Grimshaw & Rosen (1990), that children may do better on the bound variable sentences in Chien and Wexler's experiment not because they are better at bound variables, but because they are worse at them. The correct answer for these sentences is to reject them. If children do not accept bound variable interpretations for pronouns, there are two possible reasons for them to reject such sentences: a Principle B violation and the fact that there is a pronoun used as a bound variable.

2.2.1.3 More Conflicting Results: Kaufman (1987, 1988)

Kaufman (1987, 1988) has also argued against Chien and Wexler's results. Kaufman claimed that Chien and Wexler had not clearly demonstrated that children are delayed with respect to Principle B. Discussing Wexler & Chien (1985), Kaufman pointed out that only children in the oldest age groups performed better on reflexive sentences than on pronominal sentences; at the younger ages, pronominal performance was at least as good and often better than reflexive performance. In addition, Wexler & Chien (1985) did not supply reports of statistical significance, so it was impossible to determine if the scores for the pronominal and reflexive at any given age were significantly different from chance or from each other.[31] Kaufman also argued against the design of Wexler & Chien (1985): "sentences with reflexives and pronominals were tested at the same time, the children apparently having to shift in their judgments from one to the other, with no filler sentences in between" (Kaufman, 1988, p.159).

With these criticisms in mind, Kaufman designed another experiment to test children's abilities with reflexives and pronominals. Kaufman tested sixty children in two age groups: 2;7 to 3;11 and 5;0 to 6;5. Each test consisted of a truth value judgment task, as developed by Crain & McKee (1985), and a controlled interview, in two sessions. In one session the child was given a test with quantified antecedents, and in the other session the child was given a test with referential antecedents (the order of tests was counterbalanced across children). Kaufman used both simple sentences, as in (45a) and (46a), and complex sentences, as in (45b) and (46b).

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[31]This information was provided in Chien & Wexler (1988, 1990).

(45) a. The monkey scratched him.
b. The dog wanted the boy to wash him.

(46) a. Every monkey scratched him.
b. Every dog wanted the boy to wash him.

In the truth value judgment task, Kaufman obtained the results shown in the table in (47) (from Kaufman, 1988, p.227).

(47) a. Percentages Correct with Referential Antecedents

age	Youngest		Oldest	
sentence type	simple	complex	simple	complex
Accept	93	88	93	88
Reject	77	56	90	64

b. Percentages Correct with Quantified Antecedents

age	Youngest		Oldest	
sentence type	simple	complex	simple	complex
Accept	88	82	96	87
Reject	82	58	87	70

With the exception of the youngest children's rejection of mismatched complex sentence-meaning pairs, these results were significantly different better than chance.[32] Kaufman also found that children's performance with quantificational antecedents was not significantly different from their performance with referential antecedents, i.e. in both cases performance was quite good.[33]

[32]The percentages of youngest children's rejection of complex sentences (with both referential and quantificational antecedents) were not significantly different from chance. All other percentages were significantly different from chance at the .01 level, except for the oldest children's rejection of complex sentences with referential antecedents (which was significant at the .05 level).

[33]Results were similar for the interview procedure, but the percentages correct were higher across the board; see Kaufman (1988, p.233).

Kaufman suggests that some of the errors children made in other experiments designed to test Principle B may have resulted from the children having incorrectly understood the nature of the verb. In pilot work, Kaufman had found that a few children "characterized all action as transitive, even when it was clearly reflexive to the experimenter" (Kaufman, 1987, p.6). When given the sentence "Show me the cow splashed the sheep", these children had the cow jump up and down in the water with the sheep nearby but not being splashed. When asked what they were doing, these children said, "The cow was splashing the sheep"; under the same type of circumstances, these children also accepted this as a correct description of the event when it was uttered by the experimenter. So, for both production and comprehension, these children were unable to distinguish between "transitive" and "nontransitive" actions. As Kaufman explains,

> I could hardly expect these children to reject a sentence like "The horse hurt him" when the horse hurt himself in the presence of the pig, if they in fact construed the situation as one in which the horse <u>was</u> hurting the pig (Kaufman, 1987, p.6).

Kaufman's study included a pretest to eliminate potential subjects who did not give evidence of distinguishing between reflexive and transitive activity with sentences with full NPs.

Chien & Wexler (1990) argue extensively against Kaufman's results. The children in Kaufman's study did much better on simple Principle B violations than the children in Chien and Wexler's study. Chien and Wexler argue that this is because Kaufman did not include reflexive sentences in her study. Because of this, there was no relevant comparison with how well the children in Kaufman's study obeyed

Principle A. Also, Chien and Wexler claim that the lack of reflexives in Kaufman's study created a bias in Kaufman's stimuli, since a "self-action" was never the correct response.

Chien and Wexler also discredit Kaufman's claim that children do not perform differently in reaction to pronoun sentences involving a quantified antecedent as opposed to a referential antecedent. Since in Kaufman's study the children's correct response rate to simple sentences approached adults' level, Chien and Wexler examined the complex sentences with referential and quantified antecedents, as in (45b) and (46b), and noted that the quantifier sentences that Kaufman used were irrelevant to Chien and Wexler's claim about children's knowledge of Principle B versus Principle P. In order to test this claim, Kaufman should have used sentences like (48a), rather than sentences like (46b) [repeated here as (48b)].[34]

(48) a. The dog wanted every boy to wash him.
b. Every dog wanted the boy to wash him.

However, Kaufman's complex sentences with quantifier antecedents do give some indication of whether the children in her study could quantifier bind. The children in her study correctly accepted bound variable interpretations more than 80% of the time.

What can we conclude about children's knowledge of Principle B with respect to quantifier-bound pronouns? The studies of Lombardi & Sarma and Kaufman do not replicate the results obtained by Chien and Wexler, since they find no difference between bound variables and other pronouns, but so far, at least, no studies directly contradict the Chien

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[34]Chien & Wexler (1991) use sentences similar to (48a). See section 2.2.1.4 below.

and Wexler results, in that no studies find the opposite (i.e., no studies find children obeying Principle B with respect to non-quantifier-bound pronouns but not with bound variable pronouns). Grimshaw & Rosen (1990) conclude from this that there is a real difference between the two kinds of pronouns. We are then faced with the question of what this difference may mean, and whether it can explain the Principle B findings. We will return to discussion of these issues below.

2.2.1.4 Chien & Wexler (1991)

As noted previously, to show that children obey Principle B with quantified antecedents more than they obey Principle B with non-quantified-antecedents, it is necessary to show that children understand how quantifiers work and can bind pronouns to quantified antecedents.

Chien & Wexler (1991) investigated children's understanding of complex sentences involving quantified antecedents. Using a yes/no judgment task, Chien and Wexler tested 281 children between the ages of 3 years and 8 years, and fifteen adults. Their study included three sets of questions. Set 1 consisted of name-name-name and name-name-pronoun questions, as in (49) and (50).

(49) a. Is Pinocchio thinking that Goldilocks is washing Mama Bear?
b. Is Pinocchio thinking that Goldilocks is touching Mama Bear?

(50) a. Is Goldilocks thinking that Mama Bear is pointing at her?
b. Is Goldilocks thinking that Mama Bear is touching her?

Set 2 consisted of name-quantifier-name and name-quantifier-pronoun questions, as in (51) and (52).

(51) a. Is Pinocchio thinking that every bear is pointing at Goldilocks?
b. Is Pinocchio thinking that every bear is washing Goldilocks?

(52) a. Is Goldilocks thinking that every bear is washing her?
b. Is Goldilocks thinking that every bear is pointing at her?

Finally, Set 3 consisted of quantifier-name-name and quantifier-name-pronoun questions, as in (53) and (54).

(53) a. Is every bear thinking that Pinocchio is touching Goldilocks?
b. Is every bear thinking that Pinocchio is pointing at Goldilocks?

(54) a. Is every bear thinking that Goldilocks is touching her?
b. Is every bear thinking that Goldilocks is washing her?

For the questions in each set, there was both a match picture (the (a) cases) and a mismatch picture (the (b) cases). For the control mismatch cases (the cases with names, rather than pronouns: (49b), (51b), and (53b)), the mismatch pictures differed from the match pictures in various ways. For (49b), "Is Pinocchio thinking that Goldilocks is touching Mama Bear?", the picture showed Goldilocks touching herself, not Mama Bear. For (51b), "Is Pinocchio thinking that every bear is washing Goldilocks?", the picture showed two bears washing Goldilocks, but a third bear <u>not</u> washing Goldilocks. For (53b), "Is every bear thinking that Pinocchio is pointing at Goldilocks?", the picture showed three bears, each thinking that Pinocchio is pointing at himself, but not at Goldilocks.

For the experimental mismatch cases, (50b), (52b), and (54b), the mismatch pictures differed from the match pictures more consistently. In each case, the pronoun referred to the local antecedent. For (50b), "Is Goldilocks thinking that Mama Bear is touching her?", the picture showed Goldilocks thinking that Mama Bear is touching herself, not Goldilocks. For (52b), "Is Goldilocks thinking that every bear is pointing at her?", the picture showed Goldilocks thinking that each of the three bears is pointing at herself, not at Goldilocks. Finally, for (54b), "Is every bear thinking that Goldilocks is washing her?", the picture showed three bears, each bear thinking that Goldilocks is washing herself, not the bear.

The questions in Set 1 and Set 2 were designed to test children's knowledge of the syntactic Principle B versus their knowledge of the pragmatic Principle P. The questions in Set 3 were designed to test whether children have a true bound variable interpretation of pronouns.

Chien and Wexler's results are shown in (55).

(55) Percentages Correct for Each Age Group
(N = name, Q = quantifier, P = pronoun)

age group	G1[35]	G2	G3	G4	G5	A
Control Match						
N-N-N	94.17%	94.44%	94.96%	95.92%	98.45%	100%
N-Q-N	88.89%	93.52%	94.05%	96.08%	100%	100%
Q-N-N	96.30%	97.92%	97.22%	96.67%	100%	100%
Control Mismatch						
N-N-N	85.83%	88.10%	89.53%	92.52%	94.95%	100%
N-Q-N	77.78%	65.74%	66.67%	78.43%	80.21%	100%
Q-N-N	72.22%	66.67%	69.44%	78.67%	79.44%	97.78%

[35]G1, age 3 to 4; G2, age 4 to 5; G3, age 5 to 6; G4, age 6 to 7; G5, age 7 to 8; A, adults. Chien and Wexler do not discuss how many children were in each age group.

	G1	G2	G3	G4	G5	A
Experimental Match						
N-N-P	81.67%	84.92%	88.37%	87.76%	90.40%	98.89%
N-Q-P	77.78%	89.81%	90.48%	95.98%	98.96%	100%
Q-N-P	74.07%	75.00%	59.26%	76.00%	82.22%	100%
Experimental Mismatch						
N-N-P	46.67%	46.56%	52.71%	46.94%	49.50%	100%
N-Q-P	61.11%	69.44%	77.38%	85.29%	93.75%	100%
Q-N-P	61.11%	34.38%	37.04%	42.00%	54.44%	97.78%

When the question matched the picture, children's response patterns to the three types of control sentences were almost the same; they made correct judgments almost perfectly in all three cases (name-name-name, name-quantifier-name, and quantifier-name-name). A mismatch between the question and the picture depressed the children's performance, especially for the conditions involving quantified NPs (name-quantifier-name and quantifier-name-name).* From this, Chien and Wexler concluded that before age 5, children already demonstrated their ability to handle complex constructions with one embedded clause when quantified NPs were not involved, but that when the integration of quantificational concepts into complex constructions was required, children in the three youngest age groups had some problems.

For the experimental match cases, Chien and Wexler found that children responded correctly to the majority of the pronoun items when the situation required a pronoun to corefer with a nonlocal referential NP that c-commanded it (name-name-pronoun and name-quantifier-pronoun). Children younger than 6 seemed to have some trouble interpreting pronouns as bound variables (quantifier-name-pronoun). The G3 children

*In this case, a correct response was a rejection of the picture-sentence pair, which means that a depression in percentage correct here means a greater tendency for children to accept questions with quantifiers.

(the five-year-olds) performed at only slightly higher than chance level for the match quantifier-name-pronoun cases, while G1 and G2 children seemed to perform slightly better, accepting the pronoun coindexed with the nonlocal c-commanding quantified antecedent about 75% of the time.[37] Why were the children in G3 worse than both the younger children (G1 and G2) and the older children (G4 and G5) at accepting sentences with a quantifier bound to a (non-local) quantified NP? Chien and Wexler do not provide an answer to this question.

In the experimental mismatch conditions, children in all age groups permitted a pronoun to be coreferential with a local referential NP that c-commanded it (name-name-pronoun and quantifier-name-pronoun) half of the time, in violation of Principle P.[38] However, in most cases children did not allow a pronoun to be bound by a local quantified NP which c-commanded the pronoun (name-quantifier-pronoun), which would violate Principle B.

Chien and Wexler argue that these findings support the reformulated Principle B and pragmatic Principle P, and replicate the findings of Chien & Wexler (1990). However, the results also show the difficulty that children have with quantification. In addition, in spite of the fact that children tended to overreject sentences with quantifiers, the children in the three youngest age groups (ages 3 to 6), accepted quantifier binding in violation of Principle B almost a

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[37]Chien and Wexler do not discuss whether any of these differences are statistically significant.

[38]Chien and Wexler do not provide any discussion of whether these figures are around the 50% level because of chance performance by each child, or because of an averaging of good and poor performance across children.

third of the time.[39]

2.2.1.5 Evidence from Russian: Avrutin & Wexler (1992)

Avrutin & Wexler (1992), and also Avrutin (1994), present evidence from Russian which they claim supports the reformulated Principle B. Besides attempting to add crosslinguistic support to the Wexler and Chien findings, Avrutin and Wexler argue that this study is of interest because of the nature of Russian possessive pronouns, which must be disjoint from subject antecedents. The prediction then is that children who do not know Principle P will accept possessive pronouns which corefer with subjects, but will reject possessive pronouns bound by quantifier subjects.

In Russian, as in English, pronouns cannot be locally bound; reflexives must be locally bound, except in infinitival clauses (56).

(56) a.*[Papa medved']$_i$ potër ego$_i$.
Father bear scrubbed him

b. [Papa medved']$_i$ potër sebja$_{i/*j}$.
Father bear scrubbed himself

Unlike English, Russian shows antisubject orientation of possessive pronouns (57a); only reflexive forms can be used to refer to the subject (57b).[40]

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[39]The relevant figures here are the percentages of incorrect acceptance (derived from table (55)) for the experimental mismatch condition with name-quantifier-pronoun sentences. These figures were 38.89% for G1, 30.56% for G2, and 22.62% for G3 (assuming that there were no responses other than rejection and acceptance).

[40]Avrutin and Wexler argue that this antisubject orientation is accounted for if possessive pronouns in Russian are heads which move to INFL at LF, basing this analysis on work by Hestvik (1992).

(57)a. [Papa medved']$_i$ potër ego$_{*i/j}$ golovu.
Father bear scrubbed his head

b. [Papa medved']$_i$ potër svoju$_{i/*j}$ golovu.
Father bear scrubbed self's head

Avrutin and Wexler tested sixteen Russian-speaking children, ages 4 years to 7 years, and three adults, using the truth value judgment task. Sentences with definite NPs, such as those in (56) and (57), were compared to sentences with quantified antecedents, such as (58) and (59).

(58) a.[Každyj medved']$_i$ potër ego$_i$.
Every bear scrubbed him

b. [Každyj medved']$_i$ potër sebja$_{i/*j}$.
Every bear scrubbed himself

(59) a. [Každyj medved']$_i$ potër ego$_{*i/j}$ golovu.
Every bear scrubbed his head

b. [Každyj medved']$_i$ potër svoju$_{i/*j}$ golovu.
Every bear scrubbed self's head

Avrutin and Wexler found that when the antecedent was a definite NP, the children's responses to sentences with a pronoun were around the chance level and were significantly worse than their responses to sentences with reflexives. The children incorrectly accepted a local antecedent for the pronoun 52% of the time (56a), but correctly accepted a local antecedent for the reflexive 94% of the time (56b), and correctly rejected sentences with no local antecedent for the reflexive 97% of the time. In addition, children incorrectly allowed a local antecedent for the possessive pronoun 56% of the time (57a), but correctly allowed a local antecedent for the possessive reflexive 94% of the time (57b), and correctly rejected sentences with no local antecedent for the possessive reflexive 98% of the time.

There was no improvement in children's responses to sentences with pronouns when the antecedent was **každyj** ("every"). Children incorrectly allowed a local antecedent for the pronoun 41% of the time (58a), and incorrectly allowed a local antecedent for the possessive pronoun 50% of the time (59a). Responses to quantified sentences with reflexives and reflexive possessives were almost perfect. The children correctly allowed a local antecedent with reflexives 97% of the time (58b), and correctly rejected sentences with no local antecedent 94% of the time. With reflexive possessives, they correctly allowed a local antecedent 92% of the time (59b), and correctly rejected sentences with no local antecedent 92% of the time.

Avrutin and Wexler's study included two additional factors. First, they included sentences such as (60) and (61) below[41], which were similar to the "Bound Pronoun questions" of Thornton (1990) (see section 2.1.2 above).

(60) Ja znaju kto potër ego. Každyj medved'.
I know who scrubbed him. Every bear.

(61) Ja znaju kto potër ego golovu. Každyj medved'.
I know who scrubbed his head. Every bear.

The story for (60) showed three bears and a boy; each bear scrubbed himself, and one bear also scrubbed the boy. The story for (61) showed

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[41]Two additional sentence types of this sort were included, using the reflexive pronoun. In one case the sentence was a true description of the situation, and in the other case the sentence was a false description of the situation. These sentences were as in (i).

i. Ja znaju kto potër sebja. Každyj medved.
I know who scrubbed himself. Every bear.

There were no sentence types of this sort with non-quantificational answers (all of the answers were "Každyj medved").

three bears and a boy; each bear scrubbed his own head, and one bear also scrubbed the boy's head. Avrutin and Wexler found that when the antecedent is the quantifier **kto** ("who"), children's responses to sentences with pronouns improved significantly compared to their responses to sentences with definite NP antecedents. As discussed above, with definite NP antecedents, children incorrectly accepted a local antecedent for the pronoun 52% of the time (56a), and 56% of the time for possessive pronouns (57a). In these cases with **kto**, children incorrectly allowed a local antecedent for the pronoun 17% of the time for pronouns (60), and 20% of the time for possessive pronouns (61). However, as discussed in section 2.1.3 above, there may be other reasons why children reject this kind of sentence.

Second, Avrutin and Wexler compared preverbal pronouns and postverbal pronouns, but did not find significant differences. As discussed above, children incorrectly accepted sentences with a postverbal pronoun 52% of the time (56a); they incorrectly accepted sentences with a preverbal pronoun (e.g., "Papa medved ego potër") 34% of the time. However, it is not clear whether the preverbal pronoun in Russian is a clitic or whether its preverbal position is a result of scrambling. For discussion of this, and comparison to McKee (1992) (which showed no Principle B problems for pronominal clitics in Italian), see Avrutin & Wexler (1992, pp.274-280).

Avrutin and Wexler need to explain why children's responses were not better when the antecedent was **každyj** ("every") than when the antecedent was a definite NP. In fact, they argue that **každyj** is different from **every** in that it is structurally ambiguous; it is not unambiguously quantificational. Avrutin and Wexler explain this as follows. First, sentences such as (62) are ambiguous, with the two interpretations in (63).

(62) Každyj student piset sočinenija.
Every student writes papers.

(63) a. Every student is such that he/she writes papers.
b. Student(s) write/are writing papers, and it is true of each of them.[47]

Avrutin and Wexler claim that only (63b) requires the presupposition that there are at least some students who write papers, and the statement is true or false depending on whether this presupposition is true of each of them. Avrutin and Wexler note that both the English and the Russian versions of (62) have the two interpretations in (63), but claim that in Russian, but not in English, this difference is represented syntactically. In Russian, the reading in (63b) requires that a set of objects to be quantified be specified in advance; in English, on the other hand, Avrutin and Wexler claim that this is not necessary.

Avrutin and Wexler propose that when **každyj** has the reading in which the specification of a set of objects is necessary, this set of objects is denoted by an empty NP structurally situated in Spec CP. They suggest that **každyj** is operating similarly to the way that Heim, Lasnik & May (1991) proposed for **each** in **each other**. **Each** moves out of the reciprocal and adjoins to its antecedent, as in (64).

(64) John and Mary like each other.
LF: [John and Mary] each like [**t** other].

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[47]This example and its interpretations are Avrutin and Wexler's (17) a, b, and c (Avrutin & Wexler, 1992, p.270).

After this adjunction, **each** picks individuals out of the set specified by the plural NP it is adjoined to (in this case, **John and Mary**). Avrutin and Wexler suggest that **každyj** functions like **each**, so it also moves and adjoins to the NP that specifies the set of objects, in this case an empty NP in Spec CP. As a result, the pronoun is not referentially dependent on its antecedent, but the antecedent simply indicates the set from which values should be picked.

Returning to the sentences used in this experiment, Avrutin and Wexler argue that (58a) [repeated here as (65)] has only one representation in English, given in (66), but has two representations in Russian, given in (67).

(65) [Každyj medved']$_i$ potër ego$_i$.
     Every bear scrubbed him.

(66) $\forall$x (bear(x))(x scrubbed x)

(67) a. [každyj medved']t poter ego
        [every bear] t scrubbed him

     b. [[e] každyj] [[t medved'] potër ego]
        [[e]every] [[t bear] scrubbed him]
        (e = {bears})

While the single representation in English, (66), requires coindexation of **him** and **every bear**, only (67a) requires coindexation of **ego** and **každyj medved'**; (67b) does not include a pronoun bound by a quantifier. Avrutin and Wexler argue that the representation for (67b) is (68).

(68) $\exists$ S (S = {bears}) $\forall$ B ([B bear] scrubbed him)

According to Avrutin and Wexler,

> This means that there exists a previously specified set of bears, and the sentence is true for each specification of the members of this set (roughly, "for this bear, for that one, and for that one"). In [(68)], the antecedent of the pronoun is not a quantifier, but a definite NP [B bear]. For adults,

> Principle P requires coindexation of the pronoun and the antecedent, and therefore this reading [(66b, 67)] is ruled out by Principle B. Thus, this reading is unacceptable for adults. As the other reading [(66a)] is also unacceptable, for adults the sentence is unacceptable under the interpretation where **každyj medved'** "every bear" is coreferential with the pronoun. For children who do not have Principle P, however, the reading [(67b, 68)] _is_ acceptable, as there is nothing to prevent the children from taking the pronoun to be contraindexed with the quantifier (Avrutin & Wexler, 1992, p.273].

Because of this structural ambiguity, Avrutin and Wexler argue that children should sometimes accept sentences such as (65) above. As discussed above, this is the result which they obtain. Sentences with **každyj** and a local pronoun were accepted 41% of the time, and sentences with **každyj** and a local possessive were accepted 50% of the time (although on their account both of these sentence types are unacceptable in adult Russian because of Principle P).

What can we conclude from this, with respect to the reformulation of the binding theory? Unfortunately, because of these differences between **every** and **každyj**, we can't conclude much. All of Avrutin and Wexler's quantificational sentences contain **každyj**, which by their own account is not required to have a quantificational representation. If **každyj** is ambiguous between a quantificational and non-quantificational representation, how can we tell that children reject these sentences just when the representation is quantificational, but accept them otherwise?

2.2.1.6 Evidence from Icelandic: Sigurjónsdóttir & Hyams (1992)

Sigurjónsdóttir & Hyams (1992) investigated children's understanding of the Icelandic local anaphor **sjálfan sig**, the "so-called long-distance anaphor" sig, and pronouns. Sigurjónsdóttir and Hyams conclude that Icelandic children perform well on structures involving variable binding but perform poorly with both pronouns and sig in the local domain, where binding is ruled out and coreference is involved. Like the study by Avrutin and Wexler discussed in the previous section, this study is of interest both because of the possibility of adding crosslinguistic support to the theories under discussion here, and because of the addition of another linguistic element, in this case sig, which can be used to test the apparent developmental delay of pronouns in acquisition.

There have been a number of different descriptions of the nature of sig. It is not entirely clear that sig must always be considered a bound variable (see Thráinsson, 1991).[43] Sigurjónsdóttir and Hyams rely on an analysis of sig based on the binding theory proposed by Reinhart & Reuland (1989, 1991, 1993). I will briefly describe Reinhart and Reuland's theory here before turning to Hyams and Sigurjónsdóttir's study.

Reinhart and Reuland's version of binding theory attempts to account for a wider range of facts than earlier versions of binding theory, including facts about long-distance anaphors. Instead of making use of hierarchical relations, such as c-command, Reinhart and Reuland's binding conditions are conditions on predicates and reflexive-marking. They distinguish two structural binding domains: the domain of the first (accessible) subject (the local domain) and the domain of the first

[43]Whether local uses of sig are considered bound variable uses is theory-dependent (depending on whether local reflexives are considered bound variables).

finite INFL (the medium-distance domain). Reinhart and Reuland also distinguish two types of anaphors: complex anaphors which must be bound in the local domain (SELF anaphors), and simplex expressions which are medium distance (SE anaphors).[44]

Reinhart and Reuland propose that both SELF and SE anaphors are referentially defective NPs which cannot be used deictically. Binding is the mechanism which assigns anaphors the content necessary for their referential interpretation. Pronouns are assumed to occur in determiner position, but project as full NPs. SE anaphors, on the other hand, such as Icelandic **sig**, differ from pronouns in that they lack a complete specification for phi-features (i.e., number, gender, and person), and so do not project an argument that can be interpreted independently.[45] This lack of phi features in SE anaphors is responsible for their subject orientation and for their INFL locality constraints. In order for SE anaphors to serve as arguments, they adjoin to I (AGR), where they inherit the subject's features. AGR is the only element which meets the requirements that it c-commands the anaphor, is in head position, and carries phi-features (Reinhart & Reuland, 1991, p.301). Since SE anaphors must move to I to acquire phi features, SE anaphors fall under both movement theory and binding theory. With respect to binding theory, SE anaphors such as **sig** pattern with pronouns, subject to Principle B, and are not reflexivizers (Reinhart & Reuland, 1993, p.659).

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[44]Other uses of anaphors are considered to be logophoric.

[45]SE-anaphors may have person features, but always lack features for gender and number.

Reinhart and Reuland's binding conditions are not conditions on specific lexical items (pronouns or SE anaphors), but are sensitive both to anaphor-types and to predicate-types. The universal generalization that they argue for is that reflexivization must be lexically licensed.

(69) Conditions:
A: A reflexive-marked syntactic predicate is reflexive.
B: A reflexive semantic predicate is reflexive-marked.[44]

In addition, the task of ruling out pronominal anaphora in their theory is divided between condition B and conditions on the well-formedness of chains.

Reinhart and Reuland claim that their theory, like that of Reinhart (1983), consists of only conditions A and B, and only governs bound variable anaphora (Reinhart & Reuland, 1993, p.657, fn.2 and

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[44]These conditions require the definitions in (i).

(i) a. The syntactic predicate formed of (a head) P is P, all its syntactic arguments, and an external-argument of P (subject).

The syntactic arguments of P are the projections assigned Theta-role or Case by P.

b. The semantic predicate formed of P is P and all its arguments at the relevant semantic level.

c. A predicate is reflexive iff two of its arguments are coindexed.

d. A predicate (formed of P) is reflexive-marked iff either P is lexically reflexive or one of P's arguments is a SELF anaphor.

(Reinhart & Reuland, 1993, p.678).

Reinhart and Reuland also note that these definitions and the binding conditions should be relativized to an index (in order to guarantee that a given SELF anaphor, indexed j, would not count as licensing the coindexation of two arguments with a different index, i). See Reinhart & Reuland (1993, pp.662-663).

p.674). Cases of non-coreference are handled by Rule I of Grodzinsky & Reinhart (1993) (for discussion see section 1.4.2.2).

Sigurjónsdóttir and Hyams tested fifty-five Icelandic children between the ages of 3;3 and 6;0 (and ten adult controls) on seventy-two sentences in the indicative, subjunctive, and infinitive moods, with **sjálfan sig**, **sig**, and the pronouns **hann** ("he") and **hún** ("she") using an act-out task and a truth value judgment task. In addition, they examined the effects of two different verb classes, the **raka** ("shave") class of verbs, which allows **sig** to take either a local or a long-distance antecedent, and the **gefa** ("give") class of verbs, which strongly biases toward the long-distance antecedent.

In the act-out task, most of the children in each age group seemed to know that the anaphor **sjálfan sig** has to be locally bound and that the pronouns **hann** and **hún** cannot take a local antecedent, so that children did very well on both pronouns and anaphors. However, in the truth value judgment task, which is supposed to tap children's multiple interpretations of a sentence, there did seem to be a delay of pronouns compared to **sjálfan** sig. While 90% of the children who were 4 years and older knew that **sjálfan sig** has to take a local antecedent, only 11% to 44% knew that pronouns cannot take a local antecedent. Children's performance with **sjálfan sig** was stable across the two tasks, while their performance with pronouns varied significantly between the act-out task and the truth value judgment task.

Sigurjónsdóttir and Hyams analyzed the results for **sig** with respect to the subjunctive, indicative, and infinitive sentences with both the **raka** and the **gefa** verbs in the act-out and the truth value judgment tasks. They found that many Icelandic children age 4;6 and under only had the reflexive-marked lexical entry of verbs of the **raka** class. These children only allowed **sig** to take a local antecedent, while adults accepted both the local and long-distance interpretations. At the ages of 4;6 to 5;0, two developments occurred. Children acquired the transitive entry of **raka** verbs, and so started to allow a logophoric (long-distance) use of **sig** in this verb class. Second, the children distinguished between subjunctive and indicative verb forms and appropriately restricted the logophoric (long-distance) use of **sig** to subjunctive complements. With the **gefa** verbs, children's responses differed sharply from those of adults. In the act-out task, all adults favored the long-distance antecedent for **sig**, and in the truth value judgment task, 80% of the adults allowed only a long-distance interpretation of **sig**. According to Reinhart and Reuland's binding theory, this is as expected; Principle B rules out local binding of **sig** with a **gefa** verb, because the predicate is not reflexive-marked and only a logophoric interpretation is available. However, in the act-out task, 57% to 80% of the children in all age groups chose the local antecedent for **sig**. In the truth value judgment task, all the children in the youngest age group (ages 3;3 to 4;0) and 42% to 60% of the children in the older age groups (ages 4;0 to 6;0) allowed both a local and a long-distance interpretation of **sig**; 10% to 20% accepted only the local interpretation. In other words, many of the children in this study allowed **sig** to have a local antecedent with the **gefa** verbs, in apparent violation of Principle B.

Sigurjónsdóttir and Hyams predicted that those children who did not allow a local interpretation of pronouns would also not accept a local antecedent for **sig**, and conversely, children who allowed a pronoun to take a local antecedent would also allow a local interpretation of **sig**. Most of the thirty-six children included in this analysis behaved as predicted.[47]

Sigurjónsdóttir and Hyams claim that the data from Icelandic children strongly support the binding/coreference distinction. They suggest that Icelandic children have knowledge and use of Reinhart and Reuland's Conditions A and B but not of Rule I. This makes a number of specific predictions for Icelandic. It suggests that children will do well with the reflexive **sjálfan sig**, because (the Reinhart and Reuland) Condition A requires that **sjálfan sig** be interpreted as a bound variable. As noted above, this prediction is confirmed. 90% of the children who were 4 years and older bound **sjálfan sig** to a local antecedent.

For pronouns, the predictions are the same as for English: children should rule out binding of a pronoun to a local antecedent, but will not reliably rule out coreference. This predicts that children will incorrectly allow the local antecedent for sentences such as (70).

(70) *Andrés Önd vildi [að Jenni$_i$ þurrkaði$_{(subj.)}$ honum$_i$].
Donald Duck wanted that Jerry dried him
"Donald Duck wanted Jerry to dry him"

Sigurjónsdóttir and Hyams found that 56% to 89% of the children (depending on age group) allowed the pronoun to corefer with the local

[47]This result was significant at the .02 level.

antecedent in the truth value judgment task.[48]

In addition, Sigurjónsdóttir and Hyams predicted that children's performance would be good when the pronoun occurs in a context in which binding is allowed, since by hypothesis children's problems are problems with Rule I, not with binding itself. Accordingly, children should readily accept a long-distance antecedent for the pronouns in sentences such as those in (71a) and (71b), which contain a subjunctive complement and an indicative complement, respectively.

(71) a. Andrés Önd$_i$ vildi [að Jenni þurrkaði$_{(subj.)}$ honum$_i$].
Donald Duck wanted that Jerry dried him
"Donald Duck wanted Jerry to dry him"

b. Andrés Önd$_i$ sá [að Jenni þurrkaði$_{(ind.)}$ honum$_i$].
"Donald Duck saw that Jerry dried him"

Sigurjónsdóttir and Hyams found that children accepted the long-distance antecedent 70% to 95% of the time when the pronoun was contained inside an indicative or subjunctive complement.

In contrast to this, when a pronoun is contained in an infinitive complement in Icelandic, it may not take a matrix subject as antecedent,

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[48]In the act-out task, the majority of children acted out the nonlocal interpretation. Sigurjónsdóttir and Hyams suggest that an introductory sentence in the act-out task, which contained an additional NP not mentioned in the test sentence, may be partially responsible for the children's good performance on pronoun sentences in the act-out task as compared to the truth-value judgment task; children may have been choosing the extraclausal NP as antecedent because of relevance considerations (for additional discussion of relevance, see section 4.2.3). However, Sigurjónsdóttir and Hyams suggest that this provides only a partial explanation, since it does not explain why children strongly preferred the long-distance antecedent over the local one in the act-out task, while accepting both in the truth-value judgment task. Their explanation for this is based on Rule I. They suggest that only one interpretation is available for the children with sentences such as (70); this is the long-distance bound variable reading which they act out. In the truth-value judgment task, when children are forced to make judgments about coreference, the inaccessibility of Rule I results in chance performance.

as in (72).

(72) Jón$_i$ segir Pétir$_j$ [að Pro$_j$ klappan$_{(inf.)}$ honum$_{*j/?i/k}$ á
hverjum degi].
John tells Peter to pat him on every day
"John tells Peter to pat him every day"

Sigurjónsdóttir and Hyams thus predicted that children would show the same behavior in the infinitive case as in the local binding case, since binding is ruled out by the grammar, but coreference is permissible. They expected that children would accept the nonlocal antecedent in the indicative and subjunctive cases, but would perform "roughly at chance in the infinitive", as they do in the local case. This prediction was in fact confirmed; children accepted the long-distance antecedent for pronouns in sentences with infinitive complements between 35% and 56% of the time.

However, adult controls also accepted the local antecedent roughly half the time with infinitives, though adults are supposed to know and be able to apply Rule I. Sigurjónsdóttir and Hyams suggest that for sentences in which a pronoun is contained in an infinitive complement in Icelandic, under restructuring the infinitive sentence becomes monoclausal and thus takes on the properties of a local binding domain. They suggest that adults accepted the antecedent half the time because many of the adults did not appear to allow restructuring.[49] When there is no restructuring, the matrix subject may bind the pronoun, as in the indicative and subjunctive cases. Sigurjónsdóttir and Hyams noted that

[49] Sigurjónsdóttir and Hyams suggested that for some speakers of Icelandic control infinitives are IPs, which can undergo restructuring, while for other speakers the control infinitives are CPs, which cannot undergo restructuring. For further discussion see Sigurjónsdóttir & Hyams (1992, pp.393-396 and p.403, fn.38).

it was possible that at least some of the children had this more restrictive dialect which did not permit restructuring. It is thus impossible to determine what role inaccessibility of Rule I may have played in these children's results.

Assuming that **sig** is a bound variable in its logophoric use, Sigurjónsdóttir and Hyams predicted that children would readily accept a long-distance antecedent for **sig** in subjunctive complements. With **gefa** verbs, this was the case; 70% to 93% of the children accepted a long-distance antecedent for **sig** in these cases. However, the acceptance rate with **raka** verbs was much lower. Sigurjónsdóttir and Hyams suggest that the acceptance rates for **raka** verbs were depressed by the fact that some of the children had only a [+reflexive] entry for these verbs and so rejected the long-distance antecedent as a Principle A violation.

In the local domain, (Reinhart and Reuland's) Condition B rules out binding of **sig** with **gefa** verbs because the predicate is not reflexive-marked. Sigurjónsdóttir and Hyams predicted that children would, however, allow a local antecedent, because of difficulties with Rule I. In fact, children did allow a local antecedent for **sig** with **gefa** verbs, so that **sig** patterned like pronouns. However, Sigurjónsdóttir and Hyams note that children were more likely to accept a local antecedent for **sig** than for pronouns; no explanation for this difference was offered.

Sigurjónsdóttir and Hyams did not test pronouns or **sig** with quantified antecedents, but suggest that study of these structures would be useful future research. However, since the bound variable nature of **sig** is controversial, the results of Sigurjónsdóttir and Hyams with respect to the reformulation of the binding theory are inconclusive in the same ways as the studies discussed in previous sections.

2.2.1.7 Evidence from Dutch: Philip & Coopmans (1995)

Philip & Coopmans (1995) discuss work by Sigurjónsdóttir and Coopmans[50] that found that only 17% of the 5- and 6-year-old Dutch children they tested displayed knowledge that a pronoun cannot take a local antecedent.[51] This performance is unusually poor compared to the results found for other languages. Philip and Coopmans, following up on the work by Sigurjónsdóttir and Coopmans, investigated what it is about Dutch that gives children such problems with pronouns.[52]

Philip and Coopmans tested ninety-three monolingual Dutch children, eleven monolingual English children, and seventeen adult native-speakers of Dutch. The experiment consisted of a picture judgment task with four test conditions, eleven control conditions, and six filler conditions, with two different trials of each condition. The control and test conditions assessing anaphora were counterbalanced for

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[50]Philip and Coopmans cite the following:

Sigurjónsdóttir, S. & Coopmans, P. (1994) The acquisition of anaphoric relations in Dutch. Paper presented at the Child Language Seminar, Bangor. To appear in the proceedings, edited by M. Aldridge.

[51]Sigurjónsdóttir and Coopmans found that children were more willing to accept a local antecedent for pronouns with verbs like **aaien**, which can only be transitive, than with verbs like **wassen**, which can be either transitive or inherently reflexive (i.e., can take **zich**).

[52]Philip and Coopmans argue in support of a hypothesis of Sigurjónsdóttir and Coopmans that children learning Dutch have problems identifying pronouns as "referentially complete", and so treat them like SE anaphors such as **zich**. This argument is based on the binding theory of Reinhart & Reuland (1993)(see section 2.2.1.6 above).

match and mismatch picture-sentence pairs. However, all of the test conditions were mismatches; the expected adult response in each case was "no".

Three of Philip and Coopmans' test conditions (HN, QHN, and ZHN) tested the pronoun **haar** ("her"), and the fourth (ZHEM) tested the pronoun **hem** ("him"). Dutch example sentences and their English translations are shown for each test condition in (73) through (76).

(73) HN: picture shows a girl and a mother; the girl is holding her own ankle

a. Hier heb je een meisje en hier heb je een moeder.
Pakt het meisje bij de enkel vast?

b. Here you have a girl and here you have a mom.
Is the girl holding her by the ankle?

(74) QHN: picture shows a girl and three mothers; each mother is pointing at herself

a. Hier heb je drie moeders en hier heb je een meisje.
Wijst iedere moeder haar aan?

b. Here you have three moms and here you have a girl.
Is every mom pointing at her?

(75) ZHN: picture shows a girl jumping rope while looking at herself in a mirror, with a mother sitting in front of the mirror

a. Hier heb je een hele grote spiegel... en hier heb je een meisje en hier heb je een moeder.
Ziet het meisje haar touwtje springen?

b. Here you have a real big mirror... and here you have a girl and here you have a mom.
Does the girl see her jump-roping?

(76) ZHEM: picture shows a boy blowing bubbles while looking at himself in a mirror, with a father sitting in front of the mirror

a. Hier heb je een hele grote spiegel... en hier heb je een jongen en hier heb je een vader.
Ziet de jongen hem bellen blazen?

b. Here you have a real big mirror... and here you have a boy and here you have a dad.
Does the boy see him blowing bubbles?

The adult Dutch native-speakers all performed well on both test and control conditions. For control conditions, the Dutch children basically showed adult-like performance. The English-speaking children performed comparably to the Dutch children, with the exception of non-adult performance on sentences such as "Is every girl pointing at herself?" (when the picture showed three girls, each pointing at a mom). English-speaking children performed significantly worse on this question than Dutch-speaking children.[53]

Philip and Coopmans found no significant effects for age for any of the test conditions among the Dutch children between ages 4 and 6. In further analyses these age groups are collapsed.

Philip and Coopmans tested Principle B in small clauses with the sentences of the ZHN and ZHEM conditions, shown in (75) and (76). These sentences involved the subject of a small clause complement selected by a matrix perception verb. The ZHN condition, as in (75), tested the feminine pronoun **haar** (e.g., "Does the girl see her jumping rope?"),

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[53]English-speaking incorrectly accepted these sentences approximately 25% of the time, while the youngest Dutch children (4- to 6-year-olds) accepted them approximately 15% of the time, and all older Dutch children correctly rejected these sentences. Philip and Coopmans report that the difference in nonadult-like performance is significantly different for the English-speaking children and the Dutch 6-year-olds (p<.0317).

while the ZHEM condition, as in (76), tested the masculine pronoun **hem** (e.g., "Does the boy see him blowing bubbles?"). The mean percentages of adult-like performance under these conditions are given in (77).

(77) Adult-like Performance on ZHN and ZHEM Test Conditions

subject group	#	ZHN	ZHEM	t-tests HN vs. ZHN	t-tests ZHN vs. ZHEM
Dutch 4-6 yrs.	58	10%	6%	.0000	.1653
English 6 yrs.	11	33%	33%	.5059	1.0000
Dutch 7 yrs.	22	16%	36%	.0000	.0162
Dutch 8 yrs.	13	38%	35%	.0821	.5845

For the Dutch children below age 8, but not for the English-speaking children, performance was significantly worse under the ZHN condition (with small clauses) than under the HN condition. Dutch children more readily accepted a local antecedent for a pronominal subject of a small clause than a local antecedent for a pronominal object of a regular transitive verb.

The HN and QHN conditions are those that tested Principle B with referential and quantificational antecedents. The HN condition, as in (73), tested referential antecedents (e.g., "Is the girl holding her by the ankle?"), while the QHN condition, as in (74), tested quantified antecedents (e.g., "Is every mom pointing at her?"). The mean percentages of adult-like performance under these conditions are given in (78).

(78) Adult-like Performance on HN and QHN Test Conditions

subject group	#	HN	QHN	t-tests HN vs. QHN
Dutch 4-6 yrs.	58	36%	53%	.0004
English 6 yrs.	11	32%	77%	.0096
Dutch 7 yrs.	22	55%	64%	.2575
Dutch 8 yrs.	13	50%	65%	.0395

For all subject groups except for the Dutch 7-year-olds, performance on the QHN condition (with quantified antecedents) was significantly better than performance on the HN condition (with referential antecedents).

What is most notable about these results is the performance level for the QHN condition (with quantified antecedents), which was low (from 53% to 77% correct) across all the subject groups. Dutch-speaking children accepted locally bound pronouns with quantified antecedents roughly a third of the time, while English-speaking children accepted locally bound pronouns with quantified antecedents roughly a quarter of the time.

2.2.1.8 Boster (1991)

Boster (1991) attempts to test a version of the reformulated Principle B. Boster argues that her results do not support such a reformulation. As an alternative, Boster suggests that her data can be accounted for by a lexical-error hypothesis.

Boster conducted three experiments with English-speaking children between the ages of 3 and 6; the first of these experiments, using VP ellipsis sentences, was described above in section 2.1.3. In a second experiment, Boster tested twenty-four children between ages 3;3 and 6;2[54] with a picture judgment task. Children were asked questions with **every** such as (80) and (81), as well as questions with non-quantified antecedents, such as (79).

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[54]There were ten children age 3;3 to 4;9, ten children age 5;0 to 5;7, and four children age 6;0 to 6;2.

(79) Is Chip brushing him?

(80) Is every chipmunk brushing him?

(81) Is every chipmunk brushing them?

However, Boster found children were equally willing to accept a bound interpretation for all three of these sentence types. The children were willing to accept a bound variable interpretation for sentences such as (79) about 38% of the time. They accepted a bound variable interpretation for sentences such as (80) about 34% of the time, and accepted a bound variable interpretation for sentences such as (81) about 42% of the time.

In this experiment the 5-year-olds showed a 10% increase in "yes" responses for sentences like (81), where the plural pronoun **them** was substituted for the singular pronoun **him**. This means that at least a small percentage of the "no" responses for sentences like (80) in previous studies may be accounted for by their use of the singular pronoun. Furthermore, Boster's results contradict those of Wexler and Chien. Out of the twenty-four children in the experiment, all twelve who accepted at least one Principle B violation with a referential NP, as in (79), also accepted at least one Principle B violation with a quantified antecedent, as in (80) or (81). However, the converse was not true; eight of the twelve who rejected Principle B violations with the sentences with referential NPs accepted at least one Principle B violation with the quantified NPs, either with **him** or with **them** or both. So, in Boster's study, children were <u>more</u> likely to violate Principle B with quantified antecedents than with non-quantified antecedents.

In a third experiment, Boster tested the eight children from the

VP ellipsis experiment (described in section **2.1.3** above) who had accepted coreference in violation of Principle B. The third experiment consisted of a truth value judgment task, using sentences like those in the second experiment. There were two sentences with **every** and **him**, and two with **every** and **them**. Those with **him** were accepted about 31% of the time, while those with **them** were accepted 50% of the time (for an average of about 41%). However, the eight children tested seemed to divide up into two groups. One group (four children) readily accepted Principle B violations involving quantification, and the other group (the other four children) refused to accept any of them. This demonstrates the need for analysis of data from individual children, since different children seem to behave differently. Boster also points out the importance of understanding why children reject a particular interpretation for a sentence. She gives the example of one child who, when asked why the puppet was wrong when he said, "Every cat put a bandaid on him," replied, "They put their bandaids on them and he put his bandaid on him." As Boster explains:

> This illustrates the point that when a child says "no" in a truth-value judgment task of this type (where a grammatical alternative interpretation is available), it does not necessarily imply that her grammar does not permit the ungrammatical "yes" reading (Boster, 1991, pp.25-26).

Boster argued that her results do not support the view that Principle B is a condition applying to bound variable anaphora only. As an alternative, Boster proposes a theory of morphological confusion. She suggests that the child makes an initial assumption that there is a word **him** that is [+anaphoric], in addition to the word **him** that is [+pronominal, -anaphoric]. Boster assumes that knowledge of the binding principles is innate, and the child has clearly identified the English accusative pronoun **him** as [+pronominal]. However, the child has erroneously identified the lexical anaphor as [possessive + **self**] (marked [+anaphoric]). Evidence from children's speech, when they produce "his self" or "her own self", suggests that this is a common error. Sooner or later the child notices that the adult is actually using the compound **himself**, not **his** + **self**. Now the child has to change lexical entries. She already has the lexical entries **him** and **self** marked as separate NPs in her lexicon, and these two entries have conflicting features, with **him** marked [-anaphor] and **self** marked [+anaphor]. The child might initially reject **him/self**, since this juxtaposition of two NPs would violate the theta-criterion. Rather than violate the theta-criterion, some children may initially posit a new lexical anaphor, **him0**, to replace or temporarily coexist with the lexical anaphor **self**. Once the child becomes aware that **himself** is really a single compound, not a two-word combination, she realizes that **himself** is [+anaphoric] and has the same meaning as **him0**. Boster suggests that the point at which **him0** is replaced by **himself** in the lexicon is also the point at which the child will no longer accept Principle B violations.[55]

Boster argues that the persistence of Principle B violations support a lexical overgeneration hypothesis over a syntactic or pragmatic account. The most important aspect of Boster's findings, however, is their relationship to previous work. Boster did not

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[55]For related discussion see McDaniel, Cairns & Hsu (1990), who found no relationship between children's use of **self** as an NP and violation of Principle B.

replicate the findings of Wexler and Chien, and in fact found that children may violate Principle B more with quantified antecedents than with non-quantified antecedents (a fact which is not explained by the lexical overgeneration hypothesis).

2.2.1.9 Sano (1992)

Like Boster (1991), Sano (1992) proposed a lexical account of what he called the "Delay of B effect". Sano's account also adopted the ideas of Chien & Wexler (1990) and Grodzinsky & Reinhart (1993) by assuming that some pragmatic principle is involved; however, like Grimshaw & Rosen (1990), Sano argued that children's rejection of sentences with bound variable pronouns and acceptance of sentences with referential antecedents comes from children's failure to create a bound variable representation.

Sano began by assuming the Strong Continuity Hypothesis: children know and obey all innate grammatical conditions (such as the binding principles and Rule I/Principle P) throughout development. Sano further assumed that a lexical proform has a feature [±V] which indicates whether or not the proform can be construed as a bound variable; he assumed that the default setting is [-V], and children switch it to [+V] when they find a trigger for the change (e.g., when they encounter the item bound by a quantifier phrase such as **every NP**). Sano also assumed a redundancy rule for reflexives: if [+A], then [+V], where [+A] indicates items which are subject to binding Principle A; because of this redundancy rule, reflexives are automatically marked as [+V], and so should be interpreted as bound variables early on.

With these assumptions, Sano argued that English-speaking children first take **he/him**[56] to be [-V] and switch it to [+V] later. Thus, Sano's explanation for why children appear to disobey Principle B is that around the ages of 3 years to 5 years, some children still have [-V] on **him** (Sano's Hypothesis I), but at the age of 4 years or 5 years, most children have [+V] on **himself** (Hypothesis II), because of the redundancy rule.

How does this account for the Delay of B effect? Sano is assuming Strong Continuity of Rule I. Recall (from section 1.4.2.2) that Rule I disallows coreference when an indistinguishable bound variable representation is available. However, if children have [-V] on pronouns, coreference is not prohibited by Rule I, since no bound variable representation is available. In that case, children should allow local coreference with referential antecedents, since it is not blocked by Rule I. They should reject local binding with quantified antecedents, since they do not generate a bound variable representation.

Sano reinterpreted the empirical results of several previous studies in order to test the hypotheses stemming from his explanation. Sano's Hypothesis I requires that there are some children younger than six who cannot take **every bear** as the antecedent of **him** in non-local binding (where Principle B is irrelevant), as in (82).

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[56] Sano refers to all singular pronouns (**he**, **him**, **her**, etc., but not **himself** or **herself**) as **he**. However, since Sano is attempting to demonstrate that lexical features play a role in acquisition, it seems important not to conflate other lexical features, such as gender. It is also not clear what role case plays in the acquisition of lexical features for pronouns; would children automatically mark **him** as [+V] as soon as they had evidence that **he** was [+V]? More detailed investigation is necessary to understand the nature of this lexical acquisition.

(82) Is [every bear]$_i$ thinking that Goldilocks is touching her$_i$?

Sano found support for this in two previous studies. First, in Chien & Wexler (1991) (see section 2.2.1.4 above), five-year-old children accepted non-local quantifier binding of **her**, as in (82), only 59% of the time, although they were almost perfect with the control sentences in (83) and (84).

(83) Is Goldilocks thinking that Mama Bear is pointing at her?

(84) Is every bear thinking that Pinocchio is touching Goldilocks?

Sano claimed that the difference between the acceptance percentage for (82) and the smaller of the acceptance percentages for (83) and (84) gives the percentage of children with [-V] on **her**. These percentages are shown in (85).

(85) % of YES with Match Picture

	4-5	5-6	6-7
(83)	93	95	96
(84)	94	97	96
(82)	72	59	76
difference [(83)-(82)]	22	36	20

Sano claims, then, that 36% of the five-year-olds in this study have **her** marked as [-V]. In other words, approximately a third of these children would not accept **her** as a bound variable.

Sano also found support for his Hypothesis I in Thornton & Wexler (1991) (discussed in section 2.1.5 above). In a truth value judgment task, Thornton and Wexler found that children (ages 4;0 to 5;1) accepted sentences similar to (82) only 50% of the time. Sano also argued that there is evidence that some children prefer to use **they** for bound variable interpretations of **wh**-questions, even when the matrix subject

wh-phrase is singular (e.g, in sentences such as "Which boy$_i$ thinks that they$_i$ have a blue marble?"). He concluded that these facts all support his claim that children between 3 and 5 may have [-V] on **him**.

Sano's Hypothesis II requires that most children accept (87) at the age of four or five.

(86) Is Mama Bear$_i$ touching herself$_i$?

(87) Is [every bear]$_i$ touching herself$_i$?

Sano found evidence for this claim in Chien & Wexler (1990) (discussed above in section 2.2.1.1). Sano claimed that by subtracting the acceptance percentage of (87) from that of (86), we have the percentage of children who have [-V] on **himself**. These percentages are shown in (88).

(88) % of YES with Match Picture

	4-5	5-6	6-7
(86)	93	97	97
(87)	77	89	94
difference	16	8	3

For Sano, it is significant that only 8% of the children have [-V] for **himself** at ages 5 to 6. This is very different from the case of **her**, which was marked as [-V] for 36% of the children in the study discussed above.

Sano also found support for Hypothesis II in Thornton & Wexler (1991), where children between 4;0 and 5;1 accepted examples like (87) 88% of the time in a truth value judgment task.

Finally, Sano found support for the idea that children who display the "Delay of B effect" have **him** marked as [-V], but obey Rule I. He argued that the percentages in (85) should match the percentage of children who reject local binding of a pronoun with a quantifier, but accept local binding of a pronoun with a referential NP. Sano examined the data from Chien & Wexler (1990) for sentences such as (89) and (90).

(89) Is every bear touching her?

(90) Is Mama Bear touching her?

By subtracting the rejection percentage of (90) from that of (89), Sano claims to have the percentage of [-V] on **her** in local binding situations. These percentages are given in (91).

(91) % of NO with Mismatch Picture

	4-5	5-6	6-7
(89)	60	84	87
(90)	39	49	77
difference	21	35	10

As Sano predicts, the percentages he obtains for [-V] on **her** are very similar for the two cases examined, (85) and (91), especially for the younger age groups.

(92) % of [-V] on **her**

	4-5	5-6	6-7
(85)	22	36	20
(91)	21	35	10

Sano finds similar results for calculations based on percentages from Thornton & Wexler (1991).

Sano's results suggest that, for singular pronouns at least, the difference in acceptance between pronouns with referential antecedents and pronouns with quantified antecedents may have to do with difficulty with variable binding (resulting in the rejection of pronouns with quantified antecedents). I will now turn to children's interpretation of plural pronouns.

2.2.2 Plural Pronouns and Distributivity

One possibility that has been suggested to explain Chien and

Wexler's results with bound variable pronouns is that children interpret quantification differently from adults (suggested, for example, by Grimshaw & Rosen, 1990). In particular, there seems to be some relationship for children between certain quantifiers and plural pronouns. Kaufman (1988, p.289) noted that although children in her study showed an understanding of the distributive reading of the singular pronoun and reflexive used with the quantifier **every**, more than half of her subjects used the plurals **them**, **their**, **themselves**, **theirselves**, and **theirself** in their responses. Thornton (1990) notes that

> pilot work on elicitation of bound pronouns revealed that in production, some children elect to differentiate deictic from bound pronouns, preferring plural pronouns for the bound form (Thornton, 1990, fn.81, p.165).

As we have seen, it is difficult to interpret binding in children's grammar if we cannot interpret children's understanding of quantifiers such as **every**. However, it is possible to get a clearer understanding of children's binding if we examine their understanding of plural pronouns (with or without quantified antecedents). The study of children's binding with plural pronouns is relevant here because of the distinction between collective and distributive interpretations of plural NPs. According to Heim, Lasnik & May (1991), differences between the collective and distributive interpretations of plural NPs are represented at LF. Plural NPs which are interpreted collectively are referential (and therefore could be allowed to corefer with a contraindexed pronoun in the same clause, if Principle P is not obeyed). Plural pronouns which are interpreted distributively are said to be accompanied by a distributive operator, and are quantificational (and therefore could not be allowed to corefer with a contraindexed pronoun in the same clause, regardless of the status of Principle P).

For the sentences which we are discussing here, we could also think of the collective interpretation as the interpretation in which the object has wide scope. The distributive interpretation is the interpretation in which the distributive operator has wide scope.

Before we can examine children's binding with plural pronouns, it is important to determine whether children are in fact willing to accept distributive interpretations. In section 2.2.2.1 we will discuss work which examined children's acceptance of collective and distributive interpretations of plurals (Miyamoto 1992, 1993; Miyamoto & Crain, 1991); then, in section 2.2.2.2, we will turn to a study which focuses on the bound distributive interpretation of plural pronouns (Avrutin & Thornton, 1993, 1994).

2.2.2.1 Miyamoto (1992)

Miyamoto & Crain (1991) and Miyamoto (1992, 1993) examined the time course and acquisition sequence of the distributive and collective interpretations of plural pronouns in child language. Miyamoto (1992) discussed four experiments, two of which I will describe in some detail.[57]

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[57]In this section I will focus only on Miyamoto's first and second experiments. Miyamoto's third experiment investigated children's knowledge of the scopal interaction of plural pronouns with [**how many** + N] **wh**-phrases. Miyamoto found that children accepted both the collective and distributive interpretations with the plural pronoun **they** in subject position and **wh**-phrases consisting of [**how many** + N] in object position,
(continued...)

Miyamoto was investigating the following hypothesis:

> Assuming that QR is innate and furthermore, that QR is triggered by lexical properties of quantifiers, the collective and distributive interpretations of plural pronouns should both be available to children from the earliest stage of language development, once they have learned that plural pronouns can behave as quantifiers (Miyamoto, 1992, p.10).

In the first experiment, Miyamoto used a truth value judgment task, testing twenty-four children between the ages of 3;0 and 6;0 (mean age 4;11) with sentences like "They are carrying two/four cans", with a picture which showed two people, each with two cans (the distributive interpretation), or with a picture showing two people together holding a stack of four cans (the collective interpretation).

Miyamoto found that most children allowed both the collective and distributive interpretations of the plural pronoun **they**. In the collective situation, when the picture showed two people together holding a stack of four cans, both children and adults generally allowed only the collective, "four cans" description (children: 88.6% collective, 11.4% distributive, 0% both; adults: 100% collective, 0% distributive, 0% both). In the distributive situation, however, when the picture showed two people with two cans each, there was a clear

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[57](...continued)
although children still preferred the distributive interpretation. In the **wh-them** cases, although the collective and distributive responses were both observed, more acceptances of the distributive interpretation were found in responses from children than in those from adults. The fourth experiment, like the third experiment, looked at subject/object scope ambiguities, but substituted bare **wh**-phrases for the **[how many + N]** phrases. Previous work by Roeper & de Villiers (1991) had suggested that the subject/object asymmetry is not present in child grammar. However, Miyamoto found that there is a subject/object asymmetry in child grammar, just as in adult grammar. I will not discuss the third and fourth experiments further here.

contrast between child and adult responses. Children allowed a collective, "four cans" description 4.3% of the time, a distributive, "two cans" description 69.6% of the time, and both descriptions 26.1% of the time. Adults, however, always accepted both the collective and distributive descriptions. So while adults were equally willing to accept either the distributive or collective interpretation with this picture, children showed a strong preference for the distributive interpretation.[58]

Miyamoto also noted that this difference between adult and child responses only held for children under age 5. Children between 3 and 5 years allowed (only) a collective description 8% of the time, (only) a distributive description 84% of the time, and both descriptions 8% of the time. Children over age 5, however, were much more like adults; they never allowed only a collective description, but allowed only a distributive description 52.4% of the time, and allowed both descriptions 47.6% of the time. Why is the distributive description so strongly preferred early in the course of language development?

Miyamoto suggests that the distributive is the "default" interpretation for plural pronouns.[59] However, he claims, surprisingly,

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[58]This preference for the distributive description was statistically significant: $F = 26.47$, $p<.001$.

[59]Miyamoto does not add much discussion of what it means for the distributive interpretation to be the "default"; presumably, this is just another way of saying that the distributive interpretation is preferred. Miyamoto briefly discusses an explanation he attributes to Paul Bloom:

> the preference for the distributive interpretation over the collective may follow from general cognitive development. For instance, children understand "forest" as a bunch of trees more easily than as a "forest" (Miyamoto, 1992, p.68).

(continued...)

that this may vary for different children. Miyamoto noted that one subject, AK (age 5;9), preferred the collective interpretation when the puppet's description included **they** alone, and in her response AK used **both** to interpret **they** distributively.[60] Other children treated **they** alone as distributive, and in their responses used **together** to express the collective interpretation.[61] In addition, Miyamoto found three children (KS, age 4;7, NW, age 3;6, and DS, age 3;5) who could not count more than three objects (insisting there were five cans in a situation where there were actually four), but nevertheless showed knowledge of both the collective and distributive interpretations of plural pronouns. Miyamoto therefore concluded that children's knowledge of the collective

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[59](...continued)

This preference for the distributive interpretation clearly needs more investigation.

[60]Miyamoto cites the following response from AK:

[in the situation in which two people are each lifting two cans]

Kermit: They are lifting four cans.
AK: Yes. They are **both** lifting two.
Kermit: So, they are lifting two cans or they are lifting four cans?
AK: They are lifting four cans...Because they **both** have two in their hands, and remember two and two makes four.
(Miyamoto, 1992, p.18)

[61]The following response from SD, age 5;6, is given as an example:

[in the situation in which two people are each holding two cans]

Kermit: They have four cans.
SD: Each of them has two.
Kermit: Each of them has two? So, right...Each of them has four.
SD: No!
Kermit: They have two cans or four cans?
SD: All of them **together** have four. But Big Bird has two. He has two. (Miyamoto, 1992, p.19)

and distributive interpretations emerges before they have mastered the ability to count up to four objects.

Miyamoto conducted a second experiment using a different task to further investigate the preference for the distributive interpretation in children below age 5. In the second experiment, Miyamoto tested seven children, ages 3;1 to 4;9 (mean age 4;8), and some adults (eleven in one part, five in another) with a picture verification task. In the picture verification task, unlike the truth value judgment task, no separate actions were involved, so Miyamoto expected the bias for the distributive interpretation to be less prominent. Here the sentences were (a) "Do they have one bag/two bags?" (with a picture of two people, each with one bag), (b) "Do they have two/four ice creams?" (with a picture of two people, each with two ice creams), (c) "Do they have one wheel/four wheels?" (with a picture of four unicycles), (d) "Do they have one red nose/three red noses?" (with a picture of three people, each with a red nose), (e) "Are they hugging two/four cats?" (with a picture of two people, each holding two cats), (f) "Do they have two/four cars?" (with a picture of people, each with two cars), (g) "Do they have three cakes?" (with a picture of two people, one with one cake, one with two cakes), and (h) "Do they have three balloons?" (with a picture of three boys, one holding three balloons, two not holding balloons).

As in the first experiment, in the second experiment Miyamoto found a statistically significant preference for the distributive interpretation over the collective interpretation.[67] However, while in

[67] $F=11.792$, $p<.001$.

the first experiment only three children had given collective responses for the plural pronouns, there were significantly more acceptances of the collective responses in the second experiment. One explanation for this may be that in the truth value judgment task (the first experiment), there were two actions by each character involved, which may have triggered individuation of the events, biasing subjects toward a distributive interpretation. In the picture verification task (the second experiment), on the other hand, the pictures do not overtly distinguish one event from others, so no particular event became salient, leading to more even division between collective and distributive interpretations. In addition, in contexts where only two objects were involved, such as (a) above ("Do they have one bag/two bags?", with a picture of two people, each with one bag), children preferred the collective interpretation. Miyamoto speculates that since the picture obviously involved two objects, children may have been uncomfortable giving a singular response in these cases.

From the first two experiments, Miyamoto concluded that both the distributive and collective interpretations are available to children by age 3, but that the distributive interpretation is strongly preferred between the ages of 3 and 5. Miyamoto argues that the availability of the distributive interpretation implies that plural pronouns behave as quantifiers, and are subject to quantifier raising in child grammar as in adult grammar. We can now turn to the relationship between distributivity and the binding of plural pronouns.

2.2.2.2 Avrutin & Thornton (1993, 1994)

Avrutin & Thornton (1993, 1994) tested children's binding with both collective and distributive interpretations of plural pronouns. They predicted that children might accept the pronoun **them** with a local antecedent when it was given a collective interpretation (since this could be attributed to lack of Principle P), but would reject **them** with a locally bound distributive interpretation. Thirty-three children between the ages of 3;10 and 4;10 (mean age 4;4) were tested using the truth value judgment task. Sentences such as "The Smurf and the clown dried them" were presented with both collective and distributive interpretations (i.e., either the Smurf and the clown together dried the Smurf and the clown, or the Smurf dried himself and the clown dried himself).[63] In addition, Avrutin and Thornton included control sentences based on the sentences used by Miyamoto (discussed in the previous section). These sentences were given either a distributive or collective interpretation. For example, one story involved two turtles with two bugs each. The sentence was "I know how many bugs they have. Four." (the collective interpretation) or "I know how many bugs they have. Two." (the distributive interpretation).

Avrutin and Thornton found that children accepted the experimental sentences in collective contexts in 50% of the trials. Of the thirty-three children, seventeen responded as adults, rejecting every experimental sentence presented in the collective context. The remaining sixteen children were tested further. These children allowed

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[63]Note that Avrutin & Thornton only tested their subjects with the pronoun **them**; they did not test distributive or collective interpretations of **themselves**.

coreference with this type of sentence in collective contexts 93% of the time. In the distributive contexts, however, they allowed the pronoun to refer to the conjoined NP significantly less, only 42% of the time. Of these children, four consistently rejected the distributive interpretation of control sentences, and so were excluded from further analysis. Among the remaining twelve children, test sentences in the collective context were accepted 93% of the time, while test sentences in the distributive context were only accepted 27% of the time.

These results seem to support the idea that children have control of the binding principles but lack a pragmatic rule (although ideally children should have always rejected the bound distributive interpretation). However, we need to examine individual child data. Do all children behave in the manner described? Avrutin & Thornton (1994) do not provide individual child data, but the data from this experiment were provided in a handout from Avrutin & Thornton (1993), reproduced in abbreviated form as (93).

(93) Avrutin & Thornton Individual Child Responses
(figures represent the number of cases accepted)

		"The Smurf and the clown dried them"		Control Sentences	
		"collective"	"distributive"	"How Many"	
Name	(Age)			"distributive"	"collective"
Kristen	(4;3)	3/4	1/4	0/2	2/2
Corey	(4;0)	4/4	1/4	1/2	1/2
Karen	(4;1)	4/4	2/4	0/2	2/2
Greg	(3;10)	4/4	1/4	0/2	1/2
Tanya	(4;3)	4/4	1/4	2/2	1/2
Kimberley	(4;7)	4/4	0/4	2/2	1/2
Laura	(4;9)	4/4	0/4	0/2	2/2
Mark	(4;2)	4/4	1/4	2/2	0/2
Kate	(4;6)	3/4	2/4	2/2	2/2
Julia	(4;3)	3/4	1/4	2/2	0/2
Mike	(4;10)	3/4	1/4	2/2	1/2
Neal	(4;10)	4/4	2/4	0/2	2/2
Leila	(4;2)	4/4	4/4	0/2	2/2
Molly	(4;6)	4/4	4/4	0/2	2/2
Emmet	(4;9)	4/4	4/4	0/2	2/2
Evan	(4;10)	4/4	3/4	0/2	2/2

Of the sixteen children who were tested with both collective and distributive contexts, the four children who were excluded from further analysis were Leila, Molly, Emmet, and Evan; they consistently rejected the distributive interpretation of control sentences. However, of the twelve remaining subjects, five (Kristen, Karen, Greg, Laura, and Neal) also consistently rejected the distributive interpretation of the control sentences, and a sixth (Corey) accepted a distributive interpretation of the control sentences in only one of the two trials. Why were these subjects not excluded? The only differences between the excluded and included subjects were differences in their responses to the experimental sentences, exactly the ones with which we are concerned. The four subjects who were excluded accepted Principle B violations in the distributive context[64] (thus showing that they are willing to accept bound distributive interpretations), directly contradicting the theory that children will not violate Principle B where syntactic binding is required. The subjects who were included, on the other hand, did reject some of the Principle B violations in the distributive context.[65] If we eliminate all subjects that did not consistently accept the distributive control sentences, then we are left with seven subjects (if we continue to include Corey, who accepted one distributive control trial and rejected the other). Of these, however, two (Mark and Julia) consistently rejected the collective control sentences (but accepted Principle B violations with collective interpretations), and several others were inconsistent in accepting the collective controls.

Sergey Avrutin (p.c., October 1994) argues that the main concern in the experiment was why the four excluded children had accepted the bound distributive condition. He argued that the four children accepted the distributive binding condition because they can't distribute, but the other five children in principle can distribute, because they differentiate between the collective and distributive binding conditions. However, this doesn't explain why the five children reject the distributive **how many** cases (which is particularly disturbing since

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[64]Leila, Molly and Emmet all accepted the Principle B violations with distributive contexts in four out of four trials; Evan accepted these cases in three out of four trials.

[65]Karen and Neal rejected two out of four; Kristen, Corey, and Greg rejected three out of four. One subject, Laura, rejected all violations of Principle B in the distributive context; however, this may only demonstrate that Laura would never accept distributive interpretations.

Miyamoto, discussed in the previous section, found that children tend to prefer the distributive interpretation), and it's an almost circular explanation of their understanding of Principle B. How do we know that these five children can distribute? Because they distinguish between the distributive and collective interpretations in the Principle B cases, in other words, they appear to obey Principle B. How do we know that they obey Principle B? Because they reject the distributive interpretation in the bound cases. Without independent evidence that these children can distribute, we can't tell whether they really have bound variable anaphora in these cases. In this case, the question is why they distinguish between the collective and distributive binding conditions.

What can we conclude from this? First, it's not clear what the connection is between these control sentences and these experimental sentences. The control sentences involve the subject pronoun **they** and do not involve a conjoined NP, while the experimental sentences involve the object pronoun **them** and a conjoined subject (e.g., **the Smurf and the clown**). If we don't know how children are understanding collective and distributive interpretations of sentences, we can't draw conclusions about their understanding of binding in sentences with collective and distributive interpretations. It seems that Avrutin and Thornton weren't considering the **how many** condition as a pretest, but if we are concerned with distinguishing between binding and coreference in these cases, it is necessary to show that both distributive and collective interpretations of pronouns are available to the children. Unless we can be sure that both interpretations are available to children, we can't distinguish between coreference and binding in these cases. As a result, it's not clear how many of these subjects should have been included in this study, or if there were enough subjects to draw any conclusion, if we exclude those subjects who don't pass the control test. Further study is needed.

2.3 Children's Understanding of Quantification

How does children's understanding of quantification differ from that of adults? In order to evaluate the claim that children are obeying Principle B with respect to quantifier binding, it is necessary to determine if children understand quantifier binding in the same way as adults.[66] In this section I will discuss different studies which bear on this. First, in section 2.3.1 I will discuss some work on children's interpretation of plurals. Next, in section 2.3.2, I will discuss studies of the phenomenon called quantifier spreading. In section 2.3.3, I will discuss studies of scope in Chinese. Finally, in section 2.3.4, I will return to further discussion of quantifier spreading.

2.3.1 Plurals

There is some indication that children may treat plural noun phrases of certain types differently than adults do. In a pilot study by Anne Vainikka, described in Roeper & de Villiers (1991), fifteen children, ages 3;7 to 6;0, were asked a variety of questions involving plurals, as in (94).

(94) a. Do dogs have tails?
b. Does a dog have a tail?
c. Do dogs have a tail?
d. Does a dog have tails?

Vainikka found that the children showed no differentiation among these

[66]For the acquisition studies discussed in section 2.2, this is true whether or not the studies involved overt quantifiers. In the case of the study of the distributive interpretation of plural pronouns, it's necessary to know if children understand binding to the nonovert distributive operator in the same way that adults do.

four types of sentences, answering all of them affirmatively. Roeper and de Villiers conclude from this that the distributive interpretation of plurals is overgeneralized. In adult English, (94a), (94b), and (94c) can all be interpreted as meaning that there is one tail per dog. However, in adult grammar, a "yes" response to (94d) implies that the object (or objects, if generic) denoted by **a dog** should have more than one tail per dog, contrary to the usual facts; (94d) cannot mean that the object(s) denoted by **a dog** can have one tail. Miyamoto (1992, p.8, fn.3) suggests that (94d) is an example of what De Mey (1981) calls a "dependent plural" (in which a plural must be taken in what is apparently a singular meaning). However, De Mey claims that one of the structural properties necessary for a dependent plural interpretation is that the dependent plural must have a plural expression as its antecedent. For adults, it is (94a) in which **tails** is a dependent plural; children seem to be overgeneralizing this, interpreting the plural NP **tails** distributively in (94d) also. Clearly, the interaction of number and distributivity requires further study.

2.3.2 Quantifier Spreading

There is evidence for a stage in language development when children's understanding of universal quantification differs from that of adults in at least one important way. Children seem to interpret quantifiers in an overly symmetrical way; a quantifier attached to one NP in a clause is applied to all the NPs in that clause. This phenomenon has been called "quantifier spreading", and has been investigated in several previous studies (Philip & Aurelio, 1991; Philip

& Takahashi, 1991; Takahashi, 1991; Roeper & de Villiers, 1991; Philip, 1991, 1992, 1994; Crain, Thornton, Boster, Conway, Lillo-Martin & Woodams, 1994; and Philip & Coopmans, 1995a). I will focus here on the account of quantifier spreading given in Philip (1994), which is the most complete discussion of the phenomenon.

Philip (1994) discusses quantifier spreading with respect to two types of response patterns, what he calls the "symmetrical" response (the response pattern of what Philip calls the "Symmetry Child") and the "Perfectionist" response, based on children's responses to three different experimental conditions. In the first condition, the child is shown a picture with three boys, each riding a different pony, and a girl who is just standing by; the child is asked the question in (95).

(95) Condition 1: [three boys, each riding a different pony, and a girl standing]

Question: Is every boy riding a pony?

Perfectionist response: No. Not the girl.
Symmetry Child response: Yes.

In the second condition, the child is shown a picture of three boys, each riding a different pony, and a girl also riding a pony; the child is asked the question in (96).

(96) Condition 2: [three boys and a girl, each riding a different pony]

Question: Is every boy riding a pony?

Perfectionist response: No. That's a girl.
Symmetry Child response: Yes.

In the third condition, the child is shown a picture of three boys, each riding a different pony, a mom who is standing by, and an extra pony; the child is asked the question in (97).

(97) Condition 3[67]: [three boys, each riding a different pony, a mom standing, and an extra pony]

Question: Is every boy riding a pony?

Perfectionist response: No. Not that pony.[68]
Symmetry Child response: No. Not that pony.

In each of these cases, the usual adult response is "yes".[69] Preschool children, however, typically demonstrate either the Symmetry Child response pattern, in which they reject Condition 3 but are otherwise adult-like, or else the Perfectionist response pattern, in which they

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[67]Philip refers to Condition 1 and Condition 2 as the YES1 and YES2 conditions, respectively. He refers to Condition 3 as the TRANS condition.

[68]Philip discusses the fact that the Perfectionist's justification for this negative response was almost always the same as the Symmetry Child's, i.e., the presence of the "extra" mentioned object (the riderless pony), and not the presence of an unmentioned object (the mom). Based on the responses to (95) and (96), we could expect the Perfectionist to choose either object (the pony or the mom) as justification for the negative response. Because of the actual response pattern, Philip argues that a stipulation is needed which orders the rule for the symmetrical response before the rule for the Perfectionist response. See Philip (1994, pp.127-128).

[69]Philip (1994) notes that adult control subjects tested on the experimental Conditions 1-3 never gave symmetrical or Perfectionist responses. In a footnote Philip mentions that all of the experimental materials for his experiments were tested informally on five to ten adults before being tested on children. Although these adults never gave symmetrical or Perfectionist responses, they did sometimes reject sentences such as "Is a girl holding every balloon?" when the picture showed three girls, each holding her own balloon. One control group of ten adults responded negatively to this 57% of the time. Philip notes, however, that the adults who said "no" under this condition did so because they felt there had to be only one girl holding all the balloons in order to answer "yes"; in other words, they were showing a preference for a specific reading of the indefinite in subject position.

Elsewhere Philip notes that there is some experimental evidence for adult performance mistakes which look like the symmetrical response. Philip describes these results in arguing against a "conversion hypothesis" account of quantifier spreading, and suggests that adult performance could be described as the adult "reverting" to a "less costly" linguistic representation under a heavy processing load. See Philip (1994, pp.63-64).

reject Conditions 1, 2, and 3.

Philip demonstrates that this phenomenon is quite widespread. Philip (1994) summarized data from six experiments, with a total of 276 preschool children (223 monolingual English-speaking children with a mean age of 4;9, and fifty-three monolingual Japanese-speaking children with a mean age of 5;4). Of these 276 children, only thirty-two (12%) exhibited perfect adult-like performance on all trials of Conditions 1 through 3. Excluding sixty children who may have had attention problems, the sample reduced to 216 children; again, only thirty-two (15%) of this reduced sample consistently exhibited adult-like performance. The other 184 children (85%) typically gave a negative response in Condition 3, and in response to a follow-up question referred to the presence of the extra mentioned object (the riderless pony), but never the presence of the unmentioned object (the mom).[70]

Of the 184 children who showed the symmetrical response in Condition 3, eighty-seven (47%) showed no other nonadult-like performance in Conditions 1 or 2. The other ninety-seven children (53%) also exhibited nonadult-like responses to Conditions 1 and 2, showing the Perfectionist response pattern. The children who showed the Symmetry Child response pattern gave the symmetry response to Condition 3 about 57% of the time on average. The children who showed the

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[70]In addition to the studies he summarizes, Philip also cites evidence of quantifier spreading in the acquisition of French, Chinese, Japanese, and Dutch (Philip, 1994, p.33, fn.27). He presents a case study of a Catalan/French bilingual 4-year-old (Philip, 1994, pp. 287-288), who gave symmetrical responses for two different versions (quantifier-VP and VP-quantifier) of Condition 3, and presents evidence from two adult agrammatic aphasics, who also had a high incidence of symmetrical responses for Condition 3 (Philip, 1994, pp.295-296).

Perfectionist response pattern gave the symmetrical response to Condition 3 about 85% of the time on average, and gave the Perfectionist response to Conditions 1 and 2 about 58% of the time on average.[71]

Philip conducted one study in which he tested ten children (ages 3;10 to 4;5) at one time, and then retested them one year later. The average percentage of nonadult-like performance on four trials of Condition 3 did not change significantly from the first test to the second test. Only four children showed any improvement in Condition 3 from the first test to the second test, and this improvement was significant for only two of these children. However, of the seven children who gave Perfectionist responses in the first test, four no longer did so one year later in the second test.[72] Philip notes this dissociation between changes in the symmetric response and the Perfectionist response, and suggests that the two types of children may correspond to two distinguishable stages in the acquisition of universal quantification, with the stage of the Perfectionist preceding that of the Symmetry Child.

Several studies have investigated quantifier spreading in various

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[71]Philip does not discuss whether there were any age-related differences among these children, but see discussion in the next paragraph.

[72]The condition used to determine if children would give a Perfectionist response in both sessions of this experiment was slightly different from Conditions 1 and 2. For example, the children were shown a picture with three cats, each holding a different balloon, and a mouse holding an umbrella. They were asked, "Is every cat holding a balloon?" In Condition 1, the extra figure (the girl) was not doing anything; in Condition 2, the extra figure (the girl) was performing the same action (riding a pony) as the figures mentioned in the sentence (the boys). Here, however, the extra figure (the mouse) was performing the same action (holding) on a different object (an umbrella, instead of a balloon).

linguistic contexts, and have found the phenomenon to be generally insensitive to surface syntactic structure. Philip & Aurelio (1991) compared two types of spreading, which they called **every/a** spreading (as described above, where **every** precedes the indefinite NP in sentences like "Is every boy riding a pony?"), and **a/every** spreading (with sentences like "Is a boy riding every pony?"), where the indefinite NP precedes **every**. These two types of spreading were investigated in three different contexts: sentential, relative clause, and discourse. The sentential context is as described above for Condition 3. In the discourse context, **every** and the indefinite NP are in separate sentences (e.g., with a picture of three cats and two dogs and the sentences "A dog got up. Every cat jumped"; the picture shows that all three cats jumped, one of the dogs got up, and one of the dogs did not get up). In the relative clause context, the sentences contained relative clauses (e.g., "Is every whale that's lifting a boat smiling?", where there are three whales, each lifting a boat and smiling, but one extra boat). In their study, Philip and Aurelio tested forty children between the ages of 3;0 and 5;7. Of these, only twenty were included (others being unable to complete the task)[73], with a mean age of 4;3. Philip and

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[73]Children were considered unable to complete the task if they failed controls which required a negative response or if they failed to respond as an adult in two tests of **every** (one requiring a negative response, one requiring a positive response) in which there was no one-to-one mapping. However, the negative elicitation control seems quite strange; the picture shows three birds standing (and nothing else). The text was "Every bird is standing. An egg hatched. Is this picture ok?" The first sentence is true, but the second seems irrelevant, so it does not seem unreasonable for children to accept this control item. Two pictures tested **every** with the sentence "Does every boy have a balloon?". In one picture there are three boys, one with one balloon, one with two balloons, and one with three balloons. Presumably the expected response for this was "yes",

(continued...)

Aurelio obtained the results in (98), which shows the overall average incidences of quantifier spreading (the percentage of "no" responses).

(98) a.

	every/a	**a/every**
sentential context	84%	90%

b.

	sentential	relative clause	discourse
overall[74]	87%	58%	28%

The results in (98a) show that spreading is possible in both directions (**every/a** or **a/every**)[75], and the results in (98b) show that spreading is much more likely in sentential contexts, but also possible in relative clauses and in discourse contexts. It is interesting to note that children appear to be <u>worse</u> (rejecting more cases which adults would have accepted) at understanding quantifier scope in the adult way in simple sentential contexts than in the more complex sentence structures of relative clauses.

One problem with the Philip and Aurelio experiment was that the experimental tasks and the picture types were different for the sentential and the discourse items. Philip & Takahashi (1991) eliminated this problem and also looked more closely at the effect of

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[73](...continued) since every boy has at least one balloon, but some children (and possibly adults) could reject this because of the number of balloons (since two of the boys do not have "a balloon" --i.e., a single balloon-- but have two or three balloons). The other picture showed three boys, one with no balloons, one with two balloons, and one with one balloon. It would be interesting to know how these controls eliminated subjects, since half of the subject pool was eventually eliminated, and it would be important to know how adults respond to both these control items and the experimental items.

[74]**every/a + a/every**

[75]Philip (1994) notes that the contrast between the **every/a** and **a/every** conditions was at best only marginally significant (p= 0.0941).

different verb types on spreading, testing thirty-six children.[76] In addition to generally replicating the results of Philip & Aurelio (1991), they found that quantifier spreading decreased gradually with age, and that overall there was significantly more spreading with "pseudo-intransitives" (verbs like "drive" and "ride") than with "true intransitives" (verbs like "sleep"). In the "pseudo-intransitive" context, one picture showed three boys, each riding a different horse, and two additional, riderless horses; subjects were asked to accept or reject the sentence, "Every boy is riding." In the "true intransitive" context, one picture showed three dogs, each sleeping on a different bed, and two additional, empty beds; the sentence given was, "Every dog is sleeping."[77] Philip and Takahashi argue that this difference between verb types supports the idea that spreading is a linguistic (rather than a purely cognitive) phenomenon. With respect to the **a/every** and **every/a** distinction within sentences, Philip and Takahashi found no significant effect of varying the syntactic position of the universal quantifier.[78]

One other finding of both Philip & Takahashi (1991) and Philip & Aurelio (1991) related to the collective or narrow scope reading of **every**. Philip & Aurelio (1991) had found that children tended to reject a collective interpretation; 76% of the children in their study answered

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[76]Subjects were nine four-year-olds (mean age 4;6), nine five-year-olds (mean age 5;4), seven six-year-olds (mean age 6;6), and eleven seven-year-olds (mean age 7;4).

[77]Philip and Takahashi do not give percentages of acceptance for these conditions, but state that "there was a significant increase in spreading with pseudo-intransitives as compared to that found with true intransitives" ($p = .0015$)(Philip & Takahashi, 1991, p.290).

[78]Philip (1994) notes that $p = 0.1033$.

"no" to the question "Does a boy have every balloon?", when the picture showed a total of three boys and three balloons: one boy with three balloons and two boys with no balloons. Philip and Aurelio suggested that this result "may have been largely induced by the experiment itself, since other preliminary work... had shown that children of this age group were in principle capable of entertaining the adult collective reading" (Philip & Aurelio, 1991, p.278). Philip and Takahashi obtained similar results; only about a third of the subjects in each age group of their study said that the sentence "A boy is holding every balloon" matched a picture in which one boy had three balloons and two other boys had no balloons. In contrast, 100% of the children tested agreed that "A girl is holding every balloon" matched a picture in which three girls were each holding a different balloon. Philip and Takahashi also interpret this as the result of a response bias. Philip (1994) also notes even stronger findings in Dutch. As many as thirty-one of thirty-two monolingual Dutch-speaking children (mean age 5;8) gave what Philip calls a symmetrical response, even though for adult speakers of Dutch the preference for a narrow scope reading is so strong in this context that a wide scope reading of the quantifier is felt to be ungrammatical (Philip, 1994, pp.61-62).[9]

We could also relate these results to the finding by Miyamoto & Crain (1991) and Miyamoto (1992, 1993) that children between 3 and 5 years tend to strongly prefer a distributive interpretation of plural pronouns in sentences like "They are holding two/four cans" (see section 2.2.2.1 above). There appears to be some relation between quantifier

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[9]For discussion of additional Dutch results, see section 2.3.4.2.

spreading and the rejection of the narrow scope (collective) interpretation of the quantifier.

Takahashi (1991) noted a methodological problem with both Philip & Aurelio (1991) and Philip & Takahashi (1991): "the 'matching' task causes children to fixate on the idea that there should be a one to one match-up between agents and objects in the picture regardless of the type of accompanying texts" (Takahashi, 1991, p.306). Furthermore, the pictures

> encourage the creation of a 'mental picture' which fails to be an appropriate description of the sentence even under the adult interpretation. When shown a picture [of three pigs, each eating a different apple, with two "extra" apples], for instance, it is easy for the children to imagine two additional pigs to which the extra apples belong. If there are five pigs in the children's mind, the accompanying sentence, "Every pig is eating an apple" would trivially be false (Takahashi, 1991, pg. 306).

Takahashi modified the design of the previous experiments so that in the pictures in her study, all the agents were exhaustively linked with some object, and all the objects were exhaustively linked with some agent. For example, for an **every/a** case such as "Is every pig eating an apple?", the picture showed three pigs, each eating a different apple, and two alligators, each eating a different apple.

In addition, Takahashi's study included several other questions to investigate why children answered as they did. For example, with the "pig and alligator" picture described above, children were also asked, "Are three pigs eating an apple?". Questions such as this were included to show that children aren't rejecting sentences just because they aren't the simplest descriptions of the pictures (i.e., because they contain superfluous elements; in this case, although the sentence only mentioned pigs and apples, the picture also included alligators).

Takahashi also asked children questions with two quantifiers, such as "Is **every** boy holding **every** balloon?", with two different pictures: one in which there are three boys, each holding one balloon, and one in which there are three boys, each holding a string for each of three balloons (the latter interpretation was supposed to be the correct one for adults).

Takahashi tested twenty children between the ages of 3 and 6. Of these, two were eliminated because they answered "yes" to everything, and four were eliminated because they didn't pass the "three test" (responding "no" to "Are three pigs eating an apple?", in the "pig and alligator" situation described above[80]). All of the remaining children demonstrated that they would accept the distributive interpretation (responding positively to both "Is every horse eating a carrot?" and "Is a horse eating every carrot?", when the picture showed a one-to-one match of horses and carrots), and accepted both situations with the **every/every** sentences (so, these children accepted both the adult interpretation with distribution of the subject combined with distribution of the object, and also the interpretation in which there was a one-to-one mapping of subjects and objects).

Based on children's responses to test items, Takahashi identified

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[80]Recall that Takahashi included this question to screen out children who were rejecting sentences which weren't the simplest descriptions of the pictures. These children could have been what Philip (1994) calls Perfectionists. It is also possible, however, that these children rejected "Are three pigs eating an apple?" because they couldn't distribute (and so rejected the sentence because each pig was eating a different apple) or would only allow a referential interpretation of the indefinite (so that "an apple" could only refer to one particular apple). It would be interesting to distinguish among these possibilities.

three groups of subjects whose response patterns were significantly different from each other. The relevant test items included both positive and negative **every/a** and **a/every** items.[81] The first group (five children) answered "no" to all types of **every/a** and **a/every** items. This suggests that these children were spreading with both types of items.[82] The second group (six children) behaved very differently from this first group. These children accepted the positive **every/a** items almost 100% of the time, but accepted the positive **a/every** cases only about 72% of the time and also frequently accepted the negative **a/every** cases. Finally, the third group (two children) gave adult-like responses to all of the items except the positive **a/every** case, which they accepted only about 50% of the time. An additional three children

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[81]There were two picture types for **every/a** and **a/every** sentences. The first type showed, for example, three pigs, each eating a different apple, and two alligators, each eating a different apple, with the following test sentences:

T1 Is every pig eating an apple? [should be yes]
T2 Is a pig eating every apple? [should be no]

The second picture type showed, for example, three dogs, each holding a different bone, and two dogs, each holding a different fish, with the following sentence types:

T4 Is every dog holding a bone? [should be no]
T5 Is a dog holding every bone? [should be yes]

In addition, a third picture type showed, for example, three boys, each sitting on a different chair, a dog on a chair, and a cat on a chair, with sentence type T7.

T7 Is every boy sitting? [should be yes]

I will not discuss this last type here.

[82]Takahashi notes that,"Whenever the answer to a core test item was in the negative, we asked the reason for the rejection. Children's rejections invariably indicated that they were using the distributive reading" (Takahashi, 1991, p.312).

did not fit into any of these groups.

Based on her results, Takahashi proposed a series of developmental stages for children's interpretation of **every**. For adults, **every** functions syntactically as a determiner whose quantificational force is restricted to the NP which it is a part of; **every** binds only the variable that ranges over the possible referents of the NP. The developmental stages Takahashi proposes involve both the syntactic function of **every** in the children's grammar and its quantificational force. The stages involve interpretation of **every** first as an adverb quantifying over events, then as an adverb quantifying over individuals, and eventually as a determiner (the adult interpretation). The stages also involve what the children interpreted as part of the restrictive clause of the logical representation of the sentences. Takahashi proposed that first the children allow **every** to bind a variable that originates outside of its NP, then the restrictive clause is limited to the content of the sentence, then it is limited to the subject or the object, and finally it is limited to the NP which **every** is a part of.

The stages proposed by Takahashi are summarized in (99).

(99) Stage 1:
i. **every** interpreted as an adverb quantifying over events
ii. minimal restrictive clause

Stage 2:
i. **every** interpreted as an adverb quantifying over events
ii. restrictive clause reflecting sentential content

Stage 3:
i. **every** interpreted as an adverb quantifying over individual variables
ii. either the subject or the object in the restrictive clause

Stage 4:
i. **every** interpreted as a determiner in **every/a** sentences
ii. **every** interpreted as an adverb quantifying over individual variables in **a/every** sentences

Stage 5:
i. **every** interpreted as a determiner in both **every/a** and **a/every** sentences
ii. non-adult behavior persists in some **a/every** cases and in the **every/every** cases; reasons not clear

Note that **every/a** sentences appear to be treated in an adult way before **a/every** sentences are, and that the children's interpretation of the **every/every** sentences persisted beyond age 6.

In his summary of results, Philip (1994) discussed the prediction that symmetrical responses would occur with some sentence types but not others; in actual experimental findings, however, Philip argued that because of the incidence of "noise" in the data, it was enough to show that symmetrical responses occur significantly less often with some sentence types than others. Following up on Philip & Takahashi (1991) and Takahashi (1991), Philip found, as he predicted, that symmetrical responses occurred significantly more often with transitive sentences (e.g., "Is every pig eating an apple?", where the picture showed three pigs, each eating a different apple, two extra apples, and a dog eating a bone) than with intransitive sentences (e.g., "Is every girl waving?", where the picture showed three girls, each waving from a different truck, two extra trucks, and a dog). Symmetrical responses were also found significantly less often with bare NP sentences (e.g., "Are boys riding horses?", where there are three boys, each riding a horse, an extra horse, and a cat) and in cases with optionally transitive verbs (e.g., "Is every girl riding?", where there are three girls, each riding a different elephant, an extra elephant, and a cat; see discussion of

Philip & Takahashi, 1991). Symmetrical responses appear to require a verb which takes two arguments.

Additionally, Philip found evidence of symmetrical responses with ditransitives such as either "Is every dad showing a rabbit to a girl?" or "Is every dad showing a girl a rabbit?" (where the picture showed three dads, each showing a rabbit to a girl, and either an "extra" rabbit or an "extra" girl). The sentence type (whether or not it was a double object construction) seemed to have no effect on the amount of spreading. When the "extra" object was the indirect object (the girl), the number of symmetrical responses was comparable to that for simple transitive sentences. However, when the "extra" object was the direct object (the rabbit) rather than the indirect object, there was some inhibitory effect on the occurrence of the symmetrical response.[83]

Philip also compared sentences with **every** with sentences with floated **all**, for both distributive and group interpretations.[84] As an example of the group interpretation, the children were shown a picture with three girls collectively riding a single elephant, three extra elephants, and a cat; they were then asked "Is every girl riding an elephant?". For the group interpretation of **all**, children were shown a

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[83]Philip gives the percent symmetrical interpretation across forty-four children for each test condition as below:

TRANS	Is every boy riding a pony?	[extra pony]	69%
TXA	Is every dad showing a rabbit to a girl?	[extra girl]	69%
DXA	Is every dad showing a girl a rabbit?	[extra girl]	72%
TXO	Is every dad showing a rabbit to a girl?	[extra rabbit]	56%
DXO	Is every dad showing a girl a rabbit?	[extra rabbit]	53%

[84]This was motivated by the fact that in the adult grammar there are contexts in which **every** resists a collective interpretation, while **all** readily accepts a collective interpretation (Philip, 1994, p.231).

picture of three cats climbing a single ladder, with two other (empty) ladders, and a man; they were asked, "Are the cats all climbing a ladder?". Philip found no significant differences between conditions testing **every** and conditions testing **all**. With respect to the group conditions, Philip found that for twelve of twenty-three subjects, the average percentages of symmetrical responses on two trials for the group conditions did not differ significantly from the average percentages for the distributive conditions (i.e., like Condition 3). For the twenty-three subjects as a whole, there was even a significantly higher incidence of negative responses in the group-**every** condition than in the distributive-**every** condition.

Philip (1991, 1992) attempted to give a linguistic description of quantifier spreading. Philip (1991) proposed two restrictions on the occurrence of quantifier spreading, the Clause-mate condition and the Transitivity condition.[85]

The Clause-mate condition is the requirement that a spreading quantifier have an indefinite NP clause-mate (e.g., a direct object, as in "Is every pig eating an apple?"). There is no spreading when the predicate is simply a verb with no complement (e.g., "Is every girl waving?", where the picture showed three girls, each waving from a different truck, two extra trucks, and a dog).[86] This raises the

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[85]Philip (1991) also proposed a third restriction, the Cognitive Blocking Effect. Since this is superseded by Philip (1994)'s definition of distinguished participant and subevent (to be discussed below), I will not discuss the Cognitive Blocking Effect here.

[86]If we are assuming that quantifier spreading is a linguistic phenomenon there is no reason to expect spreading in this situation; however, this does show that spreading is not just a matter of requiring that the <u>objects in the picture</u> be in a one-to-one relationship.

question of why the spreading quantifier needs an indefinite NP, and what qualifies as an indefinite. Which treatment of indefinites is appropriate for describing this phenomenon? If Philip is following Heim (1982), then indefinites could be characterized as variables.[87] Can the phenomenon of spreading be generalized to other types of variables? Also, if an indefinite is required, what is the explanation for the non-adultlike interpretation of sentences such as "Is **every** boy holding **every** balloon?"

Philip's second restriction, called the Transitivity condition, states that the presence of an intransitive verb will usually block spreading, even if there is an indefinite NP in the predicate (e.g., "Is every cat waving in a box?").[88] Spreading appears to require an object. However, one example of spreading given in Philip & Aurelio (1991) is "Is every mouse in a cup?", an example with no transitive verb. Perhaps a better way to characterize this requirement would be to distinguish between arguments and adjuncts, rather than making a transitive/intransitive distinction. It appears that there is no spreading (or at least significantly less spreading) into adjuncts.

The explanation for spreading proposed in Philip (1991, 1992) is the Event Quantificational Hypothesis. This proposal consists of two

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[87]According to Heim (1982, p.127), "indefinites (at least some of them) simply have no quantificational force of their own at all, but are rather like variables, which may get bound by whatever quantifier there is to bind them."

[88]Philip (1991) discusses one study in which spreading occurred 76% of the time with sentences such as, "Is every girl riding an elephant?" (when the indefinite is the object of the verb), but only 39% of the time with sentences like, "Is every girl waving on an elephant?" (when the indefinite is in a prepositional adjunct).

key claims:

> (i) that children have to, or prefer to, quantify over events rather than objects; and (ii) that under event quantification they derive a restrictor that behaves as if it were a disjunction of stage-level versions of the predicates that are arguments for the matrix verb under the nuclear scope of the tripartite structure (Philip 1991, p.369).

Claim (i) in fact involves two parts. First, rather than deriving an adult-like logical form for universally quantified sentences, Philip claims that children who spread derive a logical form in which the determiner universal quantifier alone (e.g., **every**), rather than the whole quantifier phrase (e.g., **every boy**), occupies a position of sentential scope. In effect, he argues that children process a determiner universal quantifier in the way that an adult might process an adverb of quantification (e.g., **always**).

Second, Philip claims that the spreading child quantifies not over individual objects, but over individual "events" in the sense of Davidson (1967). Both event quantification and object quantification are part of the adult grammar. (100a) is an example of event quantification with the adverb of quantification **always**; (100a) can be glossed as in (100b).[89]

(100) a. If the cats are fed outside, the dogs always steal their food.

b. "All events/situations in which the cats are fed outside are events/situations in which the dogs steal their food"

Philip argues that children are faced with the problem of determining which type of quantification (event quantification or object

[89](100a) and (100b) correspond to Philip (1994)'s (2a) and (2b) (p.16).

quantification) is appropriate for universal quantifiers like **every** and **all**, and also suggests that object quantification is for some reason fundamentally harder to process than event quantification. For example, he suggests that verification of the truth value of a sentence may require more steps with object quantification than with event quantification (see Philip, 1994, p.17, fn.10). Verifying the truth value of a sentence containing object quantification requires individuating the objects and identifying their type, but, Philip claims, this requires abstraction away from the interpretation of the objects as participants playing specific roles in an unfolding event. However, Philip claims this abstraction is not required for event quantification, and in fact cannot occur.

It is not immediately apparent why this should make object quantification more difficult than event quantification, since, as Philip notes (Philip, 1994, pp.72-73, fn.1), event quantification requires an internal structure for the event (since "in general events may readily be perceived to consist of distinct objects interacting in certain ways"), while object quantification does not require the objects to have an internal structure[90]; "Whereas under object quantification individual objects are the discrete units being counted, under event quantification it is rather individual collections of intensionally related objects that are the discrete units being counted" (Philip, 1994, p.73). While the internal structure of events may be more salient

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[90]As Philip notes, object quantification does not require that objects have a salient internal structure, but objects may have internal structure, such as the structure of "plural individuals" in the sense of Link (1983), among others.

than that of objects, this also makes events inherently more complex than individual objects. Moreover, it's not apparent that events are more salient than the events' objects; if we talk about the event of an elephant stepping on a flea, it would seem that at least one of the objects (the elephant) is more salient than the elephant-stepping-on-a-flea event.[91]

Claim (ii) of the Event Quantificational Hypothesis involves the spreading child's restriction of the domain of quantification. Philip assumes that children who spread impose a tripartite structure (in the sense of Heim, 1982) as the logical form of sentences containing a universal quantifier.[92] The three parts of this structure are the quantifier itself, a first argument which defines a restriction on the domain of quantification, and a second argument which specifies the truth conditions which must be satisfied by members of the set denoted by the first argument.

For example, the spreading interpretation of "Is every boy riding a pony?" would be represented as in (101) (where the picture would show three ponies, each being ridden by a boy, and one pony not being ridden).[93] In order to know what counts as an event, see the definition of subevent in (104) below.

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[91]This example is due to Bob Fiengo.

[92]This is the type of structure which Philip (1994, p.92) assumes for adult interpretation of sentences containing an adverb of quantification such as **always**.

[93]This is adapted from Philip (1991)'s figure (6).

(101)

```
                 ^
               / | \
              /  |  \
             /   |   \
            /    |    \
           /     |     \
          Q      R      N
         /       |       \
       ∀e  PART (boy', e)  a boy is riding (e) a pony
                 v
           PART (pony', e)
```

"For all events such that either a boy participates in it or a pony participates in it (or both), the event is one of a boy riding a pony."

Here the universal quantifier is in the leftmost position, and the "Restrictor" (R, the first argument) is a disjunction of all events involving boys and all events involving ponies. While adults draw a restrictive clause from the "Nuclear Scope" (N, the second argument), the spreading child applies a rule so that all predicates functioning as arguments of the matrix verb must be mapped onto the restrictor as disjuncts.

Philip claims that the adult logical structure for determiner universal quantification would be (102).

(102)

```
                 ^
               / | \
              /  |  \
             /   |   \
            /    |    \
           Q  1st argument 2nd argument
          /      |          \
        ∀x     boy (x)   pony-rider (x)
```

"For all objects x, such that x is a boy, x is riding a pony."

He notes, however, that an adult event quantificational interpretation is also possible, as in (103).

```
(103)                    ^
                        /|\
                       / | \
                      /  |  \
                     /   |   \
                    /    |    \
                   /     |     \
                  Q  1st argument 2nd argument
                 /       |         \
               ∀e   PART (boy, e)  a boy is riding (e) a pony
```

"For all minimal events which have a boy
as a participant, a boy is riding a pony."

Philip suggests that (103) is truth-conditionally equivalent to (102). This means that the switch from an event to an object quantificational interpretation is potentially independent of the abandonment of spreading (see Philip, 1994, pp.88-89, for discussion). If this is the case, it seems that positing an event-quantification analysis may not be necessary to explain quantifier spreading. It is not obvious that event quantification itself is responsible for the children's interpretation.

Philip (1994) refined the Event Quantification Hypothesis to account for the behavior of both the Symmetry Child and the Perfectionist. These refinements involve Claim (ii) of the Event Quantificational Hypothesis; the Symmetry Child and the Perfectionist are distinguished by the restrictor rules which they use to restrict the domain of quantification.

In formulating these rules, Philip made two assumptions about child cognition. The first is that at an unconscious level of representation, an event is divisible into subevents, where a subevent is any part of that event in which the "participant object" that is central to the event is always at least implicitly participating.

Philip calls the object that is taken as the central participant of an event the "distinguished participant". Philip defines distinguished participant and subevent as in (104a) and (104b), respectively (Philip, 1994, p.118).

(104) a. Distinguished Participant $=_{def}$

participant which is in some sense central to the event in question (cf. topic)

b. Subevent of e $=_{def}$

any event e′ which is a part of e and which includes no participant playing the same role as the distinguished participant of e unless this participant is itself the distinguished participant of e

To say that the distinguished participant may implicitly participate in a subevent is to say that no other object participating in this subevent can play the same role as the distinguished participant; if some other object in an event e_1 plays the same role as the distinguished participant of an event e_2, then e_1 cannot be a subevent of e_2, but is simply a different event.

As an example, Philip discusses the event of a boy riding a pony. In Philip's analysis, possible subevents of this event include an event of the boy standing next to the pony (about to get on and ride), the event of the boy standing alone (waiting for the pony to arrive so he can ride it), or the event of a pony standing alone (waiting to be ridden by the boy). For Philip, these are all subevents of a boy-riding-a-pony event, since they all retain the boy as the distinguished participant, even if he is only implicitly participating (as in the last case, with the pony waiting). However, the event of a girl riding a pony is not a subevent of a boy-riding-a-pony event, since the girl is then the pony-rider, and so has the same role as the distinguished participant.

Philip's second assumption is that for children, when a sentence contains a single determiner universal quantifier (e.g., **every**), this quantifier may function as a linguistic marker of the distinguished participant of an event:

> (105) A child determiner universal quantifier Q linguistically marks the NP it is syntactically related to in surface form as denoting the distinguished participant of the type of event referred to by the sentence S in the scope of Q (Philip, 1994, p.119).

Using these assumptions and definitions, Philip proposes two different restrictor rules, one for the Symmetry Child, and one for the Perfectionist. These are given in (106) and (107), respectively.

> (106) Symmetry Child Restrictor Rule (SCRR)
>
> The restricted domain of quantification is the set of minimal events e′ such that, with respect to the event-type e denoted by the sentence S in the scope of Q:
>
> (i) e′ is a subevent of e that has a participant object of the same type as the distinguished participant of e,
>
> or
>
> (ii) e′ is a subevent of e that has a participant object of the type denoted by some referring expression in S (Philip, 1994, p.119).

> (107) Perfectionist's Secondary Restrictor Rule (PSRR): (applies only after the SCRR)
>
> The restricted domain of quantification is the set of minimal events e such that e has a participant object that is perceived (i.e. e is included by general pragmatic restriction) (Philip, 1994, p.125).

For a sentence like "Every boy is riding a pony", the symmetrical interpretation, based on the Symmetry Child Restrictor Rule, would be (108a). The Perfectionist interpretation, based on the Secondary Restrictor Rule in (107), would be (108b).

(108) a. "All minimal events which are subevents of a boy-riding-pony event, and in which a boy or a pony (or both) is a participant, are events in which a boy is riding a pony" (Philip, 1994, p.120).

b. "All minimal events which are subevents of a boy-riding-a-pony event in which either a boy or a pony (or both) is a participant, or which are events in which a perceived object is a participant, are events of a boy is [sic] riding a pony" (Philip, 1994, p.125).

As mentioned above, Philip argues that the stage of the Perfectionist precedes that of the Symmetry Child. Philip focuses on the study of the symmetric response; he argues (Philip, 1994, Chapter 2) that nonlinguistic accounts of the symmetrical response are inadequate.[34] However, the nature of the Perfectionist response (involving "perceived objects") is less clear, and seems more likely to be rooted in pragmatic or cognitive factors. This is an area which requires further investigation.

What causes children to stop spreading? Philip proposes that children outgrow the symmetrical interpretation by "simply" shifting from quantification over events to quantification over objects:

> the reason why children eventually do acquire adult-like performance with determiner universal quantifiers may not be completely determined by Universal Grammar. This is because it may be that adult performance with

[34]Among other things, Philip found that there was at most a weak relationship between the symmetrical response and pragmatic determination of the domain of quantification (Philip, 1994, p.48).

> universal quantification itself is not be [sic] completely determined by Universal Grammar. Rather, adult performance may be an interactive effect of linguistic competence and knowledge that only object quantificational readings preserve logical validity. On this view, what eventually forces the child to abandon her preference for the symmetrical interpretation is simply a growing awareness that this reading often conveys false information about the world (Philip, 1994, pp.299-300).

In this way, Philip claims, nothing has to be unlearned (i.e., there is no need for negative feedback) for the child to attain the adult grammar; the child just has to learn that quantification over objects is obligatory for determiner quantifiers like **every**. It is not clear from Philip's discussion **how** this happens; in particular, it is not clear how a child learns that quantification over objects is obligatory in these cases, when previously these cases were thought to involve either quantification over events or quantification over objects. Recall, also, that Philip discusses the possibility of an event quantificational interpretation which is equivalent to the adult object quantificational interpretation. If children can stop spreading but continue to maintain the event quantificational interpretation, then what was the role of event quantification in the children's interpretation?

2.3.3 Scope in Chinese

Lee (1986, 1991) and Chien & Wexler (1989) describe investigations of children's understanding of scope in Chinese. These studies are of interest here because of differences in scope interpretation between Chinese and English. In English, sentences such as (109) are ambiguous, while in Chinese the equivalent sentence, (110), has only one possible interpretation.[95]

(109) Every child sang a song.

(110) Meige xiaohai dou chang le yishou ge.
every-CL[96] child all sing Asp. one-CL song
"Every child sang a song"

Sentence (109) can mean that different children sang different songs, where the universally quantified NP **every child** takes wide scope over the existentially quantified NP **a song**, or (109) can mean that there was a song that all the children sang, where the existential **a song** takes wide scope over the universal **every child**. Sentence (110), however, can only have the first of these two interpretations, the wide scope interpretation of the universal **meige xiaohai**, consistent with different children singing different songs.

Scope interpretation principles (which determine scope preferences) appear to vary from language to language[97], which suggests that children may not show the scope biases that adults show. The results in this section suggest that children learning Chinese begin by accepting both of the scope interpretations available for the English equivalent of (110). This means that Chinese children start with two scope interpretations, but by the time they reach adulthood, they've eliminated one of these interpretations.

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[95]These sentences are taken from Chien & Wexler (1989), which will be discussed in section 2.3.3.2.

[96]In the glosses of Chinese data in this section, CL = classifier, asp. = aspect marker, and part. = sentence-final particle.

[97]For example, Lee (1986) cites Gil (1982) as reporting that in languages like Batak and Tagalog the patient NP tends to have wide scope over other NPs in the sentence; Lee cites Munro (1984) as reporting that in Pima the direct object or prepositional object tends to take wide scope over other NPs in the sentence.

2.3.3.1 Lee (1986, 1991)

Lee (1986) notes that since Quantifier Raising (QR) is not overt, children do not receive any overt evidence for postulating it. Since this suggests that QR is unlearnable, Lee argues that it must be innate, and we should therefore expect that children will show evidence of QR from a very early age. Lee further suggests that since QR allows quantifier scope ambiguity to be represented at LF, both wide and narrow scope interpretations should be possible in early child language. In addition, since scope interpretation principles appear to vary, Lee argues that children should not show the same scope biases as adults. To test this, Lee examined how Mandarin-speaking children interpret sentences involving the universal quantifier **mei** ("every"), the quantificational adverb **dou** ("all"), and numeral phrases of the form [one + classifier + noun].

Lee proposed the following condition for quantifier scope interpretation in (adult) Chinese (based on Huang, 1982):

> Suppose A and B are both QPs or both QNPs or Q-expressions, then if A c-commands B at SS, A also c-commands B at LF (Lee, 1986, p.58).

He predicted that young Chinese children would not show a bias in interpreting the first QNP in a sentence as having wide scope, but older Chinese children would predominantly interpret the first QNP in a sentence as having wide scope over the second QNP in that sentence.

Lee tested this hypothesis with 122 Mandarin-speaking children between the ages of 3 years and 8 years[30] and with twenty adults in

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[30]Each age group was represented by between twenty and twenty-four subjects, except for the 8-year-old group, which consisted of only (continued...)

Beijing, China.[illegible] The experiment consisted of twenty picture identification tasks (three of which were training tasks) and eleven toy manipulation tasks.

There were two types of linguistic phenomena tested. One type of item tested the child's understanding of the quantificational adverb **dou** ("all") and of the universal quantifier **mei** ("every") used in conjunction with **dou**. The second type of item examined children's interpretation of the scope relations of two quantified NPs.

In the picture identification task testing understanding of **mei** and **dou**, subjects were asked to select from two pictures the one that corresponded to the sentence said by the experimenter. For example, children were shown two pictures with panda bears. In one picture, three panda bears were sleeping. In the other picture, two panda bears were sleeping, but a third panda bear was awake. The children were given the sentence in (111).

(111) Xiongmao **dou** shuijiao le.
panda all sleep asp./part.
"(The) pandas have all fallen asleep"

For the act-out task, children were given a set of six candies or marbles and were asked to perform actions according to a test sentence such as (112).

(112) Meike tang **dou** na chulai.
every-CL candy all take out
"Take every candy out"

[illegible](...continued)
thirteen children. Each half-age was represented by at least eight subjects.

[illegible]Adult subjects were university students and staff between 19 and 36 years old.

The results for this first type of test item, from both the picture identification task and the act-out task, show that children understand the universal meaning of **dou** by age 4 years.

The second type of test item examined children's interpretation of the scope relations of two quantified NPs. In the picture identification task, children were asked to select from three pictures the one that corresponded to the sentence said by the experimenter. For example, one set of pictures showed three boys eating cake. In the first picture (which Lee called the wide scope reading), each boy is eating a different cake (i.e. the distributive interpretation). In the second picture (which Lee called the narrow scope reading), all three boys are eating the same cake (i.e. the collective interpretation).[100] In the third picture (which Lee called the "non-scope" reading[101]), two boys are eating one cake together, and a third boy is eating a different cake. The children were given the sentence in (113).

(113) Meige xiaopengyou **dou** zai chi yige dangao.
every-CL child all at eat one-CL cake
"Every child is eating a cake"

In the act-out task, the children were given props (either four figures or four candies) and four boxes, either stacked inside of each other (which Lee claimed favored a narrow scope response) or spread out so

[100]Note that this could also be considered a wide scope reading (since for each boy, there is a cake that he is eating). Strictly speaking, we can't tell from the acceptance of this type of interpretation whether the subject has computed the narrow scope reading or the wide scope reading.

[101]Lee notes that this non-scope reading is an incomplete group reading in which each member of the set of boys is in the predicate relation to at least one member of the set of cakes. Again, this could be classified as a wide scope reading, since for each boy, there is a cake that he is eating.

that each separate box was clearly visible (which Lee claimed favored a wide scope response), and were asked to perform actions according to a test sentence such as (114).

(114) Meike tang **dou** fang zai yige hezi li.
every-CL candy all put at one-CL box in
"Put every candy in a box"

In the picture identification task, adult controls demonstrated a consistent wide scope bias (i.e. they preferred the distributive interpretation). 80% of adults chose the first picture type (e.g., each boy eating a different cake) for both of the two sentences tested; 20% of adults chose the first picture type once and the second picture type (e.g., all three boys eating the same cake) once. However, the children's interpretations were more varied. There was a high degree of fluctuation between the wide and narrow scope readings among the 3, 4, 6 and 8-year-olds. In these age groups, between 38% and 47% of the subjects chose a wide scope reading (the distributive interpretation) for one test sentence and a narrow scope reading (the collective interpretation) for the other test sentence. Lee noted that the number of consistent narrow scope (collective) responses increased among 3- and 4-year-olds, followed by a decline after age 5. In addition, a narrow scope (collective) bias was seen in all but the youngest age group, with the ratio of narrow scope readings to wide scope readings gradually decreasing with age. Finally, the number of non-scope responses was always small, and disappeared completely after age 4.

These results contrast with the results of Miyamoto (1992), discussed in section 2.2.2.1 above. Miyamoto found that with sentences such as, "They are carrying two/four cans" (with a picture which showed two people, each carrying two cans), (English-speaking) children between the ages of 3 and 5 preferred a distributive interpretation (i.e., an interpretation in which the distributive operator took scope over the numeral **two**).

The patterns which Lee found were stronger for the act-out task than for the picture identification task. In the act-out task, placement of each object in a different box was considered a wide scope reading, while grouping all of the objects in one box was considered a narrow scope reading. When the boxes were stacked inside of each other (the narrow scope arrangement), a narrow scope bias was observed among the 3, 4 and 5-year-olds, while the responses of the 6, 7 and 8-year-olds (and the adults) showed a strong wide scope bias (i.e., they first unpacked the boxes). Again, there were few non-scope readings, and these became completely absent after age 5.[107] When the boxes were arranged separately (the wide scope arrangement), the results were similar. There was a narrow scope bias among the 3, 4 and 5-year-olds, and a shift toward a wide scope bias among the 6, 7, and 8-year-olds (and the adults). Also, the non-scope readings disappeared after age 3.

Lee argues that his results support his hypothesis that QR is available to the children very early, so that LF representations assigning both wide and narrow scopes to the subject quantifier can be derived. It appears that young Chinese children (3 to 5 years) tend to give a narrow scope (collective) interpretation to a universal quantifier, and then switch to a wide scope (distributive) bias after

[107]Lee notes that the five subjects who gave non-scope responses were those who failed to understand the quantifiers **mei** ("every") and **dou** ("all").

age 5. Lee points out that his data are also consistent with the possibility that children who show a narrow scope interpretation are actually interpreting the indefinite singular noun phrases such as **yige dagao** ("a cake") referentially, selecting the value for the variable bound by the existential quantifier independently of the value chosen for the variable bound by the universal quantifier. At a later stage the child would learn that a numeral phrase like **yige dagao** can be interpreted non-referentially.

Lee (1991) investigated the scope interpretation principles assumed by children with sentences containing QNPs that do not show any c-command relationship.[103] Two sentence types were included. In the first sentence type, QNP_1 was in a preverbal locative phrase, while QNP_2 was a postverbal object, as in (115).

(115) a. X zai **yige dengzi** shang fang **meigen shengzi**.
at one-CL stool on put every-CL string
"X puts every string on a stool"

b. X zai **meige dengzi** shang dou fang **yigen shengzi**.
at every-CL stool on all put one-CL string
"X puts a string on every stool"

In this sentence type, QNP_1 unambiguously takes scope over QNP_2.

In the second sentence type, QNP_1 was a direct object and QNP_2 was the postverbal object of a locative phrase, as in (116).

[103]Since the subject QNPs in the Lee (1986) study both precede and c-command the object QNPs, it is unclear whether the children who interpreted the first QNP as having wide scope were basing their interpretations on linear precedence or c-command.

(116) a. X fang **yigen shengzi** zai **meige dengzishang**.
put one-CL string at every-CL stool-on
"X puts a string on every stool"

b. X fang **meigen shengzi** zai **yige dengzishang**.
put every-CL string at one-CL stool-on
"X puts every string on a stool"

Neither QNP c-commands the other, so c-command is not relevant in these cases; however, a linearity principle would predict one reading for each of these sentences. Lee's results, however, suggest that these sentences are ambiguous.

Lee tested 118 Mandarin-speaking children between the ages of 3 and 8 years.[104] For each sentence type and quantifier order, three categories of responses were distinguished. For the first type of response, subjects consistently assigned wide scope to QNP_1 on the two test sentences. For the second type of response, subjects consistently took QNP_2 as the wide scope quantifier on the both test sentences. For the third type of response, subjects interpreted QNP_1 as having wide scope on one test sentence and interpreted QNP_2 as having wide scope on the other test sentence.[105]

Responses to the first sentence type with the **yige-meigen**

[104]There were sixteen 3-year-olds, twenty-one 4-year-olds, twenty-one 5-year-olds, nineteen 6-year-olds, twenty 7-year-olds, and twenty 8-year-olds. In addition, there was a group (of unspecified size) of adults tested as controls. Children were tested individually; adults were tested in groups of five or six.

Only act-out tasks were used, since Lee (1986) had found that children were much more consistent in act-out tasks than in picture identification tasks when responding to sentences containing more than one QNP.

[105]All responses that could not be classified as corresponding to the wide scope of one of the QNPs were excluded from analysis. As a result, percentages in the following tables will not always total 100%.

(existential-universal)[106] quantifier order are shown in (117).

(117) Percentages of Subjects Selecting Each Type of Response to Sentence Type 1, **yige-meigen** [(115a)]

age group	QNP_1-wide scope	QNP_2-wide scope	mixed
3 yrs.	6%	38%	(5%)[107]
4 yrs.	14%	38%	(8%)
5 yrs.	(33%)	(29%)	(12%)
6 yrs.	(48%)	(25%)	(15%)
7 yrs.	75%	(15%)	(10%)
8 yrs.	(70%)	10%	(15%)
adult	70%	5%	5%[108]

Here a wide scope interpretation of QNP_1 is a collective interpretation, e.g., in (115a), all the strings are placed on a single stool. For adults, this was the preferred interpretation, in accordance with linearity. After age 4, children also preferred this interpretation, although younger children preferred the interpretation in which QNP_2 took wide scope (the distributive interpretation).

Lee attributes young children's violations of linearity to a task bias, in which "the children are taking the two sets of objects separately, that is, they are giving scope-independent readings, and there is something compelling about matching objects in one-one

[106]Lee named his experimental conditions without the English translations in mind; he refers to the order in which the existential quantifier precedes the universal quantifier as the EA order, and the order in which the universal quantifier precedes the existential quantifier as the AE order. This is exactly the opposite of Takahashi (1991)'s use of EA and AE; for her, EA refers to sentences with **every** preceding **a** (universal preceding existential), and AE refers to **a** preceding **every** (existential preceding universal).

[107]For this and the following three tables, percentages shown in parentheses are estimated from graphs given in Lee (1991).

[108]The remaining 20% of adult subjects gave at least one "non-scope" interpretation. Lee suggests that this may be related to the fact that the sentence violated lexical restrictions on the universal quantifier **mei**.

correspondences" (Lee, 1991, p.193, fn.11).

Responses to the first sentence type with the **meige-yigen** (universal-existential) quantifier order are shown in (118).

(118) Percentages of Subjects Selecting Each Type of Response to Sentence Type 1, **meige-yigen** [(115b)]

age group	QNP_1-wide scope	QNP_2-wide scope	mixed
3 yrs.	63%	0	(8%)
4 yrs.	67%	0	(19%)
5 yrs.	81%	5%	(10%)
6 yrs.	95%	5%	0
7 yrs.	(95%)	0	(5%)
8 yrs.	100%	0	0
adult	100%	0	0

Here a wide scope interpretation of QNP_1 is a distributive interpretation, e.g., in (115b), the strings are each placed on a different stool. All adult subjects consistently assigned wide scope to the universal quantifier, in accordance with linearity, and children's responses were very similar to those of adults. Lee attributes children's good performance here to the task bias, suggesting that "when a violation of the linearity principle was not favored by the task bias, virtually no consistent violations of linearity could be observed" (Lee, 1991, p.197).

Responses to the second sentence type with the **yigen-meige** (existential-universal) quantifier order are shown in (119).

(119) Percentages of Subjects Selecting Each Type of Response to Sentence Type 2, **yigen-meige** [(116a)]

age group	QNP_1-wide scope	QNP_2-wide scope	mixed
3 yrs.	13%	31%	(5%)
4 yrs.	14%	62%	(5%)
5 yrs.	38%	(54%)	(5%)
6 yrs.	(52%)	(25%)	(10%)
7 yrs.	85%	5%	(10%)
8 yrs.	65%	20%	(15%)
adult	55%	25%	15%

These results parallel those for the **yige-meigen** (existential-universal) order of the first sentence type, although for adults results are less clear for this sentence type. Lee suggests that adults found these sentences scope-ambiguous. He also argues that these results again show the effects of interference of the "task bias" (or spreading) among the younger children, and that after age 7, when the wide scope interpretation of QNP_1 drops off, linearity is counterbalanced by some other scope principle.

Responses to the second sentence type with the **meige-yigen** (universal-existential) quantifier order are shown in (120).

(120) Percentages of Subjects Selecting Each Type of Response to Sentence Type 2, **meigen-yige** [(116b)]

age group	QNP_1-wide scope	QNP_2-wide scope	mixed
3 yrs.	44%	30%	(22%)
4 yrs.	(76%)	(10%)	(15%)
5 yrs.	76%	5%	(10%)
6 yrs.	76%	5%	(5%)
7 yrs.	(69%)	0	25%
8 yrs.	60%	0	25%
adult	30%	25%	40%

Here again results are unclear; according to Lee, this reflects the ambiguity of these sentences.

From his results, Lee argues that linear order is a strong scope interpretation principle for Chinese, which is firmly acquired at around age 7. There are similarities between the existential-universal sentences across sentence types, and there are differential responses to sentences with existential-universal and universal-existential orders.

2.3.3.2 Chien & Wexler (1989)

Chien & Wexler (1989), using an act-out task, also investigated Chinese-speaking children's and adults' interpretations of sentences involving two quantificational NPs. Each subject was first presented with an array of three equally sized squares and a card with an array of three different figures or numbers, or a set of three markers of different colors. The subject was then presented with a test sentence (e.g., "Draw every figure in one box") and asked to perform the action.

Chien and Wexler tested 192 children between the ages of 3 and 10, and forty-two adults. The children were divided into seven age groups with at least twenty-five children in each group except the first two groups. Altogether there were eight types of quantificational constructions. Four of these are similar to the sentence types studied by Lee (1991).

The first type of sentence, similar to Lee's (115a), is shown in (121).

(121) Zai yige gezi li hua meige tuxin.
at one-CL box inside draw every-CL figure
"In one box, draw every figure"

When adults were given the sentence in (121), with very few exceptions they assigned the wide scope reading to the existential "one box", and drew all three figures in a certain box. Children exhibited a response pattern similar to that of adults, except for the two youngest age groups.

The second sentence type, similar to Lee's (115b), is shown in (122).

> (122) Zai meige gezi li dou hua yige tuxin.
> at every-CL box inside all draw one-CL figure
> "In every box, draw one figure"

When adults were given the sentence in (122), about 50% of the time they assigned the wide scope reading to the universal "every box" and drew different figures in different boxes. About 41% of the time, they assigned wide scope to the existential "one figure", and drew the same figure in all three boxes. When children were given this sentence, they assigned the wide scope reading to the universal "every box" more frequently than to the existential "one figure", except for G7. These children (the oldest ones, age 9 to 10) assigned wide scope to the universal and to the existential almost equally often. So, once again, the response pattern exhibited by children followed a similar trend to that observed in adults.

The third sentence type, similar to Lee's (116a), is shown in (123).

> (123) Hua yige tuxin zai meige gezi li.
> draw one-CL figure at every-CL box inside
> "Draw one figure in every box"

When adults were given the sentence in (123), about 77% of the time they assigned wide scope to the existential "one figure", and drew the same figure in different boxes. About 19% of the time they assigned wide scope to the universal "every box", and drew different figures in different boxes. When children were asked to "draw one figure in every box", the wide scope reading was more frequently assigned to the existential "one figure" than to the universal "every box", except for G1 (age 3 to 4) and G2 (age 4 to 5). Children older than 5 followed the same pattern as adults. The youngest children seemed to assign both types of responses equally often. However, Chien and Wexler argue that perhaps the youngest children's responses should be disregarded:

> It should be pointed out that, in the present study, a high portion of our young children tended to give only one particular response to all the test questions they had received. Therefore, the set of data obtained from children younger than 5 should be interpreted with caution (Chien & Wexler, 1989, p.77).

The fourth sentence type, similar to Lee's (116b), is shown in (124).

(124) Hua meige tuxin zai yige gezi li.
draw every-CL figure at one-CL box inside
"Draw every figure in one box"

When adults were given the sentence in (124), almost all of them only assigned the wide scope reading to the existential "one box", and drew all three figures in a certain box. Children's response pattern to this sentence seemed to be different from that of adults. Even relatively old children, age 7 to 9, gave almost as many responses with the three boxes involved.

For these sentence types, then, the responses given by children older than 5 showed a parallel between children's scope interpretation and adults' scope interpretation.

Chien and Wexler also examined responses to sentences with two existentially quantified NPs and sentences with two universally quantified NPs. (125) and (126) are the sentences with two existentially quantified NPs.

(125) Hua yige tuxin zai yige gezi li.
draw one-CL figure at one-CL box inside
"Draw one figure in one box"

(126) Zai yige gezi li hua yige tuxin.
at one-CL box inside draw one-CL figure
"In one box, draw one figure"

For sentences such as (125), about 96% of the time adults drew a certain figure in a certain box and left two figures unused and two boxes empty. For sentences such as (126), about 76% of the time adults drew a certain figure in a certain box with two figures unused and two boxes empty, and about 18% of the time they drew different figures in different boxes. Chien and Wexler described this last interpretation as a generic reading with an interpretation like "for every x, if x=box, in x, draw one y, y=a figure."

When child subjects were asked to draw one figure in one box, in most cases, they drew a certain figure in a certain box and left two figures unused and two boxes empty (as adults did most of the time). For sentences such as (126), children showed the same response pattern, drawing a certain figure in a certain box and leaving two figures unused and two boxes empty. Chien and Wexler also found that in some cases children also assigned the generic reading to sentences with two existentially quantified NPs. However, they did this with both sentence (125) and sentence (126), while adults had only done this with sentence (126).

The most interesting results which Chien and Wexler found have to do with the interpretation of sentences with two universals. It was assumed that the only correct interpretation for the sentences with two universals is to draw all three figures in each of the three boxes.

These sentences are given in (127) and (128).

> (127) Hua meige tuxin zai meige gezi li.
> draw every-CL figure at every-CL box inside
> "Draw every figure in every box"
>
> (128) Zai meige gezi li dou hua meige tuxin.
> at every-CL box inside draw every-CL figure
> "In every box, draw every figure"

Adults gave the expected interpretation for (127) about 94% of the time, and gave the expected interpretation for (128) about 93% of the time. However, children gave very few responses corresponding to the expected adult interpretation. In many cases, children drew a figure in a box and another figure in another box until there were no figures left and no boxes unused. In other words, children required a one-to-one mapping between the subjects and objects.

Chien and Wexler offered two explanations for this set of results. One explanation involved children's use of a response set, so that they did not want to use any figure more than one time. However, Chien and Wexler suggest that this explanation is unlikely, especially given the older age at which children still produced this result. An alternative explanation was that the children knew the concept of "every N" and tried to establish a relation between the members of the two sets of elements mentioned, but did not make one universally quantified NP enter the scope of the other universally quantified NP. Instead, they assigned "sum of plural" readings; for example, a sum of plural reading for (128), according to Chien and Wexler, would be "draw three figures in three boxes such that each of the figures is drawn and each of the boxes is drawn in".

Chien and Wexler suggest that

> if this response pattern is upheld, and is seen to be a result of children's syntactic knowledge (and not an artifact) then it seems that it is an important empirical discovery which calls out for theoretical explanation. It might be central to a discussion of the acquisition of operators in child language (Chien & Wexler, 1989, p.78).

2.3.4 More on Quantifier Spreading

While Philip and others have argued that quantifier spreading is a syntactic phenomenon, Crain, Thornton, Boster, Conway, Lillo-Martin & Woodams (1994) argue that quantifier spreading, which they refer to as the symmetrical interpretation, is an experimental artifact. I will discuss the objections of Crain et. al (1994) in section **2.3.4.1**, and then turn to Philip & Coopmans (1995a), a study of quantifier spreading in Dutch which includes a response to Crain et al. (1994), in section **2.3.4.2**.

2.3.4.1 Crain, Thornton, Boster, Conway, Lillo-Martin & Woodams (1994)

To support their view, Crain, Thornton, Boster, Conway, Lillo-Martin & Woodams (1994) describe a series of seven experimental studies relating to children's interpretation of universal quantifiers. Not all of these experiments are relevant for determining the validity of the symmetrical interpretation; instead, some are meant to demonstrate children's general competence with quantifier interpretation. I will discuss the first four experiments here.[109]

Crain et al.'s general argument against the symmetrical account has to do with some of the findings of Takahashi (1991). Recall that Takahashi had found that children interpreted **every/a** sentences in an adult way before **a/every** sentences. Given a picture of three men, each feeding a different donkey, and two men, each feeding a different dinosaur, children's responses to the questions in (129) and (130) differed.

(129) Is every farmer feeding a donkey?

(130) Is a farmer feeding every donkey?

According to Crain et al., "the symmetrical account cannot in principle accommodate the finding that children respond differently to sentences like [(129)] and [(130)] in the same contexts" (Crain et al., 1994, p.4), and "If there is a single context in which these sentences do not evoke similar responses from these children, then this suffices to undermine the [symmetrical] account" (Crain et al., 1994, p.17).

It's not clear why this should be so. Philip does not claim that the symmetrical response is the only interpretation available to children. On his view, both object quantification and event quantification are available to children. If that's the case, then we should expect that other factors will determine when children will have a symmetrical interpretation and when they will have an adult-like

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[109]Experiment 5 tested for the symmetrical interpretation in American Sign Language (ASL). Experiment 6 tested for a paired list reading of quantified NPs with sentences like "What did every pig buy?" and "What didn't every pig buy?". Finally, Experiment 7 tested relative clause and conditional donkey sentences such as "Every man who has a snowplow uses it to push snow" and "If a man has a snowplow, then he uses it to push snow."

interpretation. One factor that could influence this would be the **every/a** and **a/every** ordering. There is evidence that adult scope interpretations are influenced by quantifier order (see Kurtzman & MacDonald, 1993), so we could expect that children preference for one interpretation or another would also be affected by this factor.[110]

Crain et al. argue that the symmetrical interpretation is in fact an experimental artifact, a result of a task which does not satisfy the pragmatic condition of "plausible denial". Crain (1991) defined plausible denial as a feature of an experiment that "provides a reason for children to say 'no'" (Crain, 1991, p.607). This makes sense, since of course we want to be sure that children are not just responding "yes" to everything, or responding "yes" whenever they don't know that answer.

However, that definition cannot apply to studies of the symmetrical interpretation, since the adult response in such situations is "yes", while the nonadult-like children's response is "no" (and is accompanied by a particular kind of explanation for that rejection). In order to apply plausible denial to this situation, Crain et al. have to modify their definition. Arguing against the quantifier spreading studies of Philip, Crain et al. complain that "there was nothing in the context corresponding to the negative answer on the adult interpretation" (Crain et al., 1994, p.4). This is a rather radical

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[110]Kurtzman & MacDonald found that for active sentences, there is a general preference for the interpretation in which the leftward quantified phrase has wide scope. There is also a stronger preference for a wide scope interpretation of the indefinite in the **a/every** order. They suggest that this is due to a single reference principle: "when an **a**-phrase in the surface subject or topic of a sentence is received it is immediately interpreted as referring to just a single entity" (Kurtzman & MacDonald, 1993, p.257). For related discussion, see Fodor (1982).

requirement; if it were strictly adhered to, a lot of previous research would have to be considered invalid. In addition, it necessitates complicated stories (which require the consideration of possible events that do not in the end occur), and eliminates the possibility of using picture judgment tasks.

A solution to this problem, one already adopted in Philip's work, is the use of questions probing children's rejections. We want to be sure that children (or adults) are not rejecting picture-sentence pairs for the wrong reasons. A simple solution is to ask, "What really happened?" or "Why not?". If children give consistent responses which indicate that they are giving a symmetrical interpretation, that alone seems to be evidence that an experimental artifact is not solely responsible for the rejection of a picture-sentence pair.

Crain et al.'s Experiment 1 was meant to replicate the work of Philip and others in order to identify children who assigned the symmetrical interpretation and then to investigate these children's responses using other tasks. Experiment 1 was a picture judgment task using materials from Philip's previous experiment. Children were asked a yes/no question; when they gave a negative response, they were asked by a puppet to explain why the answer was "no". There were seven pictures corresponding to the Extra Object Condition (in which, for example, there were three farmers, each feeding a different donkey, and an extra donkey), and seven filler trials. The study included thirty-four subjects between the ages of 3;0 and 5;10 (mean age 4;4).[111]

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[111]Responses for an additional three subjects were discarded; no explanation of this is given.

Crain et al. found that 35% of children's responses were consistent with the symmetrical interpretation. A group of fourteen children gave the symmetrical response 82% of the time, on at least four of the seven trials, answering "no" to "Is every farmer feeding a donkey?", and pointed to the "extra donkey" as the reason. The other twenty children gave symmetrical responses less than 6% of the time.

Experiment 2 tested the distributive interpretation with the universal quantifier, using the truth value judgment task. For example, in one story, a mother and two children are about to have a drink after skiing. The mother takes a cup of cider; the children consider drinking soda, but end up drinking cider. In other words, each of the three skiers drank a cup of cider; however, there were extra cups of cider left over (so that cups and drinkers were not in a one-to-one mapping). The test sentence was, "Every skier drank a cup of hot apple cider."

The fourteen children who had given symmetrical interpretations in Experiment 1 were the subjects for Experiment 2.[112] Overall, children accepted the test sentences in Experiment 2 88% of the time. Twelve of the fourteen children said "yes" on all four trials, so only two children were responsible for all of the rejections. However, these two children did not respond with symmetrical responses when asked "What really happened?"; instead, they seemed to prohibit the use of **every** to refer to sets with three or fewer members.[113]

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[112]Crain et al. do not specify the time span between Experiment 1 and Experiment 2.

[113]In response to the sentence, "Every skier drank a cup of hot cider", these children responded that "Three skiers drank a cup of hot apple cider."

Experiment 3, which included the same fourteen children as in Experiment 2, was an elicited production task. Crain et al. suggested that, "A child who was restricted to the symmetrical interpretation would be unable to produce a sentence with a universal quantification in the experimental contexts... Presumably, children who assign the symmetrical interpretation would produce sentences with the universal quantifier only in contexts in which there is a one-to-one correspondence between the agents and the objects being described" (Crain, et al., 1994, p.35). However, this assumes that for those children who allow the symmetrical interpretation, the symmetrical interpretation is the only interpretation available.

In one story in Experiment 3, three sisters were going to eat a snack. The oldest girl decides to eat a cherry, but the two younger sisters say they want a cookie. The two younger sisters change their minds and eat cherries, too, so that each of the three characters eats a cherry; however, there are other cherries left over. The test sentence is, "Only one girl ate a cherry." Children correctly rejected such test sentences 98% of the time, and twelve of the fourteen children produced sentences with **all** or **every** on at least three of the four trials.[114] Crain et al. note that no child ever commented on the left-over

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[114]Eleven of the responses to the cherry story contained **all** or **every**:

K: No! They all ate one.
Z: All of them ate cherries.
J: Every girl ate a cherry.
A: All the girls ate cherries.
H: All of the girls got a cherry.
C: All of them ate a cherry.
S: All the children got cherries.
G: All the girls got cherries.
T: Everyone did.
F: All of them ate a cherry.
R: Every girl did.

More interestingly, five of these responses (those with a singular) are clearly distributive (K, J, H, C, and F).

cherries.

Crain et al. suggest that the results from Experiments 2 and 3 show "that children have adult knowledge of the distributive interpretation of sentences with the universal quantifier. In appropriate contexts, children understand such sentences correctly, and they produce them" (Crain et al., 1994, p.38).

Experiment 4 tested children's knowledge of the existential wide-scope interpretation of sentences with universal quantification. Twelve children who had been in the first three experiments were included.

There were two types of sentences, like those in (131) and (132).

(131) Every dwarf ate a pizza.

(132) A Smurf jumped over every fence.

In the story for (131), three dwarfs all eat the same cheese pizza (after considering eating hamburgers instead, and after rejecting two pepperoni pizzas). Children said "yes" to sentences like (131) 92% of the time. As Crain et al. state, "This clearly demonstrates that children who give the symmetrical interpretation in the Extra Object Condition have access to the Existential wide-scope interpretation" (Crain et al., 1994, p.40). Only one child, K, rejected (131) on two out of two trials.

For (132), there were three Smurfs, all trying to jump over a series of fences. One jumped over none of the fences, one jumped over one of the fences, and one jumped over all three of the fences. Children accepted sentences like (132) 69% of the time. Six of the twelve children rejected the test sentences on some trials. The usual response (6/10 errors) to the question "What really happened?" for these children was that two of the Smurfs had not jumped over every fence: "Children who pointed out that two Smurfs failed to jump all of the fences were apparently interpreting the sentence to require every Smurf to jump every fence" (Crain et al., 1994, p.44). Crain et al. argue that this kind of response was not in accord with the symmetrical interpretation, which would have required the children to point out that one of the Smurfs hadn't jumped over any fences; children gave this kind of response only 8% of the time.

In sum, Crain et al. show that children who show the symmetrical interpretation with a picture task do have access to both a distributive interpretation and a wide-scope interpretation of indefinites. However, this does not prove that children do not also have the symmetrical interpretation. Crain et al. have failed to replicate Philip's results, using a different task, and that needs some explanation. However, that alone does not prove that the symmetrical interpretation is an artifact. Crain et al. have succeeded in knocking down a straw man-- the idea that for children who show the symmetrical interpretation that is the only interpretation available.

In addition, even Crain et al.'s results show that children are not fully adult-like. In particular, half of the children in Experiment 4 required an **every/every** interpretation for the sentence "A Smurf jumped over every fence." This could be considered a case of **a/every** spreading.

2.3.4.2 Philip & Coopmans (1995)

Philip & Coopmans (1995a) discuss quantifier spreading (referred to as the symmetrical interpretation) in Dutch and respond to the criticisms of Crain, Thornton, Boster, Conway, Lillo-Martin & Woodams (1994).

Philip and Coopmans tested ninety-three monolingual Dutch children. There were ten children ages 3;9 to 4;7 (mean age 4;3), twenty-three five-year-olds (mean age 5;6), twenty-five six-year-olds (mean age 6;6), twenty-two seven-year-olds (mean age 6;6), and thirteen eight-year-olds (mean age 8;7). In addition, there were eleven English-speaking six-year-olds (mean age 6;6), and seventeen adult native speakers of Dutch. For several analyses, Philip and Coopmans discussed the data for children who exhibited adult-like performance on all trials of all control conditions. For this purpose, the data from the four, five, six, and seven-year-old Dutch subjects were combined. These "control passers" consisted of four English-speaking six-year-olds (mean age 6;6), fifty-two Dutch four-to-seven-year-olds (mean age 6;6), and eleven Dutch eight-year-olds (mean age 8;6).

The experiment was similar to those described in section 2.3.2; subjects were shown a picture and asked a question. If the response was "no", subjects were asked "Waarom zeg je 'nee'?"/"Why do you say 'no'?". The experiment consisted of four control and five test conditions, with an additional twenty-six filler items.[115] In total, each subject responded to forty-two items, twenty which would elicit a negative response from an adult, and twenty-two which would elicit a positive response from an adult.

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[115]These filler items made up a separate study on the acquisition of anaphora in Dutch, Philip & Coopmans (1995b), described in section 2.2.1.7 above.

The control conditions were meant to test the basic semantics of adult universal quantification and lexical acquisition of the quantifier **iedere/every**. The Dutch and English versions of the control conditions are given in (133) through (136).

(133) QN Control Condition

a. Hier heb je een stel jongens en een stel paarden.
Rijt iedere jongen op een paard?

b. Here you have a few boys and a bunch of ponies.
Is every boy riding a horse?

(134) QZN Control Condition

a. Hier heb je drie meisjes en hier heb je een moeder.
Pakt ieder meisje zichzelf vast?

b. Here you have three girls and here you have a mom.
Is every girl holding herself?

(135) QJ Control Condition

a. Hier heb je een stel olifanten en een jogetje.
Houdt iedere olifant een ballon vast?

b. Here you have a bunch of elephants and you have a boy.
Is every elephant holding a balloon?

(136) QZJ Control Condition

a. Hier heb je drie moeders en hier heb je een meisje.
Pakt iedere moeder zichzelf bij de enkel vast?

b. Here you have three moms and here you have a girl.
Is every mom holding herself by the ankle?

(133) and (134) required "no" responses. For (133), the picture showed three boys, each riding a different horse, and a fourth boy, not riding a horse. For (134), the picture showed two girls each holding the mom by the wrist, and a third girl holding the mom by the ankle. These two questions tested "the knowledge that a sentence containing a single determiner universal quantifier is true if and only if every

member of some linguistically restricted domain of entities has some linguistically signalled property" (Philip & Coopmans, 1995a, p.14). (133) was falsified by one element in the picture, the one boy not riding a horse, while (134) was falsified by all of the elements in the picture, since no girl was holding herself.

(135) and (136) required "yes" responses. For (135), the picture showed three elephants, each holding a different balloon, plus a boy holding a fourth balloon. (136) showed three moms, each holding herself by the ankle, plus a girl not holding herself by the ankle. (135) and (136) tested "that the subject was pragmatically restricting the domain of quantification of the universal quantifier in an adult-like manner" (Philip & Coopmans, 1995a, p.15).

Philip and Coopmans argued that these sentence types also controlled for the problems with pragmatic felicity argued for by Crain et al. (1994). Crain et al. had argued that in Philip's previous work, subjects had to "accommodate the fact that the negation of the test sentences was not under consideration" (something which older children and adults were presumed to be better at) (Crain et al., 1994, p.21). According to Crain et al., this led children to believe that "the question is about the numerical correspondence between agents and objects" (Crain et al., 1994, p.19). If Crain et al. are right, then children would reject QJ because there is a balloon not being held by an elephant (but being held by the boy instead), and would reject QZJ because the girl isn't holding herself by the ankle.

Results for the control conditions are given in (137).

(137) Percent Adult-like Performance on Control Conditions

group	n	QN	QZN	QJ	QZJ
Dutch 4 yrs.	10	75%	65%	75%	90%
Dutch 5 yrs.	23	94%	89%	91%	96%
Dutch 6 yrs.	25	88%	94%	90%	100%
English 6 yrs.	11	100%	73%	86%	86%
Dutch 7 yrs.	22	100%	100%	95%	100%
Dutch 8 yrs.	13	92%	100%	100%	100%

Philip and Coopmans suggest nonadult-like performance on the QZN and QZJ conditions "could also be due to difficulties with variable binding, rather than with universal quantification" (Philip & Coopmans, 1995a, p.24).

There were five test conditions in Philip and Coopmans' experiment. The Dutch and English versions of these experimental conditions are given in (138) through (142).

(138) QS1 Test Condition

a. Hier heb je drie jongens, vier paarden en een moeder.
Rijdt ieder jongen op een paard?

b. Here you have three boys, four ponies, and a mom.
Is every boy riding a pony?

(139) QS2 Test Condition

a. Hier heb je drie jongens, vier varkens, en een moeder.
Heeft iedere jongen een varken opgepakt?

b. Here you have three boys, four pigs, and a mom.
Has every boy picked a pig up?

(140) QXJ Test Condition

a. Hier heb je drie meisjes, vier olifanten, en een poesje.
Draagt (er) een olifant ieder meisje?

b. Here you have three girls, four elephants, and a kitty cat.
Is an elephant carrying every girl?

(141) QXN Test Condition

a. Hier heb je drie meisjes, drie olifanten, en een vader.
Draagt (er) een olifant ieder meisje?

b. Here you have three girls, three elephants, and a dad.
Is an elephant carrying every girl?

(142) QXJR Test Condition

a. Hier heb je drie jongens, drie schildpadden, en een moeder.
Zit er een jongen op iedere schildpad?

b. Here you have three boys, three turtles, and a mom.
Is there a boy sitting on every turtle?

QS1, shown in (138), and QS2, shown in (139), were designed to test for symmetrical (spreading) responses with **every/a** sentence types. Negative responses to these questions were coded as symmetrical responses only if the answer to the follow-up question included mention of the "extra mentioned object" as the reason for saying "no". QS1 and QS2 differed in terms of the placement of the head of the verb phrase.

QXJ, shown in (140), QXN, shown in (141), and QXJR, shown in (142), were all designed to test for symmetrical responses with **a/every** sentence types. It was predicted that adult native speakers of Dutch would accept QXJ and QXJR, but would reject QXN, while adult native speakers of English would accept all three conditions.

For the QS conditions (e.g., "Is every boy riding a pony?", with each boy on a different pony, plus an "extra" pony), the percentage of symmetrical interpretation responses was 48% across all subjects, and the Control Passers (children who showed adult-like performance 100% of the time on all control conditions) gave the symmetrical interpretation response 37% of the time. Philip and Coopmans argue that

> This latter finding rules out conclusively any speculative hypothesis that the symmetrical interpretation response results from the child entertaining nonadult-like pragmatic conditions of "plausible denial" or "felicitous use" with respect to universally quantified questions (Philip & Coopmans, 1995a, p.25).

They also note that most of the children in each age group exhibited adult-like performance on at least one of the two trials of the QS condition. Individual children's responses to quantifier spreading situations are variable.

For the QXJ condition ("Is an elephant carrying every girl?", when the picture showed three girls on one elephant, with an "extra" three elephants), English-speaking children gave adult-like "yes" responses 68% of the time. However, when these children did give "no" responses, their answers to "Why not?" always referred to the extra mentioned objects as the reason for rejection.

For the QXN condition ("Is an elephant carrying every girl?", where each girl is riding a different elephant, and there are no "extra" elephants), subjects gave an adult-like "yes" response 91% of the time. Children could have been accepting this either because of the symmetrical interpretation or because they were accepting the less-preferred wide-scope construal of the quantifier.

For the Dutch children performance on the QXJ and QXN conditions was strikingly nonadult-like. Dutch 6-year-olds gave adult-like "yes" responses under the QXJ condition only 16% of the time. For the QXN condition, the Dutch children below the age of 7 responded almost identically to the English-speaking children.

An analysis of the English-speaking children's performance on the

QS condition compared to the Dutch children's performance on QS showed no significant group contrast. Philip and Coopmans thus conclude that "when the universal quantifier occupies the subject position symmetrical interpretation is not affected by surface syntactic structure in Dutch any more than it is in English or Japanese" (Philip & Coopmans, 1995a, p.29).

In response to the criticisms of Crain et al., Philip and Coopmans clarify expectations about the frequency of symmetrical interpretation responses. In early work (Philip & Aurelio, 1991; Philip & Takahashi, 1991; Philip, 1992; see section 2.3.2 above), it was suggested that children had a strong preference for the symmetrical interpretation; "Subsequent research revealed, however, that the high levels of nonadult-like performance observed in these early studies had been partially inflated by the confounding effect of a nonlinguistic strategy of responding negatively whenever the visual input contained an object not mentioned in the linguistic input" (Philip & Coopmans, 1995a, p.30, fn.19). In subsequent work, this nonlinguistic strategy was controlled for.

Philip and Coopmans go on to note that since the symmetrical interpretation, on the event quantificational account, is dependent on a random "decision" on the part of the child to quantify over events rather than objects, the frequency of symmetrical interpretation responses can be manipulated by the experimental design. If sentences testing for the symmetrical interpretation are presented in such a way that object quantificational interpretations are strongly encouraged, then adult-like performance is likely to be "artificially induced"[116]. Philip and Coopmans suggest that the studies of Crain et al. (1994) deliberately focused on individual objects, which made the child "inclined to interpret a universally quantified sentence as quantifying over objects rather than events" (Philip & Coopmans, 1995a, p.31). Philip and Coopmans conclude that

> The methodological moral here is that because symmetrical interpretation is partially determined by a "free choice" that the child has-- but that the adult does not have--as to which mode of quantification to adopt, it should only be examined under experimental conditions that are not systematically biased in favor of one or the other modes of quantification (Philip & Coopmans, 1995a, p.31).

Since both object quantification and event quantification are available to adults, the question that Philip and Coopmans should be asking is what constitutes a biasing context for adults: are adults more likely to adopt an object quantificational analysis under the conditions of a truth value judgment task than under the conditions of a picture judgment task?

In spite of this debate with Crain et al. about the status of the symmetrical interpretation, I will be assuming here, with Philip and his colleagues, that the symmetrical interpretation (quantifier spreading) is an actual interpretation available to children, and not just an experimental artifact.

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[116]This seems a funny way of putting it. It's not really the case that adult-like performance is artificially induced, since the children actually do have access to that interpretation; it's just that the materials are biased toward that interpretation, so the amount of adult-like performance is perhaps artificially inflated.

CHAPTER 3: PROPOSALS

In this chapter, I will first discuss the conclusions which can be drawn from the literature (section 3.1). In section 3.2 I will discuss an alternative explanation for quantifier spreading. Finally, in section 3.3 I will discuss some empirical consequences of the proposals offered here.

3.1 Conclusions from the Literature

What conclusions can we draw from this review of the literature?

In the first chapter (section 1.2) we saw that children between the ages of 3 and 6 have difficulties with the distinction between the definite pronoun **it** and the indefinite pronoun **some**.

Second, in general, the studies of VP ellipsis show that there is a preference for sloppy identity. In addition, there is interesting evidence that at least a small number of children do not obey the requirements of indexical identity in VP ellipsis contexts. Thornton and Wexler show that children who appear to violate Principle B of the binding theory in VP ellipsis constructions also accept sentences such as (1), with the interpretation that different people were captured.[1]

(1) The Indian with a spear captured him and the Indian on a horse did too.

This interpretation (in which different people are captured) is identical to one of the possible adult interpretations of (2).

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[1]Boster (1991) also found acceptance of a sloppy interpretation for sentences which had a pronoun with a local antecedent in the first clause. We don't know what these children would have done with sentences like (1) (with the interpretation discussed above), but these children might be similar to the children found by Thornton and Wexler.

(2) The Indian with a spear captured someone and the Indian on a horse did too.

Third, from the studies of pronouns, the conclusions are less clear. While the claim in the literature has been that children obey the binding principles but lack some pragmatic rule or inferencing ability, it is not clear that children do in fact obey the reformulated binding principles. In particular, the predicted difference between pronouns with quantified antecedents and pronouns with referential antecedents is not apparent. Lombardi & Sarma (1989) and Boster (1991) found that children accepted apparent Principle B violations both with quantified and referential antecedents (and Boster found that children accepted sentences with **them** locally bound to NPs with **every**, suggesting that some of the rejections in Chien and Wexler's studies may have been a result of pronominal number choice). Kaufman (1987, 1988) found no difference between quantified and referential antecedents. While Philip & Coopmans (1995b) found that Dutch and English-speaking children performed significantly better on sentences with quantified antecedents than on sentences with referential antecedents, the correct rejection of the sentences with quantified antecedents was quite low (53% to 77% correct). While children seem to be less inclined to accept locally bound pronouns when the antecedent is quantified, it appears that children tend to reject sentences with quantifiers more generally. In addition, results from several of the other studies discussed in section 2.2 are inclusive.

Finally, the studies of quantification in child grammar show that, at the same age at which children are having difficulties with pronouns (between the ages of 3 and 6), they are also having difficulties with quantification and scope. There is the evidence of quantifier spread, and also the evidence that children accept **every/every** sentences with a one-to-one mapping interpretation, in both English (Takahashi, 1991) and Chinese (Chien & Wexler, 1989). Now I will turn to an alternative proposal for quantifier spreading which also can account for this interpretation of **every/every** sentences.

3.2 An Alternative Proposal for Quantifier Spreading

Philip argues that there are two parts to an analysis of quantifier spreading. The first part, on Philip's account, is event quantification. Here I will argue for a resumptive quantification analysis instead, making use of a definition of exhaustiveness. The second part is the restriction on the domain of quantification. On Philip's account, this requires a stipulation of how the child decides which objects are participants in the relevant event. Here I will make use of a definition of a relevant sequence for an exhaustive interpretation.

May (1989) discusses absorbed quantification as a way of semantically characterizing relative scope (replacing the syntactic representation of relative scope at Logical Form). One particular type of quantification which he discusses is resumptive quantification. This is illustrated by the sentence in (3).

(3) Nobody loves nobody.

Here the relevant interpretation is the one in which there are no individuals standing in the lover-lovee relationship.[7] (3) can be represented as in (4).

(4) **NO** x,y (x loves y)

The satisfaction clause for this is given in (5).

(5) g satisfies **NO** x,y (x loves y) iff no sequence g′ satisfies x loves y, where g′ differs from g in at most the values assigned to x and to y.

"Truth, then, will require satisfaction of a relation by n-many pairs of individuals drawn from the Cartesian product of the domain and the counter-domain" (May, 1989, p.405). (5) can be given more generally as in (6).

(6) g satisfies $Q_{1,\ldots,n}\phi_{1,\ldots,n}$ iff Q-many sequences g′ satisfy $\phi_{1,\ldots,n}$, where g′ differs from g in at most the values assigned to the 1st-nth places.

Takahashi (1991)(discussed in section 2.3.2) found that all of the children in her study accepted "Is **every** boy holding **every** balloon?", with two different pictures: one in which there are three boys, each holding one balloon, and one in which there are three boys, each holding a string for each of three balloons (the latter interpretation was assumed to be the only correct one for adults). Similarly, Chien & Wexler (1989) found that children learning Chinese also often give sentences with two universal quantifiers a one-to-one mapping interpretation. As will be discussed in section 5.2.5.4, all of the children in the present study, and about half of the adults, accepted a one-to-one mapping interpretation for sentences with **every/every**. I suggest that this interpretation is a result of resumptive

[7]This is equivalent to the usual interpretation of "Nobody loves anybody."

quantification.

In order to characterize this interpretation of **every/every** sentences (such as, "Every boy holds every balloon") in terms of resumptive quantification, we can represent it as in (7). The satisfaction clause for (7) would be (8).

(7) **EVERY** x,y (x holds y)

(8) g satisfies **EVERY** x,y (x holds y) iff for **exhaustively many** sequences g', g' satisfies "x holds y", where g' differs from g in at most the values assigned to **x** and to **y**.

Exhaustively many sequences satisfy "x holds y" if and only if each object **x** in the domain is in a pair which satisfies "x holds y", and each object **y** in the domain is in a pair which satisfies "x holds y". The simplest case of this is the case of a one-to-one mapping between **x**'s and **y**'s.

For this relationship to hold, only relevant assignments to **x** and **y** are considered. For the sentence, "Every boy is holding a balloon", a sequence is not relevant if there exists a **w**, **w** not a boy, such that "w holds y" is true, or if there exists a z, z not a balloon, such that "x holds z" is true. However, if there exists a **u**, **u** a boy holding nothing, or a **v**, **v** a balloon which is not being held, these sequences <u>are</u> relevant (thus leading to an account for quantifier spreading).

Children (and many adults) are allowing the quantifier **EVERY** x,y to have this "exhaustively many" interpretation in sentences such as "Every boy holds every balloon". If there were an "extra" **x** or an "extra" **y**, in other words an object in the domain that was not part of a relevant pair which satisfied "x holds y", then the sentence could be judged false (although this would require that other possible interpretations be ignored, such as the interpretation in which each instance of **every** is a separate quantifier, and one instance of **every** takes scope over the other).

This one-to-one mapping interpretation of the **every/every** sentence may seem strange, but is reminiscent of cumulative interpretations of sentences with numerical expressions. For example, Scha (1984) discusses the sentence in (9).

(9) 600 Dutch firms have 5000 American computers.

(9) can have an interpretation in which the total number of Dutch firms which have an American computer is 600 and the total number of American computers possessed by a Dutch firm is 5000. Both cumulative quantification and resumptive quantification are cases of polyadic quantification which leaves the variables independent of each other.[3]

The exhaustive interpretation of **every/every** sentences also seems to be related to the distinction between the **each other** and the **each-the-other** relationship for reciprocal sentences, discussed in Fiengo & Lasnik (1973). Fiengo and Lasnik discuss sentences such as (10).

(10) The men are hitting each other.

(10) can have the interpretation that every man is such that he is hitting every other man (the **each-the-other** interpretation), or it can have an interpretation in which the set of men can be divided into subsets such that within each subset the **each-the-other** relationship holds. In the first case, if there are four men, A, B, C, and D then A is hitting B, C and D, B is hitting A, C and D, and C is hitting A, B

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[3]In fact, van der Does (1993, p.545, fn.27) suggests that resumptive quantification is a special case of cumulative quantification.

and D. In the second case, A and B may be hitting each other, and C and D may be hitting each other (the **each other** interpretation), so that for the subset of A and B, the **each-the-other** relationship holds, and for the subset B and C, the **each-the-other** relationship holds. Exhaustively many members of the set A, B, C, and D are in the "hitting" relationship.

May notes that his analysis of pair quantifiers as resumptive quantification is reminiscent of Heim (1982), where it is argued that indefinites should be treated as variables. May suggests that indefinites can be resumptive to another quantifier, as opposed to definites and other quantifiers, which can be resumptive only to (syntactically) identical determiners. One reason for believing this comes from the analysis of donkey sentences such as (11), which can be represented as in (12) (with a pair quantifier).

(11) Every owner of a donkey beats it.

(12) $\forall$ x,y (x is owner of y) x beats y.

May notes that (12) will be true just in case for every pairing of a donkey and a donkey-owner, the donkey-owner beats the donkey; "if there are donkey owners who beat some, but not all, of their donkeys, then [(11)] will be false, as not every donkey is beaten by its owner" (May, 1989, p.408).

As noted, resumptive quantification and the exhaustive interpretation of **every** can account for quantifier spreading. An indefinite such as **a pony** (in a sentence such as Philip's "Every boy is riding a pony"), can be resumptive to another quantifier when the indefinite is in the quantifier's scope (thus there is no spreading into adjuncts).[4] Because of the requirement of exhaustiveness, all of the relevant boys and all of the relevant ponies must be in the "riding" relationship; if there is an "extra" pony (or an "extra" boy), the sentence will be rejected.

Philip has two kinds of arguments against a resumptive quantification or unselective binding explanation of quantifier spreading. First, he objects that children can't be "strangely applying" unselective binding in the sense of Lewis (1975):

> If children were entertaining for a sentence such as **Every boy is riding a pony** a logical form such as $\forall x,y\ [[\text{boy}(x)\ \&\ \text{pony}(y)] \rightarrow \text{ride}(x,y)]$ or $\forall x,y[[\text{boy}(x) \vee \text{pony}(y)] \rightarrow \text{ride}(x,y)]$, then they would almost always find this sentence false, and for very peculiar reasons. For example, it would be found false of a picture showing three boys each riding a different pony! This is because under such a reading the meaning of the sentence paraphrases as "every boy is riding every pony" (circumstances satisfying such truth conditions would be rare indeed) (Philip, 1994, p.102, fn.24).

Philip argues that we can't have an unselective binding account of quantifier spreading because it equates quantifier spreading with an **every/every** interpretation. However, if we adopt the exhaustive interpretation of the universal quantifier, this is no longer a problem. We can account for both the one-to-one mapping interpretation of **every/every** sentences and for quantifier spreading by modifying the possible interpretations of the universal.

Second, Philip argues against an account for spreading which

[4]In order to account for **a/every** quantifier spreading we may also have to say that an indefinite may be resumptive to a quantifier which it c-commands, in other words, we have to account for how the positions of the indefinite and the quantifier can be reversed.

relies on quantifying over n-tuples of entities instead of individual entities: "This would simply return us to the problem of falsely predicting a "yes" response under the transitive condition. The lone pony running loose ... does not obviously constitute, without some additional (crucial) stipulation, one of a set of related entities" (Philip, 1992, pp.335-336). In addition, there is the problem of what happens in the situation in which the Symmetry Child's response to "Is every boy riding a pony?" is "yes", when shown a picture of three boys, each riding a different pony, and a girl riding a fourth pony. Philip (1992) is correct in noting that an account for spreading based on resumptive quantification would require some "additional (crucial) stipulation"; this is exactly the point he later makes in Philip (1994), that spreading requires two parts. However, the second part, restricting the domain of quantification, is also necessary for Philip's event quantificational analysis. The event quantificational analysis has to stipulate the definitions for "distinguished participant" in an event and "subevents", repeated here as (13).

(13) a. Distinguished Participant $=_{def}$

participant which is in some sense central to the event in question (cf. topic)

b. Subevent of e $=_{def}$

any event e' which is a part of e and which includes no participant playing the same role as the distinguished participant of e unless this participant is itself the distinguished participant of e (Philip, 1994, p.118).

For a resumptive quantification analysis, I have to provide the definition of what counts as a relevant sequence for an exhaustive interpretation.

Let's return to the case in which the spreading child's response to "Is every boy riding a pony?" is "yes", when shown a picture of three boys, each riding a different pony, and a girl riding a fourth pony. Why is the pony which is ridden by the girl not considered an "extra" pony (one not in the riding relationship with a boy)? If a girl is riding a pony, there is a situation in which a **w** is riding a **y**; this is not a relevant sequence g′, so the pony being ridden by a girl does not count for the boy-riding-a-pony relationship. This has an effect similar to the effect of Philip's use of the definitions of distinguished participant and subevent.

The advantage to the resumptive quantification analysis is that it can also account for the exhaustive interpretation of **every/every** sentences (which the event quantification analysis does not account for). Here quantifier spreading is an extension of the exhaustive interpretation of **every/every** sentences. Therefore, what children who spread have to learn is that indefinites cannot normally be resumptive to universal quantifiers.[5] As we will see in section **5.2.5.4**, many adults will accept an exhaustive interpretation of **every/every** sentences; we could conclude, then, that this interpretation is available, but strongly dispreferred by adults. In that case, children have to learn that this is a dispreferred interpretation (much as Chinese children learn to disprefer a narrow scope interpretation of the universal in a sentence like "Meige xiaohai dou chang le yishou ge", "Every child sang a song.") How children learn different scope interpretation principles requires further investigation.

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[5]A possible exception might be donkey sentences; see discussion above.

3.3 Consequences

The main claim of this dissertation is that children are treating definite pronouns like **him** as indefinite in some sense. Recall from Chapter 1 some of the differences in the interpretation of definites and the interpretation of indefinites. In particular, indefinites (but not definites) can vary in reference when they are not bound variables.

This leads to an account for why children accept apparent violations of Principle B. If children are allowing definite pronouns to have an indefinite interpretation, then nothing prevents coreference in situations where coindexation is ruled out by Principle B: "John hit someone" doesn't mean the same as "John hit himself", but **someone** may corefer with **John**. Children who allow an indefinite interpretation for definite pronouns should allow such coreference when the pronoun is **him** or **them**. Even in cases of quantification, a varying coreference is allowed. "Every boy hit someone" is consistent with a situation in which each boy hit himself. Therefore, with this account of Principle B violations we would predict no differences between quantified and non-quantified antecedents.[6]

Children who accept these apparent B violations should give other evidence of treating pronouns as [-definite]. For example, they should accept the unbound distributive interpretation of **him**.

Subjects who quantifier spread should accept the one-to-one mapping interpretation of **every/every** sentences (i.e., they should demonstrate an interpretation which requires exhaustiveness).

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[6]Although there may be a higher correct rejection rate for sentences with locally bound pronouns with quantified antecedents, simply because children seem to have a tendency to reject sentences with quantifiers.

Finally, at least some of the children who give evidence of [-definite] **him** and who quantifier spread should accept quantifier spreading onto pronouns (i.e., they should say "Not that one" when asked "Did every bear spray *him*?", when two bears each spray a different tiger, but a third tiger is not sprayed).

CHAPTER 4: METHODS

In this chapter I will describe the design of an experimental study which focuses on binding in distributive and collective contexts and different interpretations of sentences with quantifiers (results will be given in the next chapter). Both adults and children are included in this study. This differs from previous work in that it includes a number of different sentence types and interpretations, all of which can be related to syntactic identity and dependency.

In section **4.1**, I will briefly discuss a pilot study and some related work which suggested the necessity of testing children's understanding of pronominal number. Then in section **4.2** I will describe the design of the main study.

4.1 Pilot Study

One early hypothesis that I attempted to investigate was that children may have been rejecting sentences such as "Every bear is washing her" because they preferred that the expression **every bear**, which refers to a plurality, not be coreferent with the singular pronoun **her**. Perhaps more generally children prefer bound variables to be plural pronouns. Boster (1991) had found a slightly greater acceptance rate for a locally bound interpretation of sentences like "Every bear is washing them" compared to sentences like "Every bear is washing her" (although this difference was not significant) (see section **2.2.1.8** above). Thornton (1990) also suggested that children preferred to use plural pronouns as the bound form (see section **2.2.2** above).

I conducted pilot work testing children's interpretations of singular and plural possessive pronouns with different quantified antecedents. There were eight children in the pilot study, ages 4;3 to 5;2 (mean age 4;8). The pilot study consisted of three tests. Test 1 was essentially a pretest of simple sentences (without quantifiers) with possessive pronouns, reflexives, and object pronouns. It included some sentences with number disagreements, such as "The monkey brushed their hair" (with a picture which showed a monkey brushing his own hair). Child acceptance of all of these number disagreement sentences was uniformly high, suggesting that children may not distinguish between the singular and plural possessive pronouns. Test 2 was designed to test acceptance of quantified antecedents with both singular and plural possessive pronouns, but again, child acceptance rates for all sentence types was very high (near 100%). Test 3 was designed to test acceptance of bound interpretations of singular and plural pronouns with quantified and non-quantified antecedents. Acceptance of these sentences ranged from 38% to 58%.

The pilot work did not make it possible to distinguish between problems with pronominal number and problems with binding and quantification. However, while the results of this pilot work were unclear, they suggested that some children do not distinguish between singular and plural pronouns.

Scholes (1981) found that children do not comprehend pronominal number contrasts reliably above chance until approximately age five-and-a-half. Using a picture-verification task, Scholes looked at the development of pronominal gender, number and case. He found that the acquisition of these forms proceeds in a fairly linear fashion, with performance significantly above chance first occurring at age five.

Scholes' experiment had two parts. In the first, children were shown a single display of six drawings, and asked to identify the picture matching each of the sentences in (1).

(1) a. Someone is touching him.
b. Someone is touching her.
c. Someone is touching them.
d. He is touching someone.
e. She is touching someone.
f. They are touching someone.

In the second part, single sentences were paired with two drawings from the set given in the first part, with the contrasts **him** vs. **them**, **her** vs. **them**, **them** vs. **him**, **he** vs. **they**, **she** vs. **they**, and **they** vs. **she**. Overall, the performance of 3- and 4-year-olds on the second part was about 60% correct and 76% correct, respectively. For number, 3-year-olds averaged about 49% correct, while 4-year-olds averaged about 62% correct. Overall performance by the 4-year-olds closely approached the .05 level above chance (while 3-year-olds were performing at around chance); however, comprehension for both gender and case exceeded that for number, and the number results were not significantly above chance. For 5-, 6-, and 7-year-olds, the comprehension for the gender distinction exceeded those for number for all three groups. Five-year-olds' comprehension of number was still not significantly above chance, at about 77%, while 6-year-olds were above chance at the .02 level for number comprehension, at about 83%, and 7-year-olds were above chance at the .01 level for number comprehension, at about 87% correct.

Scholes' study seems to offer the only available evidence with respect to children's understanding of pronoun number. However, there are several improvements that could be made upon Scholes' design. The pictures were line drawings whose interpretation depended on a difficult decision about who was performing the touching and who was being touched, and the sentences in (1) may have been confusing (since the verb used was **touching**, which can be used without an object as in "They are touching", which can mean "they are touching each other"). These factors may have dampened children's performance. Also, since Scholes' study involved a picture choice, it only demonstrated children's preferences for a particular interpretation, but not the restrictions on their interpretations. Nevertheless, Scholes' results are interesting since they suggest that the acquisition of pronominal number differs in some way from the acquisition of gender and case. Why is pronominal number acquired so late, and is there any connection between this and children's performance with respect to Principle B of the binding theory?

Scholes' study suggests that the subjects tested in the pilot work mentioned here were too young to be making the necessary distinctions relating to number. Thus, we need to turn to older children. As a result of this pilot work, several design changes were made (including the addition of a pronominal number pretest), and there was a shift in focus from younger children (around age 4 or 5) to children between 5 and 7.

4.2 Experimental Design

This study consists of three parts: a pronominal number pretest, a second part testing binding with quantified antecedents with both distributive and collective interpretations, and a third part testing quantifier binding and related phenomena.[1] All three parts involved a picture judgment task, although the procedure was modified for Part 3 (see section 4.2.2.3 below).[2]

In section 4.2.1 I will describe adult and child subjects. In section 4.2.2 I will describe the experimental materials. Finally, in section 4.2.3 I will describe the experimental procedure.

4.2.1 Subjects

For the kind of subtle judgments that are being investigated here, it is important to include adult subjects for comparison with child subjects. Both are described below.

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[1]There was an additional task immediately following Part 2. This was a prompted production task involving possessive pronouns and the quantifiers **every** and **all**. This will be described in section 4.2.2.2.

[2]The picture judgment task was chosen over other tasks for a number of reasons. First, it is comparable to the task used in several other relevant studies, in particular several of the studies by Wexler and Chien. In addition, the modified version of the picture judgment task seems comparable to some of the studies of quantifier spreading discussed in section 2.3.2 above. The picture judgment task allows us to test the subject's understanding of the same sentence in multiple contexts, and every subject is presented with the same situation (there is no chance of a story being acted out differently for different subjects; the only variability is in pronunciation and the number of repetitions of each sentence). Finally, this task is fairly fast and easy to run (requiring only one experimenter), so that each subject could be tested on a number of different sentence types. The picture judgment task has two major disadvantages. One is the difficulty of illustrating some actions in pictures; this in part determined which verbs could be used. The second is the tendency for children to prefer to say "yes" to adult questions; this tendency was countered with the use of a number of "no" fillers, and in fact did not seem to be a problem with most children.

4.2.1.1 Adult subjects

Adult subjects were students taking an introductory psychology class at Baruch College, who received two experimental credit hours for participation.[3] They came from a variety of ethnic backgrounds, but all were native speakers of English. Altogether there were twenty-three adults who took part in the experiment. One subject's data are excluded from the analysis because it became clear that she had misunderstood the task.[4] The remaining twenty-two adults were fifteen women and seven men.

With adults, all parts of the experiment were conducted in one session, which was between an hour and an hour and a half in length.[5] The procedures were identical to those used with children, except that for adults only Part 3 was audio-recorded (while with children all three parts were recorded).

4.2.1.2 Child subjects

Child subjects were monolingual English-speakers with no known speech, hearing, or vision problems. Subjects were enlisted through

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[3]There were two exceptions to this. Both were non-linguists who had graduated from college within the past five years. The performance of these two subjects appears indistinguishable from the performance of the other adult subjects.

[4]This subject asked for directions several times during the experiment, and after the experiment mentioned that she had thought she was supposed to respond as she expected a child would respond. No other adults seemed to misinterpret the instructions in this way.

[5]The two non-students mentioned above were seen in two sessions. The first session included the number pretest and Part 2. Part 3 was conducted in a second session which took place approximately two months later.

public elementary schools in Connecticut, a daycare center in Manhattan, and an after school program in Brooklyn, through personal acquaintances of the author, or through fliers posted in stores and libraries in Brooklyn.[6] Each child was seen individually (though occasionally a parent or adult was also present for some sessions) in one to four sessions.[7] In most cases, children were rewarded at the end of each session with an animal picture to color.

A total of sixty-one children were tested, ranging in age from 3;4 to 9;5 (mean age 5;9). Of these, four (ages 3;3, 3;4, 3;11, and 6;6) were uncooperative or were unable to complete the task. Of the remaining fifty-seven children, twenty-three (ages 3;8 to 7;2, mean age 5;3) did not pass the object pronoun section of the number pretest (see section 4.2.2.1 below), and were either not tested further or else their data were not included for the analysis of Part 2 and Part 3. An additional four children were excluded from Part 2 and Part 3 because they failed on the quantifier fillers in Part 2.[8] The remaining thirty

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[6]I am extremely grateful to the following programs and schools which allowed me access to children: Andover Elementary School (Andover, CT); the Hill and Plain School (New Milford, CT); the Elizabeth Seton Preschool and Kindergarten (New York, NY), and the Congregation Beth Elohim After School Center (Brooklyn, NY). In addition, I am grateful to the Prospect Park YMCA Child Care Center (Brooklyn, NY) for allowing me to do my pilot work there.

[7]One of the youngest children, AE (age 3;9), required a total of seven sessions (one session for the pretest, four for Part 2, and two for Part 3). This was partly due to scheduling difficulties and partly due to limitations of AE's attention span.

[8]There were twelve quantifier fillers in Part 2, six matches (which required acceptance) and six mismatches (which required rejection). The match pictures showed three animals performing an action, while the mismatch pictures showed two out of three animals performing that action. Half of the quantifier fillers tested understanding of **all**, and half (continued...)

children who were included in Part 2 ranged in age from 3;4 to 9;5 (mean age 6;2). Of these, twenty-four children were available to be included in Part 3. The children in Part 3 ranged in age from 3;4 to 7;7 (mean age 5;10).

4.2.2 Materials

For each experimental item the visual input was an 8 1/2" X 11" black-and-white picture. Animal pictures were computer-generated using various graphics programs. They were then cut and pasted, and photocopied onto card stock. For sample pictures, see **Appendix K**.

Four general decisions were made about the materials for all parts of this study. First, all animals pictured were male, and subjects were told this. This was so that gender would not be an additional factor in determining a pronoun's referent. The pronouns tested were thus singular masculine (**he**, **him**, and **his**, and in Parts 2 and 3, **himself**) and plural (**they**, **them**, and **their**, and in Parts 2 and 3, **themselves**). Masculine pronouns were chosen over feminine pronouns because of the distinction between the object pronoun **him** and possessive **his**, as opposed to the ambiguous **her**.

Second, the principal linguistic input in each case was a yes/no question asked about one of the pictures. As a result, response data are in the form of "yes" or "no" answers (and, in Part 3, responses to the question, "Why not?"). As a result, the experimental task did not

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[a](...continued)
tested understanding of **every**. All subjects correctly answered all of the match pictures. However, these four children failed to reject quantifier mismatches in 5 or 6 out of 6 cases.

put great demands on subjects' memory.

Third, all of the questions were in the past tense. Since pronominal number is part of what's being investigated here, past tense was used to eliminate the need for subject verb agreement marking. For the same reason (in this case, to avoid the complication of dependent plurals), in sentences with possessive pronouns, the things possessed were all mass nouns or inherent plurals.[9]

Finally, in all cases, verbs were chosen based on whether they could be shown as both reflexive and non-reflexive actions, and as both collective and distributive. This limited the possible verbs a great deal, but made different types of pictures more comparable. For sentences with possessive pronouns, verbs were chosen based on whether the possessor-possessed relationship could be clearly illustrated.

In the following sections I will discuss the materials for the number pretest and Parts 2 and 3 more specifically. In section **4.2.2.1** I will describe the materials used in the number pretest. In section **4.2.2.2** I will describe the materials used in Part 2 (including the prompted production pilot study mentioned above). Finally, in section **4.2.2.3** I will describe the materials used in Part 3.

4.2.2.1 Number Pretest

The number pretest was designed to see whether the children distinguished between singular and plural pronouns. There were twenty-four experimental items. Each picture was shown with two different

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[9]This was not true for the elicited production task following Part 2. See section **4.2.2.2**.

sentences, one match and one mismatch (and each sentence was given with two different pictures, one match and one mismatch). There were eight items involving singular and plural object pronouns, eight items involving singular and plural subject pronouns, and eight items involving singular and plural possessive pronouns. These experimental sentences are given in **Appendix A1**.

The pictures generally showed five animals. For example, for A1 and A5, "Did the bear spray him?", subjects were shown a picture with a bear, a parrot, and three baby tigers. In A1, the match case, the bear sprayed the parrot, but not the baby tigers; in A5, the mismatch case, the bear sprayed the baby tigers (as a group), but not the parrot. These same pictures were used with A2 and A6 respectively, with the sentence "Did the bear spray them?". A1 and A5 tested the singular pronoun, while A2 and A6 tested the plural pronoun.

Object pronoun items included the verbs **spray** and **brush**. Subject pronoun items included the verbs **brush** and **pour (water) on**. Possessive pronoun items included the verbs **wipe (his/their glasses)** and **cut (his/their hair)**.

Sixteen filler items were included in the number pretest (in addition to four training items at the beginning), for a total of forty items. Fillers, which were generally simpler sentences and pictures (containing no quantifiers and no pronouns), were meant to encourage "no" responses and to avoid satiation with experimental materials. Two thirds of the fillers (ten items) required "no" answers. Verbs in the filler items included **spray**, **point to**, **brush**, **pour (water) on**, **tickle**, **wash**, **wipe**, **drink**, **step on**, and **climb**. A list of fillers is given in

Appendix A2.

The order of items was semi-random, so that similar items were separated and so that no more than three "no" answers were expected in a row, and no more than three "yes" answers were expected in a row. There were two possible orders for the number pretest (Form 1 and its reverse, Form 2; see **Appendix A1**); approximately half of the child subjects and half of the adult subjects were presented with materials in each order. The number pretest was usually completed in one session of about 15 or 20 minutes.

Since the main focus of Part 2 and Part 3 was on sentences with object pronouns (e.g., "The bears sprayed them"), only those subjects who passed the object pronoun section of the number pretest were included in Part 2 and Part 3. Subjects were considered to pass a section by performing significantly above chance at the .05 level as determined by binomial expansion. To be above chance, subjects had to answer at least 6 out of 8 of the experimental items correctly. Subjects were also excluded if they were incorrect on more than two filler items.[10]

4.2.2.2 Part 2

Part 2 was designed to test binding Principles A and B, distributive and collective interpretations of pronominals, and binding with **every**, **all**, and plural antecedents. Part 2 consisted of twenty-three experimental picture-sentence pairs, with three tokens of each

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[10]Three subjects (ages 4;4, 4;11, and 5;9) who passed the object section of the number pretest were excluded based on this criterion.

picture-sentence pair. The sentence types, and schematic renderings of the pictures, are given in **Appendix B1**.

Items in Part 2 included the verbs **spray**, **brush**, and **pour (water) on** for sentences with object or reflexive pronouns, and **cut (his/their hair)**, **wipe (his/their glasses)**, and **drink (his/their juice)** for sentences with possessive pronouns.

Forty-six filler items were included in Part 2 (in addition to four training items at the beginning of the first half of Part 2); a list of these fillers is given in **Appendix B2**. There were three types of fillers. The first thirty were Simple fillers, with simpler sentences and pictures (containing no quantifiers and no pronouns). These were meant to encourage "no" responses and to avoid satiation with experimental materials. Two thirds of these simple fillers (twenty items, fillers 11-30) required "no" answers. For most "no" fillers, the picture and sentence did not match because the wrong animal was performing the action; in this way, subjects were focused on who was doing what to whom.

Another four items, the Spreading fillers (fillers 31-34), while sufficiently different from the main body of experimental items to be considered fillers, were in fact of interest in themselves. These four items tested "quantifier spreading" type sentences with the quantifiers **every** and **all** (using the verbs **brush** and **tickle**). All four of these items were expected to receive "yes" responses from adults; an incorrect answer would be a rejection of these items. One possible reason for rejection, though not the only possible reason, was quantifier spreading. A rejection alone would not be sufficient evidence for quantifier spreading; however, some children spontaneously explained their rejections, giving explanations which were later coded as spreading responses.

Finally, the remaining twelve Quantifier fillers (fillers 35-46), while also of interest, were sufficiently different from the main body of experimental items to be considered fillers. These items tested subjects' understanding of the universal force of the quantifiers **every** and **all**. Six items tested **every**, and six items tested **all**. Half of each of these required "yes" responses, and half required "no" responses. The items which required rejection showed only two out of three animals performing an action on a fourth animal. For example, one sentence was "Did every bear spray the pig?". The picture requiring rejection showed two bears spraying the pig and a third bear not spraying the pig (filler 35); the picture requiring acceptance showed all three bears spraying the pig (filler 36).

The order of fillers and experimental sentences was semi-random, so that similar items were separated and so that no more than three "no" answers were expected in a row, and no more than three "yes" answers were expected in a row. Items were presented in two different orders (Form 1 and its reverse, Form 2; see **Appendix B1**); approximately half of the child subjects and half of the adult subjects were presented with materials in each order.

Part 2 was quite long, with a total of sixty-nine experimental items plus forty-six fillers, for a grand total of one hundred fifteen items. For most children, Part 2 required two sessions of 20 to 30 minutes each.

Immediately following Part 2 there was a very short prompted production task. In this task, the experimenter told the subjects two short stories which detailed the misadventures of three monkeys and three parrots, respectively. At the end of each story, subjects were asked one question with either **every** or **all**. For example, after hearing how each of the monkeys had bumped his nose, subjects were asked, "What did every monkey bump?" or "What did all the monkeys bump?"; subjects typically answered "his nose", "their nose" or "their noses". This task is discussed in more detail in section **5.2.2.2**.

4.2.2.3 Part 3

Part 3 was designed to test more extensively children's understanding of quantifier binding and related phenomena. Part 3 involved a modified version of the picture verification task used in the number pretest and Part 2. In its original form, the task paired one sentence with one picture; however, in Part 3, for each picture, subjects were asked more than one question. In Part 3, there was a total of fifty-two questions.[11] These questions and schematic drawings of each picture are presented in **Appendix C**. Subjects were shown fifteen different pictures, and asked from three to five questions for each picture. There was only one token of each sentence type. When a subject responded "no" to a question, he or she was asked "Why not?" or "What really happened?".

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[11]Two adults and eleven children were asked an additional twelve pilot questions (with four additional pictures), which were added on at the end of Part 3. These additional questions tested bound distributive interpretations and **every-a** quantifier spreading, with variations in the pictures. These questions will not be discussed further here.

The main focus in this section was on subjects' answers to the question "Why not?" or "What really happened?". As a result, it was thought that a more extensive design involving fillers was not necessary, since, in the previous parts, the major reason for having fillers was to encourage subjects to reject picture-sentence pairs when necessary (since children generally have a preference for saying "yes" over saying "no"). In Part 3, in many cases, children were demonstrating the phenomenon under study by incorrectly rejecting picture-sentence pairs.

Some of the questions in Part 3 were intended to duplicate questions in Part 2.[17] There were two reasons for this. First, for some subjects there was a delay between Part 2 and Part 3. As a result, it was necessary to confirm that children's judgments of certain experimental sentences had not changed during the time delay. Second, since there were differences between the procedures for Part 2 and Part 3, this duplication allowed a comparison of these two procedures, and in a sense allowed each procedure to control for the other. Part 2 included multiple tokens of each question and included fillers. Part 3 did not include these, but allowed an opportunity to ask "Why not?" in order to get an understanding of why certain picture-sentence pairs were rejected.

The questions in Part 3 can be divided into 7 sections. The questions in Section 1 (Q1 to Q7) were an introduction to the task and a replication of some of the questions in Part 2. Section 2 (Q8 to Q13)

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[17]For a comparison of results on items from Part 2 repeated in Part 3, see **Appendix F**.

tested sentences with quantifiers in subject position. Section 3 (Q14 to Q19) tested sentences with quantifiers in object position. Section 4 (Q20 to Q34), the main body of Part 3, tested a variety of sentence types using pictures which showed a one-to-one mapping between subjects and objects. Section 5 (Q35 to Q40) was a replication of Part 2, testing a bound distributive interpretation with pronouns. Section 6 (Q41 to Q46) tested **a/every** quantifier spreading, and Section 7 (Q47 to Q52) tested **every/a** quantifier spreading.

All subjects saw the pictures in the same, semi-random order, but the questions for each picture were ordered randomly (each was written on a separate card, and the cards were shuffled for each subject). The order of presentation of pictures is given in **Appendix** C.

4.2.3 Procedures

An overview of the experimental protocol is given in (2).

(2) Experimental Protocol

SESSION 1 [time: about 20 minutes]
name animals
Training 1: picture choice, plural vs. singular subject NP, **he** vs. **they**
Training 2: four practice yes/no judgment (two yes, two no)
Number Pretest

SESSION 2 [time: 20 to 30 minutes]
name animals
Training 1: (see above)
Training 2: (see above)
Part 2 (1st half)

SESSION 3 [time: 20 to 30 minutes]
same as session 2; may omit naming animals, may omit training 1
no training 2
Part 2 (2nd half)
prompted production pilot

SESSION 4 [time: 15 to 20 minutes]
name animals
no training
Part 3: multiple questions/picture; answers to "Why not?"

All data were recorded on response sheets by the experimenter during the experiment. In addition, for child subjects, all parts of this study were audio-recorded using a hand-held mini-cassette recorder (for adults, only Part 3 was recorded). All recordings were transcribed either by the experimenter or by a professional transcriber. Any transcriptions not done by the experimenter were checked by the experimenter for accuracy.

For all three parts (and at the beginning of both sessions of Part 2), subjects were first shown pictures of the characters involved in experimental sentences, and asked to name the animals. Each time they were reminded that all of the animals were males.

In the number pretest and Part 2, subjects were given two types of training. For the first training set, subjects were shown two pictures at the same time; one picture showed one tiger wearing glasses, while the other showed three identical tigers wearing glasses. Subjects were then asked to point to the picture which showed "The tigers are wearing glasses", and then to point to the picture which showed "The tiger is wearing glasses." Subjects were given feedback on their responses, and when it was clear that they understood the distinction between the two sentences, the experimenter moved on to the second training pair. Subjects were again shown two pictures at once; this time, one picture showed one mouse holding balloons, and the other picture showed three identical mice holding balloons. Now the subjects were asked to point to the picture which showed "They are holding balloons", and then to point to the picture which showed "He is holding balloons."[13] The purpose of this training was to focus subjects' attention on the distinction between singular and plural. Surprisingly enough, there were subjects who had a great deal of difficulty with this distinction[14]; all of these subjects were later eliminated since they failed the number pretest. This training set was used before the number pretest and, depending on the time between sessions, at the beginning of either or both halves of Part 2.

The second training set consisted of four sample picture-sentence pairs; subjects were shown a picture and asked to reply "yes" or "no" to a question about the picture. Subjects were given feedback on these four pairs. Two picture-sentence pairs were matches, eliciting "yes" responses, and two were mismatches, eliciting "no" responses. This training set was used before the number pretest and before the first session of Part 2, and was meant to familiarize subjects with the task of responding to the questions about the pictures. Experimental and filler items in the number test and in Part 2 were similar to these training items, except that no feedback was given.

One consideration in this type of study is the presence or absence

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[13]This training may have affected (i.e., improved) children's performance on the number pretest with subject pronouns. Therefore, comparisons of the relative order of competence for subject vs. object or possessive pronouns may not be valid. However, the main focus of this study was on object pronouns, so the benefits of this training seemed to outweigh the disadvantages.

[14]The children who had difficulties with this task were not necessarily the youngest children tested. One child who had a great deal of trouble with this, and who was subsequently eliminated because of the number pretest, was age 6;8.

of other potential antecedents for the pronouns in the experimental sentences. What this amounted to here was a question of what other animals to include in the picture, whether or not to have a lead-in sentence, and the order of presentation of the animals in a lead-in sentence. Kaufman (1987) (discussed in section 2.2.1.3 above), described pilot work which showed the need for some kind of context in studies of pronoun use:

> Sentences like "The monkey scratched him" sometimes produced quizzical looks, or questions like "Who's him?" even when they correctly followed an enactment of the event. The event itself was just not sufficient to establish the intended reference. What appeared to be needed was a linguistically encoded referent (Kaufman, 1987, p.7).

In contrast, Koster (1993) argues against the relevance of a lead-in sentence:

> anaphora acquisition studies should not confuse anaphora across discourse and anaphora within sentences. In the first case, the role of syntax is clouded by the interference of pragmatic, non-grammatical strategies. To reduce the effects of pragmatic strategies and concentrate on syntactic knowledge, possible antecedents must occur within the sentence structure. Lead-in sentences are not suitable for presenting possible antecedents (Koster, 1993, p.94).

The problem with having intrasentential antecedents is that the sentences can then become long and unwieldy, placing a greater demand on subjects' memory.

Foster-Cohen (1994) presents other arguments against lead-in sentences based on relevance. She suggests that lead-in sentences create redundancy, which adds to children's difficulty in rejecting mismatch situations. The problem is "the naming of the protagonists which one may assume are already identifiable from the picture. If they are not obvious from the first picture, the fact that the trials all involve the same protagonists will quickly obviate the need to keep repeating the protagonists' identification" (Foster-Cohen, 1994, p.250).

On the other hand, as noted by Philip & Coopmans (1995a), having a context-setting sentence that mentions all of the types of objects depicted in the picture "served to reinforce the pragmatic restriction of the domain of quantification to events and objects depicted in the picture" (Philip & Coopmans, 1995a, p.12).

With this tension between avoiding redundancy and restricting the domain of quantification in mind, the decision was made to include context-setting sentences here. However, an attempt was made to take into account the facts about relevance discussed by Foster-Cohen. Foster-Cohen discussed difficulties with the experimental format used by Grimshaw & Rosen (1990). In one trial in Grimshaw and Rosen's study, children saw Big Bird pat Ernie, and heard a puppet say, "I saw Big Bird doing something with Ernie. Big Bird patted him." Foster-Cohen notes that children may have difficulty with this because the presentation of information does not conform to given/new ordering: "The position of Ernie in the focus or comment position at the end of the context sentence leads the child to expect him to be relevant to any subsequent interpretation" (Foster-Cohen, 1994, p.251).

To avoid this difficulty, in this study all sentences, experimental and filler, were preceded by a context-setting sentence in which the animal or animals undergoing the action described in the sentence was named last (in the focus or comment position). In this way, this last-mentioned animal or group of animals was pragmatically available as a referent or referents, if it was permitted to be a referent by the subject's grammar.[15]

Another consideration in this type of study is the sentence stress used. Here the number pretest differed from Part 2 and Part 3. In the number pretest, the experimenter purposely stressed each pronoun. This stress was meant to be contrastive[16]; in a sentence like "Did the bear spray HIM? (where the match picture showed the bear spraying a parrot but not three baby tigers, while the mismatch picture showed the bear spraying the tigers, but not the parrot), the stressed pronoun was meant to indicate HIM, not **them**.

In Part 2 and Part 3, however, the pronouns were purposely destressed, since many of the questions in those parts were testing binding, and it has been shown (e.g., McDaniel & Maxfield, 1992) that stress is relevant for binding.[17]

In general, the time span between sessions was less than a week; many of the older children were seen over a period of two days, with two sessions each day. However, for six children, Part 3 was conducted a month after Part 2.

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[15]In discussing issues of competence and performance, Thornton (1990) suggested that "an obligatory rule of the grammar will override processing factors in all but exceptional circumstances" (Thornton, 1990, p.327). It's not clear to what degree we want to distinguish pragmatic factors from processing factors, but we might also expect that obligatory rules of grammar will override pragmatic factors in most circumstances.

[16]For further discussion of this, see section 5.1.1.

[17]If McDaniel and Maxfield are right, and children who do not show knowledge of Principle B are insensitive to contrastive stress, then some of the subjects who were eliminated in the number pretest may have been potential Principle B violators.

CHAPTER 5: RESULTS

In the following sections I describe the results obtained in the study described above in section **4.2**. In section **5.1** I describe the results for the number pretest. Then in section **5.2** I will turn to the results from Part 2 and Part 3. Since several of the same types of phenomena were tested in both Part 2 and Part 3, results from both parts will be presented together, grouped by phenomena. The descriptions of subjects in Part 2 and Part 3, as well as additional statistics (e.g., analyses by sex, by verb type, etc.) are presented in **Appendix** E and **Appendix** F, respectively.

5.1 Number Pretest

The design of the number pretest is described in section **4.2.2.1** above. The experimental sentences used in the number pretest are given in **Appendix A**.

Subjects were considered to pass a section of the number pretest by performing significantly above chance at the .05 level (based on a binomial distribution). To be above chance, subjects had to answer at least 6 out of 8 of the experimental items correctly.

Since adult results on the number pretest appear to be unexpectedly bad, I discuss them first in section **5.1.1**. Once I have accounted for the adult results on the number pretest, I turn to child results in section **5.1.2**. Finally, in section **5.1.3** I summarize the results of the number pretest.

5.1.1 Adult Results on the Number Pretest

As discussed in section **4.2.1.1**, twenty-two adult subjects were included in the study as controls. It was expected that all adults would perform more or less perfectly on the number pretest. Seven adults (32%) had perfect scores on all three sections of the number pretest, and another seven adults had no more than one mistake for each section of the number pretest. In sum, 64% of adults passed all three sections. However, eight adults (36%) made more than one mistake, and therefore failed, at least one section of the number pretest.[1] It is interesting to look at what these last eight adults were doing. Their errors are shown in (1).

(1) Adult Incorrect Responses on the Number Pretest, by Item

(A= object pronouns, B= subject pronouns, C= possessive pronouns)

	incorrectly accepted	incorrectly rejected											
KP	---											C3,	C4
JG	---		A2,	A3,	A4,		B2,		B4,	C1,	C2,	C3,	C4
JR	---	A1,	A2,		A4,	B1,	B2,	B3,	B4,	C1,	C2		
MB	---		A2,		A4,		B2,		B4,		C2		
BY	---		A2,		A4,		B2			C1,	C2,	C3	
HL	C8			A3,	A4,	B1,	B2,				C2		
CC	C8						B2,		B4,				C4
PK	C6				A4,		B2,	B3,	B4,		C2		

Five of these adults (23%) failed on object pronoun sentences (e.g., "Did the bear spray **him/them**?"), six (27%) failed on subject pronoun sentences (e.g., "Did **he/they** brush the elephant?"), and seven (32%) failed on possessive pronoun sentences (e.g., "Did the parrot wipe **his/their** glasses?"). However, most of the errors (94%) which these adults made were incorrect rejections. Of these, 70% were rejections of plural pronouns.

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[1]For adult (and child) responses to each sentence, see **Appendix D**.

Recall how this part of the experiment was conducted. Take B2 (which all of these adults rejected) as an example; the picture for B2 showed three parrots brushing an elephant, with a mouse holding a brush off in a corner. Subjects were told, "Here is a mouse and here are some parrots. Did THEY brush the elephant?" When questioned after the pretest, several of these adults said that they had rejected these cases because they thought the plural pronouns referred to **all** of the mentioned animals; in the case of B2, they had rejected the picture-sentence pair because the mouse did not brush the elephant along with the parrots. This was not a misunderstanding of the number of the pronoun, but a different interpretation of the stress which was put on the pronoun. While the stress was meant to be contrastive (**they** vs. **he**), some adults considered it to be emphatic, and thus expected it to include all of the named animals. Although these responses are quite reasonable, in the discussion that follows I will continue to use the term "correct" only for the responses intended in planning this experiment, unless otherwise noted.

What can we say about the remaining mistakes? (1) is repeated as (2), with all of the overrejections of plural pronouns eliminated.

(2) Adult Incorrect Responses on the Number Pretest, by Item

(A= object pronouns, B= subject pronouns, C= possessive pronouns)

	incorrectly accepted	incorrectly rejected
KP	---	C3
JG	---	A3, C1, C3
JR	---	A1, B1, B3, C1,
BY	---	C1, C3
HL	C8	A3, B1
CC	C8	
PK	C6	B3

With these remaining mistakes, only three adults (14% of the total number of adults) have two or more mistakes in any one section (shown in boldface): JG and BY failed possessives, and JR failed subjects. After we take into account the different stress interpretation discussed above, the numbers and percentages of adults passing each pronoun type are those given in (3).

(3) Adults Passing the Number Pretest, by Pronoun Type

	object pronouns	subject pronouns	possessive pronouns
number passing	22	21	20
percentage of adults	100%	95%	91%

Since all of these adults passed the object pronoun section of the pretest, they can be included in the subsequent sections of the study.

The items of the number pretest were presented in two different semi-random orders (Form 1 and its reverse, Form 2), and there was an effect of order of the items for adults. Eleven adults responded to Form 1 (with an overall percentage of 95% correct), and eleven adults responded to Form 2 (with an overall percentage of 84% correct). An Analysis of Variance (ANOVA) on the overall number of correct responses by form was significant.[7] The difference in difficulty in the two forms may be related to the emphatic stress explanation discussed above. Of the eight adults who made more than one mistake on any one section of the number pretest, all but two had responded to Form 2, the form which had a lower correct response rate in general.

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[7]For the eleven adults who responded to Form 1, the mean number of correct responses (out of 24) was 22.82; for the eleven adults who responded to Form 2, the mean number of correct responses was 20.18. $F(1,20) = 5.122$, $p<.05$.

There was no effect of sex for adults. Subjects for the number pretest included seven men, with an overall percentage of 85% correct, and fifteen women, with an overall percentage of 92% correct. An ANOVA on the overall number of correct responses by sex was not significant.[3] Note that the overall number of correct responses used for the comparisons of sex and of Form 1 vs. Form 2 are based on the original percentages, not those which take into account the different stress interpretation discussed above.

5.1.2 Child Results on the Number Pretest

A total of fifty-seven children, twenty boys and thirty-seven girls, were included in the number pretest, ranging in age from 3;4 to 9;5 (mean age 5;9). Thirty-four children (60%) passed the object pronoun section of the number pretest, and so were included in the subsequent sections of this study.[4] Thirty-six children (63%) passed the subject pronoun section, and fifteen children (26%) passed the possessive pronoun section.

It is important to note that when children failed these sections, they did so differently than did the adults who had failed with plural pronouns, as discussed above. While adults had overrejected, children

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[3]For the seven men, the mean number of correct responses (out of 24) was 20.29; for the fifteen women, the mean number of correct responses was 22.07. $F(1,20) = 1.757$, $p=.200$.

[4]Four of these children (ages 3;9, 5;3, 5;4, and 6;5) were later excluded from Part 2 and Part 3 because they failed on the quantifier fillers in Part 2.

either overaccepted or both overaccepted and overrejected.[5] Numbers and percentages of correct acceptances are shown in (4). For child and adult results on each sentence, see **Appendix D**.

(4) Correct Acceptance Rates on the Number Pretest

	4/4 correct		3/4 correct		<2 correct	
object pronouns						
children	43	75%	11	19%	3	5%
adults	16	73%	1	4%	5	23%
subject pronouns						
children	48	84%	6	11%	3	5%
adults	13	59%	3	14%	6	27%
possessive pronouns						
children	27	47%	12	21%	18	32%
adults	9	41%	9	41%	4	18%

For correct acceptance rates, children and adults differed significantly

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[5]One child, JE, seems to have shown the same response pattern as the adults:

A2 [bear sprayed three tiger cubs, but did not spray the parrot]
DID THE BEAR SPRAY THEM?
C: **No. 'Cause he's not spraying the bird. The bird (could) fly away from him.**

A4 [elephant brushed three monkeys, but did not brush the tiger]
DID THE ELEPHANT BRUSH THEM?
C: **No, only the monkeys.** [counted as correct response]

C2 [parrot wiped three tigers' glasses, but didn't wipe elephant's glasses]
DID THE PARROT WIPE THEIR GLASSES?
C: **No. 'Cause he didn't wipe the elephant's.**

The responses to A2 and C2 could possibly have been misinterpretations of the pronouns (so in A2, **them** could have been taken as referring to the parrot, and in C2 **their** could have been taken as referring to the elephant), but the response to A4 clearly shows that **them** was taken as referring to all the mentioned animals (and was rejected because only the monkeys were brushed). Therefore, A2 and C2 were (conservatively) counted as incorrect, but A4 was counted as correct. As a result, JE could be included in Part 2 and Part 3, since he was considered to have passed the object pronoun section of the number pretest.

with respect to object pronouns and subject pronouns.[6] These differences are due to higher adult rejection rates, discussed in the previous section. Incorrect rejection rates for possessive pronouns were high for both adults and children.[7]

In general, children did not overreject in the same way as adults. While 70% of adult incorrect rejections were rejections of plural pronouns, only 46% of child incorrect rejections were rejections of plural pronouns. The emphatic stress interpretation found for adults does not seem to be a factor in children's overrejections (with the possible exception of JE; see footnote 5).

Numbers and percentages of correct rejections are shown in (5).

(5) Correct Rejection Rates on the Number Pretest

	4/4 correct		3/4 correct		<2 correct	
object pronouns						
children	30	53%	9	16%	18	31%
adults	22	100%	0		0	
subject pronouns						
children	30	53%	7	12%	20	35%
adults	22	100%	0		0	
possessive pronouns						
children	18	32%	14	24%	25	44%
adults	18	82%	4	18%	0	

Here we can see the real differences between adults and children; children often incorrectly accepted sentences that should have been rejected. For each pronoun type, children overaccepted significantly

[6]Chi-square tests on a crosstabulation of these adult and child scores were significant: for object pronouns Chi-square = 7.071, df=2, $p<.05$; for subject pronouns, Chi-square = 8.182, df=2, $p<.05$.

[7]A Chi-square test on a crosstabulation of adult and child scores on possessive pronouns was not significant: Chi-square = 4.908, df=3, $p=.179$.

more often than adults.[a]

Recall that subjects were considered to pass a section by performing significantly above chance (at the .05 level). To be above chance, subjects had to answer at least 6 out of 8 of the experimental items correctly (which called for equal numbers of acceptances and rejections). The number and percentage of children passing each pronoun type are given in (6).

(6) Children Passing the Number Pretest, by Pronoun Type

	object pronouns	subject pronouns	possessive pronouns
number passing	34	36	15
percentage of children	60%	63%	26%

More than twice as many children passed on the object and subject pronouns as passed on the possessive pronouns. It should not be too surprising that possessive pronouns were more difficult for children than object pronouns or subject pronouns. For object pronouns and subject pronouns, only one thing was being tested: the number of the pronoun. However, for the possessive pronouns, two things were tested: the number of the pronoun and also whether the pronoun could refer sentence-internally.

For the possessive pronoun section of the number pretest, half of the items offered a choice between singular and plural outside referents. The pictures for items C1, C2, C5 and C6 showed a parrot that wiped the glasses of an elephant (a possible referent for **his**) or

[a]Chi-square tests comparing crosstabulations of adult and child scores were all highly significant: for object pronouns, Chi-square = 15.832, df=2, p<.0005; for subject pronouns, Chi-square = 15.832, df=2, p<.0005; and for possessive pronouns, Chi-square = 18.725, df=2, p<.0001.

wiped the glasses of three tigers (possible referents for **their**). However, the other items, C3, C4, C7 and C8, tested for a sentence-internal referent for the pronoun. For example, the picture for C3 ("Did the monkey cut his hair?") showed a monkey cutting his own hair and a single mouse standing by.[9] While this was a match picture because of number, there is evidence that some subjects rejected this because they thought that to express this action the sentence should have been "The monkey cut **his own** hair"; seven subjects responded to one or more of these items (C3, C4, C7, or C8) by saying "No, he cut **his own** hair" or "No, they cut **their own** hair."[10]

This suggests that C3 and C4 may have been (incorrectly) rejected more often than C1 and C2, and that C7 and C8 may have been (correctly) rejected more often than C5 and C6. Across all children, C1 and C2 were accepted 87% of the time; C3 and C4 were accepted only 58% of the time. Average scores on C1 + C2 were significantly different from average scores on C3 + C4.[11] However, across all children, C5 and C6 were correctly rejected 78% of the time, while C7 and C8 were correctly rejected only 59% of the time. Average scores on C5 + C6 were

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[9]The picture for C4 ("Did the monkeys cut their hair?") showed three monkeys, each one cutting his own hair, and three mice standing by. The picture for C7 ("Did the monkey cut their hair?") showed a single monkey cutting his own hair, with three mice standing by. The picture for C8 ("Did the monkeys cut his hair?") showed three monkeys, each one cutting his own hair, with a single mouse standing by.

[10]These seven subjects were ET (3;4), KF (4;9), AM (5;1), HH (5;3), KV (5;7), JE (6;3) and EC (6;10).

[11]The mean acceptance for C1 + C2 was 1.7368. The mean acceptance for C3 + C4 was 1.3509. A paired samples t-test was significant: $t= 2.98$, $df=56$, $p<.005$.

significantly different from average scores on C7 + C8.[12]

(7) shows numbers and percentages of children responding correctly to C1 and C2 (the outside referent cases) and C3 and C4 (the sentence-internal referent cases).

(7) Children's Correct Responses to Possessive Match Items

	0 correct		1 correct		2 correct	
C1 + C2	3	5%	9	16%	45	79%
C3 + C4	13	23%	11	19%	33	58%

It is worth looking more closely at the children who passed the object section of the number pretest (and so were included in Part 2) but failed the possessive section. There were sixteen children who fell into this category.[13] Of these, twelve (75%) rejected either C3 or C4; eight (50%) rejected both C3 and C4; and five (31%) rejected C3 and C4 but made no other mistakes on possessives. These children were ET, EW, AL, EB, and TO. This will be important later, since all of the possessive questions in Part 2 (shown in **Appendix B**) give a sentence-internal referent for the pronoun, and, as we will see, some children rejected these interpretations.

As with adults, there was an effect of order of the items for children. Thirty-four children responded to Form 1, with an overall percentage of 75% correct responses, and twenty-three children responded to Form 2, with an overall percentage of 84% correct responses. An

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[12]The mean correct rejection for C5 + C6 was 1.1754. The mean correct rejection for C7 + C8 was 1.5614. A paired samples t-test was significant: $t = -3.04$, $df=56$, $p<.005$.

[13]The four children, mentioned above, who were excluded from Part 2 and Part 3 because they failed on quantifier fillers on Part 2 had also fallen into this category.

ANOVA on the overall number of correct responses by form was significant.[14] However, notice that while adults had done better on Form 1, children did better on Form 2, so that the same explanation cannot account for the performance of both adults and children. I could find no particular pattern of responses that would explain this difference between Form 1 and Form 2 for children.

There was no effect of sex for children. The twenty boys tested had an overall percentage of 77% correct, and the thirty-seven girls tested had an overall percentage of 80% correct. An ANOVA on the overall number of correct responses by sex was not significant.[15]

Scholes (1981) presented evidence that children do not distinguish between **he** and **they** and between **him** and **them** until about age 6. To examine this claim with these children, the fifty-seven children were divided into four age groups. Group 1 consisted of thirteen children below age 5, Group 2 consisted of nineteen five-year-olds, Group 3 consisted of seventeen six-year-olds, and Group 4 consisted of eight children over age 7. The number and percentage of children in each age group who passed each pronoun section are given in (8).

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[14]For the thirty-four children who responded to Form 1, the mean number of correct responses (out of 24) was 17.97; for the twenty-three children who responded to Form 2, the mean number of correct responses was 20.26. $F(1,55) = 4.989$, $p<.05$.

[15]For the twenty boys, the mean number of correct responses (out of 24) was 18.50; for the thirty-seven girls, the mean number of correct responses was 19.11. $F(1,55) = .307$, $p = .582$.

(8) Children Passing Each Pronoun Type, by Age Group

group	#	object pronouns		subject pronouns		possessive pronouns	
G1	13	3	23%	4	31%	2	18%
G2	19	13	68%	14	74%	3	19%
G3	17	11	65%	10	59%	6	55%
G4	8	7	88%	8	100%	4	50%

The differences between age groups are significant in the first two cases.[16] The average score for each pronoun type is given by age group in (9). Recall that possible scores were from 0 to 8 correct, with a passing score being above 6. Passing scores are shown in boldface.

(9) Average Number Correct for Each Pronoun Type, by Age Group

group	#	object pronouns	subject pronouns	possessive pronouns
G1	13	5.8	4.9	5.4
G2	19	**6.8**	**6.9**	5.7
G3	17	**6.4**	**6.6**	5.9
G4	8	**7.5**	**7.9**	**6.6**
Adults	22	**7.4**	**7.2**	**6.9**

These results suggest that children distinguish between singular and plural object pronouns and subject pronouns around age five (earlier than Scholes claimed), but (keeping in mind the extra factor discussed above) do not distinguish between singular and plural possessive pronouns until after age seven.

5.1.3 Summary and Discussion of Number Pretest Results

The number pretest served several purposes. At the very least, it separated out subjects who were competent with the picture-judgment task

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[16]Chi-square tests on crosstabulations of failing or passing by age group were significant for object pronouns and subject pronouns, but not for possessive pronouns. For object pronouns, Chi-square = 10.590, df=3, $p<.05$. For subject pronouns, Chi-square = 11.569, df=3, $p<.01$. For possessive pronouns, Chi-square = 4.908, df=3, $p=.179$.

from those who weren't. In order to pass the number pretest, subjects had to be willing to both accept and reject picture-sentence pairs.

The number pretest also eliminated subjects who did not distinguish between singular and plural; 40% of child subjects were eliminated because they did not distinguish between singular and plural object pronouns. In the following sections, there will be some differences between singular and plural pronouns when the pronouns are used as bound variables. Since all of the subjects who were included in Part 2 and Part 3 showed that they can distinguish between singular and plural pronouns in referential uses, these cases will have to be attributed to children's interpretation of variables, and not just to problems with pronominal number.

We have also seen in the number pretest that some children may have difficulties with the number of possessive pronouns, or may reject possessive pronouns when they refer sentence-internally. This is something which will have to be taken into account when we look at bound uses of possessive pronouns in section 5.2.2.

Finally, there are differences with respect to age in children's ability to distinguish between singular and plural pronouns. Children can distinguish between singular and plural subject pronouns and object pronouns around age five, but appear to be slower at distinguishing between singular and plural possessive pronouns (though, as discussed above, this may be due to other factors in the interpretation of possessive pronouns in this task).

5.2 Main Results

Section **5.2.1** will describe results with sentences containing the reflexive pronouns **himself** and **themselves**. Section **5.2.2** will describe results for possessive pronouns, including some prompted production data. Section **5.2.3** will discuss some tests of quantifiers. In section **5.2.4** I will begin discussion of the central findings of this study, describing results for binding in distributive and collective contexts. In section **5.2.5** I will discuss results with picture-sentence pairs in which the picture showed a one-to-one mapping of subjects and objects. These are of interest both because they allowed the investigation of different ways of expressing this distributive interpretation and also for comparison with the quantifier spreading contexts. Finally, in section **5.2.6** I will discuss the quantifier spreading results, and in section **5.2.7** I will discuss relationships among the results.

Throughout this section I will distinguish between questions from Part 2 and questions from Part 3, when necessary, by referring to questions from Part 2 as items 1 to 23, and referring to questions from Part 3 as Q1 to Q52. Recall that in Part 2, subjects were tested on three tokens of each item. In Part 3, subjects were tested on only one token of each item, and were asked, "Why not?" when their response was "no". Items 1 to 23 are shown in **Appendix B**. Q1 to Q52 are shown in **Appendix C**. Additional description of subjects for Part 2 and Part 3 are given in **Appendix E** and **Appendix F**, respectively.

A discussion of the differences between the results from Part 2 and those from Part 3 is included in **Appendix G**.

5.2.1 Reflexives

Four items in Part 2 tested reflexives. Items 1 and 2 tested Principle A of the binding theory with **himself**; item 1 required acceptance and item 2 required rejection. Items 3 and 4 tested the distributive and collective interpretations of **themselves** (both required acceptance). The overall numbers and percentages of correct responses for each of these items are given in (10).

(10) Overall Correct Responses for Reflexive Items

item	correct response	children		adults	
1- **himself**	accept	86/90	96%	65/66	98%
2- **himself**	reject	88/90	98%	66/66	100%
3- **themselves** (dist.)	accept	85/90	94%	65/66	98%
4- **themselves** (coll.)	accept	83/90	92%	61/66	92%

All of the children and all of the adults responded correctly to these items for at least 2 out of 3 tokens of each item.

We can conclude that these children (and adults) obey Principle A of the binding theory, and will accept both a collective and a distributive interpretation of the reflexive **themselves**.

5.2.2 Possessive Pronouns

There were two tests of possessive pronouns. In section **5.2.2.1** I will discuss the items in Part 2 which contained possessive pronouns. Then in section **5.2.2.2** I will discuss the results of a pilot study testing production of possessives.

5.2.2.1 Possessive Items in Part 2

In Part 2 there were six items which tested possessive pronouns. These varied in terms of antecedent type (e.g., **every monkey** vs. **the**

monkeys) and in terms of the pronoun and interpretation (i.e., **his**, distributive **their**, and collective **their**). Individual results on these questions for adults and children are given in **Appendix H**.

Items 7, 8, and 9 tested possessive pronouns whose antecedent was **every NP** (e.g., **every monkey**), while items 16, 17 and 18 tested possessive pronouns whose antecedent was a plural NP (e.g., **the monkeys**). Items 7 and 16 tested **his** with a distributive interpretation; items 8 and 17 tested **their** with a distributive interpretation; and items 9 and 18 tested **their** with a collective interpretation. In terms of prescriptive grammar, item 8 (e.g., "Did every monkey cut their hair?", where each monkey cut his own hair) and item 16 (e.g., "Did the monkeys cut his hair?", where each monkey cut his own hair) were ungrammatical. However, most adults accepted item 8 (but rejected item 16), so I considered acceptance of item 8 to be correct, and considered acceptance of item 16 to be incorrect.[17] Overall acceptance rates for these items are summarized in (11).

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[17]Newman (1993), in discussing the use of "epicene" pronouns, suggests that **they** (and **their**) may be anaphoric to quantified noun phrases in both collective and distributive senses; for most speakers, **they** indicates nothing about gender and number, but shows that the referent is viewed as "unindividuated" (i.e, in some sense generic or not associated with specific entities).

(11) Overall Child vs. Adult Acceptance of Possessive Pronoun

Items		children		adults	
item 7 **every monkey-his**	(dist.)	66/90	73%	60/66	91%*
item 8 **every monkey-their**	(dist.)	72/90	80%	55/66	83%
item 9 **every monkey-their**	(coll.)	77/90	86%	54/66	82%
item 16 ***the monkeys-his**	(dist.)	42/90	47%	13/66	20%**
item 17 **the monkeys-their**	(dist.)	71/90	79%	52/66	79%
item 18 **the monkeys-their**	(coll.)	77/90	86%	52/66	79%

significant at * p<.05 **p<.01[18]

A univariate MANOVA of children's responses was significant. There were two main effects, antecedent type (**every** or plural) and possessive type (distributive **his**, distributive **their**, and collective **their**), which were both significant, and there was a significant interaction between the two.[19]

Performance on these items should be related to performance on the possessive questions in the number pretest, especially C3 and C4 (which contained pronouns with sentence-internal referents). C3 ("Did the monkey cut his hair?") tested a singular antecedent-pronoun pair, so it had no equivalent in Part 2. However, C4 ("Did the monkeys cut their hair?") tested a bound distributive interpretation with **their**. This was identical to item 17, and differed from item 8 only with respect to the antecedent (which was **every monkey** for item 8). A total of seven children rejected items 8 and 17; of these children, five had also rejected C4.[20]

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[18]Significance here is based on 2-group t-tests comparing adult and child acceptance. For additional details, see **Appendix** H.

[19]For antecedent type, F (1,174) = 4.55, p<.05. For possessive type, F(2,174) = 12.59, p<.001. For the interaction of antecedent type by possessive type, F(2,174) = 4.02, p<.05.

[20]ET, JE, KB, CQ, and TO rejected item 8; AL, AT, JE, KB, and CQ rejected item 17. Of these children, all but KB and CQ also rejected C4.

We could argue that these seven children do not have a bound variable interpretation available to them (at least with possessive pronouns), since they rejected the bound distributive interpretation with **their**. What do these children do with the bound distributive sentences with **them** (see section **5.2.4.5** below)? Of these seven children, six performed significantly better than at chance on (i.e., correctly rejected) the bound distributive sentences with **them**, while the seventh (AT, age 5;5) performed at chance (incorrectly accepting 6 out of 12 tokens). If these children do not have a bound distributive interpretation, this lack does not cause them to violate Principle B.[71] However, there may be other explanations for the rejection of the bound variable interpretation with **their**. For two of these seven children (ET, age 3;4, and JE, age 6;3), there is evidence that they did not like internal reference for possessives; they responded to questions such as "Did the monkeys cut their hair?" with, "No, they cut **their own** hair" (see section **5.1.2** above).

5.2.2.2 Some Production Data for Possessives

In Part 2, the sentences with possessive pronouns were designed so that the things possessed were either mass nouns (juice or hair) or inherent plurals (glasses). This was done to avoid the problem of

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[71]Compare this result to the results of Avrutin & Thornton (1993, 1994), discussed in section **2.2.2.2** above. Avrutin and Thornton found that four children who did not accept the bound distributive interpretation with control sentences (e.g., "I know how many bugs they have. Two." for a situation in which two turtles had two bugs each) accepted a bound distributive interpretation for sentences like "The Smurf and the clown dried them", in violation of Principle B. For discussion, see section **2.2.2.2**.

dialectal variation with respect to dependent plurals.[17] However, in order to examine the relationship between distributivity and number more closely, a short pilot study was included between Part 2 and Part 3. Subjects were told that they would hear two short stories and then would be asked some questions. For the "monkey story", the subjects were shown a picture of three monkeys; for the "parrot story" the subjects were shown a picture with three parrots.These stories are given in (12) and (13).

> (12) This is a story about some monkeys. These three monkeys were playing, and they were running around, and they weren't looking where they were going. And this one ran into a tree, and bumped his nose. And this one ran into a wall, and bumped his nose. And this one ran into a telephone pole, and bumped his nose.
>
> Question: What did every monkey bump? OR
> What did all the monkeys bump?
>
> (13) This is a story about some parrots. These three parrots were not being very careful. And they have very long tails. And this one was not being careful, and he found a mousetrap, and it went like this on his tail, so he hurt his tail. And this one got in the way of someone wearing big boots, and that person stepped on his tail. So he hurt his tail. And this one was closing a closet door, and he wasn't careful, and he closed it on his tail. So he hurt his tail.
>
> Question: What did every parrot hurt? OR
> What did all the parrots hurt?

The two stories were always presented in this order. Each subject was asked one question with **every** and one question with **all** (approximately half were asked the **every** question with the "monkey story" and half with the "parrot story").

The stories were meant to strongly evoke a distributive interpretation, focusing on each individual animal successively, and

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[17]For some discussion of dependent plurals see Roberts (1986) and De Mey (1981).

with repeated mention of **his nose** or **his tail**. One problem with this, however, was the sentence, "And they have very long tails" in the second story (which provides the plural **tails**).

Responses to this task may also give some understanding of subjects' preferences for distributive or collective interpretations. It could be argued that singular responses to these stories (e.g., either **his nose** or **their nose**) indicate a distributive interpretation, since there is one nose per monkey, but the question asks about **every monkey** or **all the monkeys**. It could also be argued (though the stories themselves are biased against this) that a plural response (e.g., **their noses**) indicates a collective interpretation (since only the collection of monkeys, and not any individual monkey, has noses).[73]

Twenty-one adults responded to these two stories. Their paired responses (for **every** and **all**) are shown in (14).

(14) Adult Responses to Possessive Elicitation

	every	**all**	number of adults	
a.	their nose/tail	their nose/tail	7	(33%)
b.	his nose/tail	their nose/tail	8	(38%)
c.	their nose/tail	their noses/tails	2	(9%)
d.	their noses/tails	their nose/tail	1	(5%)
e.	their own nose/tail	their own noses/tails	1	(5%)
f.	their nose/tail	their own noses/tails	1	(5%)
g.	his nose/tail	his nose/tail	1	(5%)

These response show a strong preference for the distributive interpretation. The singular responses of (14a), (14b), and (14d) can all be considered distributive, while the plural responses in (14c), (14e), and (14f) are collective for **all** and the plural response in (14d) is collective for **every**. 71% of these adults gave only singular

[73]But see Roberts (1986), pp.102-103.

responses, with some variation in the number of the pronoun in response to questions with **every**.

Forty children responded to these two stories. However, only twenty-nine of these children gave responses to both stories, and of these, only twenty-three gave fully usable responses.[74] Their paired responses are shown in (15).

(15) Child Responses to Possessive Elicitation

	every	**all**	number of children
a.	their nose/tail	their nose/tail	9 (39%)
b.	his nose/tail	their nose/tail	5 (22%)
c.	their nose/tail	their noses/tails	5 (22%)
d.	his nose/tail	his nose/tail	3 (13%)
e.	his nose/tail	their noses/tails	1 (4%)

Children's responses also show a strong preference for the distributive interpretation. The singular responses of (15a), (15b), and (15d) can all be considered distributive, while the plural responses in (15c) and (15e) are collective for **all**. 74% of these children gave only singular responses, and also showed some variation in the number of the pronoun in response to the questions. No child gave a collective interpretation in response to a question with **every**, but a total of six children (26%) gave a collective interpretation in response to a question with **all**.

Both adults and children preferred **their** over **his** when the antecedent contained **every**, contrary to prescriptive grammar. A slight majority of adults preferred **their** over **his** (55% vs. 45%) for the bound distributive interpretations with **every** (all of the responses except for

[74]Other responses did not include possessives for both **every** and **all**; for example, the responses given by AT were "Nose" and "Tails" (for **every** and **all**, respectively).

(14d)). For children also, a majority preferred **their** over **his** (61% vs. 39%) for the bound distributive interpretations with **every**.

These results can be taken as further evidence that these children permit, and in fact prefer, a distributive interpretation. This was true even of the seven children, discussed in the previous section, who rejected the bound distributive interpretation in the picture judgment task. Of these children, six produced at least one distributive response.[75] Only one child (AT, age 5;5) gives no evidence of having a bound distributive interpretation of pronouns available.[76]

5.2.3 Tests of Quantification[77]

Part 2 included six fillers which tested whether subjects recognized the quantifiers **every** and **all** as having universal force. Six questions required acceptance (i.e., the picture showed three out of three animals performing some action on a fourth animal), while six questions required rejection (i.e., the picture showed only two out of the three animals performing some action on the fourth animal). Half of

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[75]Three children (KB, CQ, and TO) produced singular responses with **their** in answer to both the question with **all** and the question with **every**. JE produced "their tail" in response to the question with **every**, and did not respond to the question with **all** (and so is not included in (15)). ET responded with "their nose" to the **every** question and "their tails" in response to the **all** question. Finally, AL produced singular responses with **his** in answer to both the question with **all** and the question with **every**.

[76]AT produced a response without pronouns. For the question with **every**, AT responded with "Nose"; for the question with **all**, AT responded with "Tails".

[77]This section does not include discussion of quantification in the one-to-one mapping situation, which will be discussed in section **5.2.5**, or discussion of quantifier spreading, which will be discussed in section **5.2.6**.

these questions tested **every** and half tested **all**, with the verbs **spray**, **brush**, and **tickle**.

All of the adults performed perfectly on these questions. However, as mentioned previously, four children were excluded from Parts 2 and 3 because of their performance on these quantifier fillers. In order to do significantly better than chance on these fillers, children had to be correct on more than 8 out of 12 tokens. All children performed perfectly on the six questions that required acceptance, but for the six questions that required rejection, the four excluded children rejected none or only one. Of the remaining thirty children, eighteen (60%) correctly rejected all six, six (20%) correctly rejected five out of six, five (17%) correctly rejected four out of six, and one (3%) correctly rejected three out of six.

Part 3 included additional tests of quantifiers, testing quantifiers in both subject and object positions. The picture for Q8, Q9, and Q10 showed three mice and a giraffe; all of the mice were tickling the giraffe. Q8 ("Did every mouse tickle the giraffe?"), Q9 ("Did all the mice tickle the giraffe?"), and Q10 ("Did the mice tickle the giraffe?") were all correctly accepted by 100% of adults and children.

The picture for Q11, Q12, and Q13 showed three parrots and an elephant, but only 2 of the 3 parrots brushed the elephant. Results with **every**, **all**, and the plural are shown in (16).[78]

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[78]The three children who incorrectly accepted Q11 (with **every**) were AE, KY and KL. The two children who incorrectly accepted Q12 (with **all**) were AE and KY. In Part 2, AE had correctly rejected 2/3 of similar sentences with **every** and 2/3 of similar sentences with **all**; KY had (continued...)

(16) Rejection of Q11, Q12 and Q13-- Subject Position

	children		adults	
Q11 **every**	21/24	87%	22/22	100%
Q12 **all**	22/24	92%	22/22	100%
Q13 **the**	7/22	32%	5/22	23%

Q13 showed that the definite plural (in this case, **the parrots**) in subject position was taken as having the force of a universal quantifier like **every** or **all** by about a quarter of the adults and about a third of the children.[29] [30]

The picture for Q14, Q15, and Q16 showed one monkey and three bears; the monkey was spraying the three bears. Q14 ("Did the monkey spray every bear?"), Q15 ("Did the monkey spray all the bears?"), and Q16 ("Did the monkey spray the bears?") were all correctly accepted by 100% of adults and children.

The picture for Q17, Q18, and Q19 showed one bear and three baby tigers, but the bear sprayed only 2 of the 3 baby tigers. Results with **every**, **all**, and the definite plural are shown in (17).[31]

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[28](...continued)
correctly rejected 3/3 similar sentences with **every** and 2/3 similar sentences with **all**; KL had correctly rejected 3/3 similar sentences with **every** (but had incorrectly accepted 2/3 of the sentences with **all**).

[29]Both the children and the adults who rejected Q13 gave similar explanations; "not all" or "only some" of the parrots brushed the elephant.

[30]A Chi-square test on a comparison of child and adult responses to Q13 was not significant: Chi-square =.458, df=1, p=.498.

[31]The one child who incorrectly accepted Q17 (with **every**) was RR. The one child who incorrectly accepted Q18 (with **all**) was AE.

(17) Rejection of Q17, Q18 and Q19-- Object Position

	children		adults	
Q17 **every**	23/24	96%	22/22	100%
Q18 **all**	22/23	96%	22/22	100%
Q19 **the**	10/23	43%	7/22	32%

Like Q13, Q19 showed that the definite plural (in this case, **the baby tigers**) in object position was taken as having the force of a universal quantifier by about a third of adults and children.[32] [33]

5.2.4 Bound Distributive Interpretation of Pronouns

There were several tests of pronoun use in both Part 2 and Part 3. Individual results and results of t-tests on child and adult acceptance are summarized in **Appendix I**. The simplest cases are simple sentences with **him**. In addition, there were several other items with pronouns. There were three types of sentence-picture pairs for each of three antecedent types. The antecedent types were **every X** (e.g. **every bear**), **all the Xs** (e.g. **all the bears**), and **the Xs** (e.g. **the bears**). There were two picture types: one with a distributive action (e.g., three bears, each bear spraying himself), and one with a collective action (e.g., three bears, together spraying themselves as a group). The distributive picture was shown with sentences with **him** and with sentences with **them**.

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[32]As with Q13, the children and the adults who rejected Q19 gave similar explanations; "not all" or "only some" of the baby tigers were sprayed by the bear.

[33]A Chi-square test on a comparison of child and adult responses to Q19 was not significant: Chi-square =.650, df=1, p=.420.

5.2.4.1 Simple Sentences with Him (or He)

The simplest cases to start with are the simple sentences with **him** (e.g. "Did the bear spray him?", with a picture showing a bear spraying himself). From Part 2 and Part 3, there was a total of four tokens of this type (the three tokens of item 6 plus Q6). These were incorrectly accepted by children significantly more often than by adults (37% vs. 6% overall acceptance).

Of the eleven children who correctly rejected Q6 in Part 3, five used the reflexive **himself** in their answer to "Why not?", and another two used **his self**. In addition, one child who incorrectly accepted Q6, CZ (age 5;11), also used the reflexive in her response, shown in (18).

(18) CZ's response to Q6
Did the elephant brush him?
CZ: Yes, he brushed himself.

There was a total of four tokens of items which tested simple sentences with **him** with a nonreflexive picture (the three tokens of item 5 plus Q2).[34] For example, for Q2 ("Did the bear spray him?") the picture showed a bear spraying a baby tiger. These were incorrectly rejected by adults 1% of the time, and by children 17% of the time. The reasons given for rejecting Q2 are shown in (19).[35]

(19) Reasons for Rejecting Q2

[picture shows a bear spraying a baby tiger]

Did the bear spray him? Response: No.
AM (5;1) **Because he was spraying the baby tiger.**
EW (5;4) **Because it's not facing to the bear.**

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[34]Individual subject data and statistical results for this sentence type are given in **Appendix I**.

[35]Subjects' ages are given in parentheses after their identifying initials; adult subjects are labeled with "AD".

KY (5;7) **Um, the bear actually sprayed the baby tiger.**
AG (5;11) **The bear sprayed the baby tiger.**
KL (6;1) **'Cause he didn't wanna get wet.**
E: Who didn't want to get wet?
C: **The bear.**
JE (6;3) **The bear sprayed the baby tiger.**
TO (7;7) **Because he's not spraying himself.**

JR (AD) **'Cause the bear's holding the hose, and he's spraying the tiger.**

Some of these responses, particularly those of KY and TO, strongly suggest that some of these children may have expected the pronoun to get its reference within the sentence.[*]

The same seems to be true for Q3, "Did he spray the baby tiger?" (with a picture showing a bear spraying a baby tiger), which was accepted by 100% of adults and 92% of children. The reasons given by the two children who rejected Q3 are shown in (20).

(20) Reasons for Rejecting Q3

[picture shows a bear spraying a baby tiger]

Did he spray the baby tiger? Response: No.
CA (6;1) **Because the bear's holding the hose and he's not.**
RR (6;11) **Because he ain't holding the hose.**

These responses to questions with subject pronouns may seem unusual. One aspect of the experimental design may help to account for them. Recall the discussion of the context-setting sentence and Foster-Cohen's arguments about redundancy and relevance in section 4.2.3. Context-setting sentences were used in this study, and were in fact designed to fit most naturally with questions with object pronouns. For this picture, the context-setting sentence was, "Here is a bear and here is a

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[*]However, when a sentence such as "Did the bear spray him?" was asked with a picture showing the bear spraying himself, KY performed at chance, and TO performed significantly better than chance. See section 5.2.4.5.

baby tiger." Since **baby tiger** is in the prominent last position, it is most likely that the pronoun here would be taken to refer to the baby tiger. When asked, "Did the bear spray him?", both CA and RR answered "yes", taking **him** to refer to the baby tiger. Similarly, when asked, "Did he spray the baby tiger?", these two subjects seem to have taken **he** to refer to the baby tiger, and thus rejected the sentence.[37]

5.2.4.2 <u>Every</u> as antecedent

Item 10 and Q35 tested the distributive interpretation of **every X** with **him** (e.g., "Did every bear spray him?", where each bear sprayed himself). Children incorrectly accepted this sentence type significantly more often than adults (40% vs. 11% overall acceptance).[38] This result differs from previous findings (e.g. Chien & Wexler, 1988, 1990, discussed in section 2.2.1.1 above) that children rejected a sentence such as "Did every bear spray him?" with a locally coreferent (or reflexive) interpretation more often than a sentence such as "Did the bear spray him?" with a locally coreferent interpretation. Note, however, that in previous tests of such sentences with **every**, the

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[37]Since in Part 3 several questions were asked for each picture, it may not be the context-setting sentence that was relevant here, but the previous question. For both CA and RR, the previous question was Q1, "Did the bear spray the baby tiger?"; thus **baby tiger** was the last mentioned NP. Also, CA and RR may have expected **he** to refer to the baby tiger in order to distinguish Q3 from Q1. Finally, further evidence that these children were expecting **he** to refer to the baby tiger comes from their very similar reasons for rejecting Q4, "Did the baby tiger spray the bear?":

CA: **Because the bear has the hose and he doesn't.**
RR: **Because the baby tiger ain't holding the, the hose.**

[38]Individual subject data and statistical results for this section are given in **Appendix I**.

picture showed one extra character. Here, as with the picture for the sentence, "Did every bear spray them?", the picture showed three characters not being sprayed. On the adult interpretation, then, there was no possible referent for the pronoun **him**.

Item 11 and Q36 tested the distributive interpretation of **every X** with **them** (e.g., "Did every bear spray them?", where each bear sprayed himself). Children incorrectly accepted this sentence type significantly more often than adults (40% vs. 5% overall acceptance).

Item 12 tested the collective interpretation of **every X** with **them** (e.g., "Did every bear spray them?", where the bears together sprayed themselves as a group). Children incorrectly accepted this sentence type significantly more often than adults (39% vs. 6% overall acceptance).

5.2.4.3 <u>All</u> as antecedent

Item 13 and Q37 tested the distributive interpretation of **all the Xs** with **him** (e.g., "Did all the bears spray him?", where each bear sprayed himself). Children incorrectly accepted this sentence type significantly more often than adults (40% vs. 7% overall acceptance).[9]

Item 14 and Q40 tested the distributive interpretation of **all the Xs** with **them** (e.g., "Did all the bears spray them?", where each bear sprayed himself). Children incorrectly accepted this sentence type significantly more often than adults (42% vs. 9% overall acceptance).

Item 15 tested the collective interpretation of **all the Xs** with

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[9]Individual subject data and statistical results for this section are given in **Appendix I**.

them (e.g., "Did all the bears spray them?", where the bears together sprayed themselves as a group). Children incorrectly accepted this sentence type significantly more often than adults (38% vs. 6% overall acceptance).

5.2.4.4 Plural definite antecedents

Item 21 and Q38 tested the distributive interpretation of **the Xs** with **him** (e.g., "Did the bears spray him?", where each bear sprayed himself). Children incorrectly accepted this sentence type significantly more often than adults (37% vs. 2% overall acceptance).[40]

Item 22 and Q39 tested the distributive interpretation of **the Xs** with **them** (e.g., "Did the bears spray them?", where each bear sprayed himself). Children incorrectly accepted this sentence type significantly more often than adults (42% vs. 2% overall acceptance).

Finally, item 23 tested the collective interpretation of **the Xs** with **them** (e.g., "Did the bears spray them?", where the bears together sprayed themselves as a group). Children incorrectly accepted this sentence type significantly more often than adults (39% vs. 5% overall acceptance).

5.2.4.5 Summary

These results are summarized in (21).[41]

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[40]Individual subject data and statistical results for this section are given in **Appendix I**.

[41]Individual subject data and statistical results for this section are given in **Appendix I**.

(21) Overall Child & Adult Incorrect Acceptance of Pronoun Items

	children		adults	
local **him** (item 6/Q6)	42/114	37%	5/88	6% **
every-him (item 10/Q35)	46/114	40%	10/88	11% *
every-them (dist.)(item 11/Q36)	46/114	40%	4/88	5% **
every-them (coll.)(item 12)	35/90	39%	4/66	6% **
all-him (item 13/Q37)	46/114	40%	6/88	7% **
all-them (dist.)(item 14/Q40)	48/114	42%	8/88	9% **
all-them (coll.)(item 15)	34/90	38%	4/66	6% **
Xs-him (item 21/Q38)	42/114	37%	2/88	2% **
Xs-them (dist.)(item 22/Q39)	48/114	42%	2/88	2% **
Xs-them (coll.)(item 23)	35/90	39%	3/66	5% **

significant at * $p<.005$ ** $p<.001$

It has been suggested in the literature (e.g., Avrutin & Thornton, 1993, 1994, discussed in section 2.2.2.2 above) that children may accept cases such as item 6/Q6, and collective interpretations as in items 12, 15, and 23, but will not accept bound distributive cases. However, this does not seem to be the case. (22) shows overall acceptance by pronoun and by antecedent type.

(22) Children's Overall Acceptance by Pronoun and by Antecedent Type

antecedent / interpretation	**every**	**all**	plural
him-dist.	40%	40%	37%
them-dist.	40%	42%	42%
them-coll.	39%	38%	39%

A univariate MANOVA of these responses was not significant. There were two main effects, antecedent type (**every**, **all**, or plural) and pronoun type (distributive **him**, distributive **them**, and collective **them**), neither of which was significant. However, when age was included as a covariate, there was a significant effect of age.[42]

More revealing are the patterns of acceptance by individual adults and children. Combining the results from Part 2 and Part 3 allows us to examine individual subjects' performance on different questions and compare that performance to chance. Here I will examine the performance of children who correctly reject pronoun sentences significantly more often than chance (at the .05 level), children who perform at chance, and children who incorrectly accept pronoun sentences significantly more often than chance (at the .05 level).[43]

These results are summarized, by subject, in (23) and (24). Performance is listed as better than chance at the .05 level, at chance, or by the percentage of incorrect acceptance when performance was significantly worse than chance.

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[42]For antecedent type, $F(2,261) = .11$, $p = .894$. For pronoun type, $F(2,261) = .28$, $p = .759$. For the interaction of antecedent type by possessive type, $F(4,261) = .13$, $p = .971$.

With age as a continuous covariate, $F(1,260) = 7.45$, $p < .01$ for age. For antecedent type, $F(2,260) = .12$, $p = .891$. For pronoun type, $F(2,260) = .28$, $p = .754$. For the interaction of antecedent type by possessive type, $F(4,260) = .13$, $p = .970$.

For both of these analyses, only the results from Part 2 were included, to avoid unequal numbers of tokens (since collective **them** was not included in Part 3).

[43]Both the children who perform at chance and the children who perform significantly worse than chance are children who do not obey Principle B of the binding theory.

(23) Adult Performance on Pronoun Sentences Compared to Chance

adult	simple **him**	coll. **them**	simple **him** +coll. **them**	dist. **them**	dist. **him**	dist. **him** + dist. **them**
DU	>.05	>.05	>.05	>.05	>.05	>.05
BC	>.05	>.05	>.05	>.05	>.05	>.05
KK	chance	chance	chance	>.05	>.05	>.05
KP	>.05	>.05	>.05	>.05	>.05	>.05
AM	>.05	>.05	>.05	>.05	>.05	>.05
RM	>.05	>.05	>.05	>.05	>.05	>.05
SG	>.05	>.05	>.05	>.05	>.05	>.05
HL	>.05	>.05	>.05	>.05	>.05	>.05
XG	chance	chance	chance	chance	chance	chance
JR	>.05	>.05	>.05	>.05	>.05	>.05
DY	>.05	>.05	>.05	>.05	>.05	>.05
MP	>.05	>.05	>.05	>.05	>.05	>.05
JG	>.05	>.05	>.05	>.05	>.05	>.05
MB	>.05	>.05	>.05	>.05	>.05	>.05
JC	>.05	>.05	>.05	>.05	>.05	>.05
BY	>.05	>.05	>.05	>.05	>.05	>.05
CC	>.05	>.05	>.05	>.05	chance	>.05
PK	>.05	>.05	>.05	>.05	>.05	>.05
RL	>.05	>.05	>.05	>.05	>.05	>.05
PX	>.05	>.05	>.05	>.05	>.05	>.05
MR	>.05	>.05	>.05	>.05	>.05	>.05
DD	>.05	>.05	>.05	>.05	>.05	>.05

(24) Child Performance on Pronoun Sentences Compared to Chance

child	simple **him**	coll. **them**	simple **him** +coll. **them**	dist. **them**	dist. **him**	dist. **him** + dist. **them**
ET	>.05	>.05	>.05	>.05	>.05	>.05
AE	chance	chance	chance	chance	>.05	chance
AM	chance	chance	chance	>.05	chance	>.05
AL	>.05	chance	>.05	>.05	>.05	>.05
EW	chance	chance	chance	**67%**	**67%**	chance
TM	chance	chance	chance	chance	chance	chance
AT	>.05	chance	chance	chance	**67%**	chance
KV	>.05	>.05	>.05	>.05	>.05	>.05
KY	chance	chance	chance	**67%**	chance	chance
CZ	chance	chance	chance	**75%**	**83%**	**79%**
EB	chance	chance	>.05	>.05	>.05	>.05
AG	chance	**100%**	**92%**	**92%**	**75%**	**83%**
JG	**100%**	chance	**85%**	**83%**	**92%**	**88%**
KL	**100%**	chance	**77%**	**75%**	**75%**	**75%**
CS	chance	chance	>.05	>.05	chance	chance
MT	>.05	chance	>.05	>.05	>.05	>.05
CA	chance	**100%**	**92%**	**100%**	**92%**	**96%**

-continued-

child	simple **him**	coll. **them**	simple **him** +coll. **them**	dist. **them**	dist. **him**	dist. **him** + dist. **them**
JE	>.05	>.05	>.05	>.05	>.05	>.05
CM	chance	chance	chance	>.05	>.05	>.05
VN	chance	chance	chance	>.05	**75%**	chance
KB	>.05	>.05	>.05	>.05	>.05	>.05
EC	>.05	>.05	>.05	>.05	>.05	>.05
RR	chance	chance	**77%**	**83%**	**83%**	**83%**
CQ	>.05	>.05	>.05	>.05	>.05	>.05
BH	chance	chance	chance	**92%**	**75%**	**83%**
MM	chance	>.05	chance	**67%**	>.05	chance
JF	chance	>.05	>.05	>.05	>.05	>.05
TO	>.05	>.05	>.05	>.05	>.05	>.05
JS	chance	chance	>.05	>.05	>.05	>.05
JR	chance	chance	>.05	>.05	>.05	>.05

The simplest cases to start with are the simple sentences with **him** (e.g. "Did the bear spray him?", with a picture showing a bear spraying himself). From Part 2 and Part 3, there was a total of four tokens of this type (the three tokens of item 6 plus Q6). To be worse than at chance at accepting this sentence type, subjects had to incorrectly accept all four tokens. Two out of the thirty child subjects (7%) did so. These children were JG (age 5;11) and KL (age 6;0).

The next cases to consider are the bound collective interpretations of **them** (e.g., "Did every bear spray them?", where the bears together sprayed themselves as a group). There were nine tokens of this type, all in Part 2 (three tokens each of item 12, item 15, and item 23). To be worse than at chance at accepting this sentence type, subjects had to incorrectly accept at least eight out of nine tokens. Again, two out of thirty children (7%) did so. These children were AG (age 5;11) and CA (age 6;1).

These two cases are similar, since accepting them has been attributed to the lack of the pragmatic Principle P or Rule I.

Combining these two groups, we have a set of thirteen tokens. To be significantly worse than at chance on this set, subjects had to incorrectly accept at least ten out of the thirteen tokens. Five children (17%) accepted ten or more of these tokens. These children were JG, KL, AG, CA, and RR (age 6;11).

The more interesting cases are the bound distributive cases with either **him** or **them** (e.g., "Did every bear spray him?" or "Did every bear spray them?", where each bear sprayed himself). There was a total of twelve cases of tokens with **him** (three tokens each of item 10, item 13, and item 21, plus Q35, Q37, and Q38) and twelve cases of tokens with **them** (three tokens each for item 11, item 14, and item 22, plus Q36, Q39, and Q40). To be significantly worse than at chance in these cases, subjects had to incorrectly accept at least eight out of the twelve tokens. Ten children (33%) accepted eight or more tokens with **him**.[44] Ten children (33%) also accepted eight or more tokens with **them**.[45]

If we combine these two bound distributive cases, we have a total of twenty-four tokens. To be significantly worse than at chance for this set, subjects had to incorrectly accept at least seventeen out of the twenty-four tokens. Seven children (23%) accepted more than seventeen tokens of bound distributive sentences.[46]

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[44]The ten children who accepted bound distributive **him** significantly more than chance were EW (5;4), AT (5;5), CZ (5;10), AG (5;11), JG (5;11), KL (6;0), CA (6;1), VN (6;7), RR (6;11), and BH (7;0).

[45]The ten children who accepted bound distributive **them** significantly more than chance were EW (5;4), KY (5;7), CZ (5;10), AG (5;11), JG (5;11), KL (6;0), CA (6;1), RR (6;11), BH (7;0) and MM (7;1).

[46]These children were CZ, AG, JG, KL, CA, RR, and BH. The other four children who accepted the bound distributive with **him** (AT and VN) or the (continued...)

We can also look at when children did significantly better than chance. Seven children (23%) did significantly better than chance on all of the measures discussed above. Nineteen adults did significantly better than chance on all of these measures; the three remaining adults were KK, XG, and CC. CC was at chance for bound distributive cases with **him**; KK was at chance for simple sentences with **him**, collective sentences with **them**, and the combination of those two sentence types; XG was at chance for all of these measures.

There were various patterns of acceptance for individual children. For example, VN accepted bound distributed cases with **him** but rejected those with **them**; in addition, she performed at chance on the collective cases. MM, on the other hand, accepted the bound distributed cases with **them**, but rejected those with **him**, and rejected the collective cases.

(24) is repeated here as (25), with just the children's results for simple **him** + collective **them** (the coreference cases) and the results for distributive **him** + distributive **them**.

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[4](...continued)
bound distributive with **them** (MM), or both (EW) were counted as performing at chance for this combined category.

(25) Child Performance on Pronoun Sentences Compared to Chance

child	age[47]	simple **him** +coll. **them**	dist. **him** + dist. **them**
ET	3;4	>.05	>.05
AE	3;9	chance	chance
AM	5;1	chance	>.05
AL	5;4	>.05	>.05
EW	5;4	chance	chance
TM	5;5	chance	chance
AT	5;5	chance	chance
KV	5;7	>.05	>.05
KY	5;7	chance	chance
CZ	5;10	chance	**79%**
EB	5;11	>.05	>.05
AG	5;11	**92%**	**83%**
JG	5;11	**85%**	**88%**
KL	6;0	**77%**	**75%**
CS	6;1	>.05	chance
MT	6;1	>.05	>.05
CA	6;1	**92%**	**96%**
JE	6;3	>.05	>.05
CM	6;5	chance	>.05
VN	6;7	chance	chance
KB	6;9	>.05	>.05
EC	6;10	>.05	>.05
RR	6;11	**77%**	**83%**
CQ	7;0	>.05	>.05
BH	7;0	chance	**83%**
MM	7;1	chance	chance
JF	7;3	>.05	>.05
TO	7;7	>.05	>.05
JS	7;9	>.05	>.05
JR	9;5	>.05	>.05

Two children, AM and CM, performed at chance on the coreference cases but performed significantly better than chance on the distributive cases; these two children perform as predicted by the reformulated binding theory. However, three children performed worse on the distributive cases than on the coreference cases. CS performed significantly better than at chance on the coreference cases, but at

[47]Age at the time of Part 2.

chance on the distributive cases, and CZ and BH both performed at chance on the coreference cases and significantly worse than chance on the distributive cases. All of the other children performed at the same level for the coreference and the distributive cases.

5.2.5 One-to-one Mapping of Subjects and Objects

Some of the pictures in Part 2 and Part 3 showed a one-to-one mapping of subjects and objects. The questions for these pictures were interesting both because they allowed the investigation of different ways of expressing this distributive interpretation and also for comparison with the quantifier spreading contexts. Sentences contrasted singular with plural pronouns, and plural noun phrases with expressions with **every**. In this section I will discuss the one-to-one mapping with sentences with object pronouns, subject pronouns, indefinites, and two universal pronouns.

5.2.5.1 Object Pronouns

Two sentence types tested singular and plural object pronouns with a one-to-one mapping of subjects and objects. There was a total of four sentences such as "Did the bears spray them?", where the picture showed three bears, each spraying a different baby tiger (three tokens of item 19 plus Q21). These were accepted significantly more often by adults than by children (95% vs. 84% overall acceptance).[48]

It could be argued that acceptance of this sentence was evidence

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[48]Individual subject data and statistical results for this section are given in **Appendix J**.

that subjects were giving this picture a collective interpretation, since it was not true that each bear sprayed "them" (the baby tigers), but that each bear sprayed one baby tiger. However, as we have seen with possessive pronouns (see section **5.2.2.2**), pronominal number and the distributive/collective interpretation are not closely linked. However, this can be seen as the reason for some adults' rejection of this sentence type (i.e., KP and SG). In Part 3, the reasons shown in (26) were given for rejecting Q21 ("Did the mice wash them?").

(26) Reasons for Rejecting Q21

[picture showed three mice, each one washing a different giraffe]

Did the mice wash them?   Response: No.
KY (5;7) **They washed the giraffes.**
CZ (5;11) **Because, um, the giraffes were there first.**
AG (5;11) **The mice washed the giraffe.**
KL (6;1) **He washed the giraffe.**
CS (6;2) **'Cause they're holding it like this.**
JE (6;3) **The mice washed the giraffes.**

KP (AD) Did the mice wash them?
KP: Did the mouse?
E: Did the mice wash them?
KP: **No.**
E: Why not?
S: **Each mouse is washing one giraffe.**
SG (AD) **Because there are, every mouse is just washing one giraffe.**
JR (AD) **Um, you don't know who "them" is, so, no.**

One unanticipated problem with this question was the irregular plural **mice**. Both AG and KL seemed to reject Q21 because they thought that **mice** was singular, and as a result used the singular **the giraffe** in their responses (cf. JE, who used **the giraffes**). Some of the other answers (e.g., KY), however, suggest that some of the children may have interpreted **them** as referring to **the mice**.[49]

More interestingly, several children accepted an identical picture type with sentences such as "Did the bears spray him?" (the picture showed three bears, each spraying a different baby tiger). There were four tokens of this sentence type (three tokens of item 20 plus Q20). Children accepted these significantly more often than adults (48% vs. 10% overall acceptance).[50] This is what I will refer to as the unbound distributive interpretation of **him**.

One problem with this item was that there was no possible referent for **him** in the picture-- no single animal that might have been sprayed, but wasn't. However, it is tempting to attribute acceptance of this item to children's interpretation of **him** as a variable. This item can be compared with Q52 (discussed in section 5.2.6 below), which did have a possible referent for **him**.

We can compare the same sentences (e.g., "Did the bears spray them?" and "Did the bears spray him?") with different interpretations. Item 22/Q39 and item 21/Q38 tested these sentences with a bound distributive interpretation (i.e., each bear sprayed himself) while item 19/Q21 and item 20/Q20 tested them with an outside distributive interpretation (i.e., each bear sprayed a different tiger). These results are summarized in (27) and (28).

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[49]Note that KY was one of the children who performed significantly worse than at chance for sentences with bound distributive **them**.

[50]Individual subject data and statistical results for this section are given in **Appendix J**.

(27) Overall Acceptance of Inside and Outside Distributive Interpretations by Adults[51]

	them	**him**
outside interpretation	95%	10%
inside (bound) interpretation	2%	2%

(28) Overall Acceptance of Inside and Outside Distributive Interpretations by Children[52]

	them	**him**
outside interpretation	84%	48%
inside (bound) interpretation	42%	37%

Q26 and Q27 were similar to Q21 and Q20, but contained **every**. Q26 ("Did every bear spray them?") was accepted by 77% of adults (17/22) and 79% of children (19/24).[53] Reasons for rejecting Q26 are given in (29).

(29) Reasons for Rejecting Q26

[picture showed three bears, each spraying a different baby tiger]
Did every bear spray them? Response: No.

KY (5;7)	**'Cause they're spraying the baby tigers.**
CZ (5;11)	**Because the, um, baby tigers wanted to get sprayed.**
KL (6;1)	**'Cause they didn't wanna get wet.** E: Who didn't want to get wet? KL: **The bears.**
CA (6;1)	**Because the bear holding the thing and, um, they're spraying the tiger.**
CS (6;2)	**Because he's not spraying himself.**
KK (AD)	**Every bear sprayed him.**

[51]For figures and significance, see (30).

[52]For figures and significance, see (30).

[53]A Chi-square test comparing adult and child responses to Q26 was not significant: Chi-square =.024, df=1, p=.876.

KP (AD)	**They're spraying separate baby tigers.**
JR (AD)	**'Cause you don't know who "them" is.**
PK (AD)	**Is that-- (-) you said, "Did every bear spray them?", so they would have to be spraying all the bears together.**
PX (AD)	**Every bear sprayed their own (tiger).**

Several of the children's reasons for rejecting Q26 again suggest that they interpreted **them** as referring to **the bears**[54] (and CA and CS have some additional confusion with the number); most of the adult reasons for rejecting Q26 suggest that these adults require an obligatory wide scope interpretation for **every** in this example.

Q27 ("Did every bear spray him?") was accepted by only 14% of adults (3/22), but was accepted by 67% of children (16/24). A Chi-square test comparing adult and child responses to Q27 was highly significant.[55]

These results are summarized in (30). Recall that the picture in each of these cases showed a one-to-one mapping of subjects and objects.

(30) Overall Child and Adult Acceptance of item 19/Q21, item 20/Q20, Q26, Q27

	children		adults	
item 19/Q21 **the mice-them**	95/113	84%	84/88	95% *
item 20/Q20 **the mice-him**	54/113	48%	9/88	10% **
Q26 **every bear-them**	19/24	79%	17/22	77%
Q27 **every bear-him**	16/24	67%	3/22	14% ***

significant at * p<.05 **p<.001 *** p<.0005

Almost half (48%) of these children accepted this unbound distributive interpretation with **him** with a plural definite NP subject, and more than half (67%) accepted the unbound distributive

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[54]The answers given by KY, CZ and KL all suggest that they interpreted **them** as referring to **the bears**; all three of these children were significantly worse than at chance on the bound distributive cases with **them**.

[55]Chi-square = 13.314, df=1, p<.0005.

interpretation with **him** with **every bear** as subject.

5.2.5.2 Subject Pronouns

While the items described in the previous section tested object pronouns, Q23, Q24, Q31 and Q32 tested subject pronouns with the same picture type (showing a one-to-one mapping of subjects and objects). Q24 ("Did they wash the giraffes?") was accepted by 96% of the children and 91% of the adults. In contrast, Q23 ("Did he wash the giraffes?") was accepted by 57% of children and 5% of adults. A Chi-square test comparing child and adult responses to Q23 was significant.[56] Of the children who accepted Q23, three (AE, KY, and RR) had failed the subject pronoun section of the number pretest, and so may not have known the difference between **they** and **he**. However, the other ten children (43% of the total number of children responding to this question) had all passed the subject pronoun section of the number pretest.

Q31 and Q32 were similar to Q24 and Q23, but contained **every**. Q31 ("Did they brush every tiger?") was accepted by 100% of the children and 73% of the adults. A Chi-square test comparing child and adult responses to Q31 was significant.[57] Q32 ("Did he brush every tiger?") was accepted by 59% of the children but only 9% of the adults. A Chi-square test comparing child and adult responses to Q32 was also significant.[58]

Of the six adults who rejected Q31 ("Did they brush every

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[56]Chi-square = 14.174, df=1, $p<.0005$.

[57]Chi-square = 6.947, df=1, $p<.01$.

[58]Chi-square = 12.239, df=1, $p<.0005$.

tiger?"), two said they rejected it because they didn't know who **they** referred to. However, the other four gave more interesting reasons for their rejections, as shown in (31).

(31) Reasons for Rejecting Q31

[picture showed three elephants, each brushing a different tiger]

Did they brush every tiger? Response: No.
DU (AD) **They did not brush every tiger. No.**
E: Ok. Why not?
DU: **Because he only brushed one, and he only brushed one, and he only brushed one.**
MP (AD) **Each elephant brushed a tiger.**
PK (AD) **Because, um, they're only brushing one of the tigers.**
DD (AD) **Each elephant brushed a tiger.**

As in (29) (Q26, "Did every bear spray them?"), these adults seem to require wide scope for **every** in this example, but aren't satisfied that this can be expressed with the plural pronoun **they**.

These results with subject pronouns are summarized in (32). Recall that the picture in each of these cases also showed a one-to-one mapping of subjects and objects.

(32) Child & Adult Acceptance of Q24, Q23, Q31, Q32

	children		adults		
Q24 **they-the giraffes**	22/23	96%	20/22	91%	
Q23 **he-the giraffes**	13/23	57%	1/22	5%	***
Q31 **they-every tiger**	22/22	100%	16/22	73%	*
Q32 **he-every tiger**	13/22	59%	2/22	9%	***

significant at * p<.01 *** p<.0005

As with the object pronouns discussed in the previous section, several children accepted an unbound distributive interpretation of the subject pronoun **he**. More than half (57%) of the children accepted **he** with the plural definite NP object, and more than half (59%) accepted **he** with **every tiger** as object.

5.2.5.3 Sentences with Indefinites

Q25 and Q30 tested sentences with a universal quantifier and an existential quantifier. Q25 ("Did every bear spray a baby tiger?") was accepted by 100% of children and adults. However, when the order of existential and universal was reversed, acceptance was reduced, especially for adults. Q30 ("Did an elephant brush every tiger?") was accepted by 91% of the children, but only 45% of the adults. A Chi-square test comparing child and adult responses to Q30 was significant.[39] Reasons for rejecting Q30 are given in (33).

(33) Reasons for Rejecting Q30

[picture showed three elephants, each brushing a different tiger]

Did an elephant brush every tiger? Response: No.

KV (5;7)	**Because there's three elephant--**
	E: Ok. Elephants?
	KV: **Elephants. There's not just one.**
EB (5;11)	**'Cause there is no elephant. There's three of them.**
DU (AD)	**An elephant only brushed one tiger each.**
KP (AD)	**They're brushing separate tigers.**
AM (AD)	**Each elephant brushed one tiger.**
RM (AD)	**One elephant brushed this tiger, one elephant brushed this tiger, and another elephant brushed that tiger.**
SG (AD)	**There was only, um, each, each, each elephant is only brushing one tiger.**
JR (AD)	**Each elephant only brushes one tiger.**
DY (AD)	**Yes. Um, no. Because there are more than one, there's more than one elephant.**
MP (AD)	**Each elephant brushed a tiger.**
JG (AD)	**An elephant brushed a tiger.**
MB (AD)	**Because an elephant brushed one tiger.**
JC (AD)	**Um, 'cause only one elephant is for one tiger.**
MR (AD)	**Because there's three elephants.**

There are two different kinds of errors shown here. The children's

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[39]Chi-square = 10.476, df=1, p<.005.

responses suggest that they are taking **an elephant** as referential or specific. The adults, on the other hand, are rejecting the **a/every** sentence with this distributive interpretation; they seem to be requiring **an elephant** to take wide scope over **every tiger** (for a collective interpretation) , and so reject this sentence for this picture. This agrees with the findings of Kurtzman & MacDonald (1993), who studied adult scope preferences; they found that there is a general preference for the interpretation in which the leftward quantified phrase has wide scope, and found this preference to be even stronger with the **a/every** order.

Q34 and Q22 repeated Q25 and Q30, except that instead of the universal quantifier **every** they contained plural definite NPs. Q34 ("Did the elephants brush a tiger?") was accepted by 91% of the children and 71% of adults.[60] Q22 ("Did a mouse wash the giraffes?") was accepted by 65% of the children and by 18% of the adults. A Chi-square test comparing child and adult responses to Q22 was significant.[61]

Another case in which child acceptance was greater than adult acceptance was Q33, "Did the elephants brush the tigers?". This was accepted by 100% of the children, but only 86% of the adults.[62]

These results are summarized in (34).

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[60]A Chi-square test comparing child and adult responses to Q34 was not significant: Chi-square = 2.692, df=1, p=.101.

[61]Chi-square = 10.197, df=1, p<.005.

[62]However, a Chi-square test comparing child and adult responses to Q33 was not significant: Chi-square = 3.220, df=1, p=.073.

(34) Child & Adult Acceptance of Q25, Q30, Q34, Q22 and Q33

	children		adults		
Q25 **every/a**	24/24	100%	22/22	100%	
Q30 **a/every**	20/22	91%	10/22	45%	**
Q34 **the/a**	20/22	91%	15/21	71%	
Q22 **a/the**	15/23	65%	4/22	18%	**
Q33 **the/the**	22/22	100%	19/22	86%	

significant at * p<.01 ** p<.005

5.2.5.4 Sentences with Two Universal Quantifiers

Finally, two questions tested sentences with two universal quantifiers. The usual adult interpretation for Q28 ("Did every bear spray every baby tiger?") and Q29 ("Did all the bears spray all the baby tigers?") would require a double distribution of bears and tigers, so that each of three bears sprayed each of three tigers (for a total of nine bear-tiger sprayings). For Q28 and Q29, however, subjects and objects were in a one-to-one mapping; there were three bears, each spraying a different baby tiger (for a total of three baby tigers). 100% of the children accepted Q28 and Q29. For adults, 50% accepted Q28 and 36% accepted Q29. Chi-square tests comparing child and adult responses to Q28 and Q29 were both highly significant.[63]

The results for sentences with two universal quantifiers are summarized in (35).

[63]For Q28, Chi-square = 15.771, df=1, p<.0001.
For Q29, Chi-square = 21.955, df=1, p<.00001.

(35) Child & Adult Acceptance of Q28 and Q29

	children		adults		
Q28 **every/every**	24/24	100%	11/22	50%	**
Q29 **all/all**	24/24	100%	8/22	36%	***

significant at ** p<.0001 *** p<.00001

A Chi-square test comparing adult acceptance of Q28 and Q29 was significant[44]; for these subjects, **every** permitted this kind of interpretation more readily than **all** did.

5.2.6 Quantifier Spreading

Four of the fillers in Part 2 were meant to test quantifier spreading, but the yes/no answers to these questions alone are not sufficient to show quantifier spreading. There were four of these questions, two testing **every** and two testing **all**, using the verbs **brush** and **tickle**. For example, the question, "Did every parrot brush an elephant?" went with a picture showing two parrots, each brushing a different elephant, plus an "extra" parrot. The expected adult response to this was yes. Actual results are summarized in (36).

(36) Acceptance of Spreading Fillers

	4/4	3/4	2/4	1/4	0/4
adults	12 (54%)	5 (23%)	0	2 (9%)	3 (14%)
children	3 (10%)	6 (20%)	3 (10%)	4 (13%)	14 (47%)

Overall, adults accepted 74% of the spreading fillers, while children accepted 33% of them. While we can see that these spreading fillers were frequently rejected by children, and not infrequently by adults, we can't tell the cause of rejection from these questions alone. Only

[44]Chi-square = 12.571, df=1, p<.0005.

by examining the responses to the question "Why not?" in Part 3 (and spontaneous explanations for rejection in Part 2) can we determine which rejections were evidence of spreading.

In section 5.2.6.1 I will discuss the pictures and questions used and the acceptance rates for each type of picture-sentence pair. In section 5.2.6.2 I will describe the classification of responses to the question "Why not?". In section 5.2.6.3 I will focus on **every/a** spreading and **a/every** spreading. Finally, in section 5.2.6.4 I will discuss spreading responses to other kinds of sentences.

5.2.6.1 Acceptance Rates

Two sections of Part 3 tested quantifier spreading. One section (Q41 to Q46) tested **a/every** quantifier spreading, while the other section (Q47 to Q52) tested **every/a** quantifier spreading.[65] I will briefly discuss five of the questions from each section, and then focus on the two most important cases, Q41 and Q47.

There were two pictures for **a/every** spreading. One showed two parrots, each brushing a different elephant, plus an "extra" parrot (a total of three parrots and two elephants). The other showed three mice, each tickling a different giraffe, plus an "extra" mouse (a total of three mice and two giraffes). There were also two pictures for **every/a** spreading. The first showed two parrots, each brushing a different elephant, plus an "extra" elephant (a total of two parrots and three

[65] I am using **a/every** and **every/a** here as shorthand for existential-universal order and universal-existential order. In fact, some sentences had the plural instead of the universal quantifier, and some sentences had pronouns instead of existential quantifiers. I will try to show in section 5.2.6.4 that spreading also occurred with these sentences.

elephants). The second showed two mice, each tickling a different giraffe, plus an "extra" giraffe (a total of two mice and three giraffes).

In addition to sentences with a universal quantifier and an existential quantifier, these sections included sentences with singular and plural pronouns (in the place of the existential quantifier) and plurals (in the place of the universal quantifier).

With the **a/every**-type picture, Q42 ("Did they brush every elephant?") was accepted by 45% of the children and 50% of the adults. Q43 ("Did he brush every elephant?") was accepted by 30% of the children and 14% of the adults. Q44 ("Did a mouse tickle the giraffes?") was accepted by 50% of the children and 23% of the adults. Q45 ("Did they tickle the giraffes?") was accepted by 70% of the children and 45% of the adults. Finally, Q46 ("Did he tickle the giraffes?") was accepted by 38% of the children and 5% of the adults. Chi-square tests comparing child and adult responses to these questions were not significant, except for Q46 (**he/the**), which was accepted significantly more often by children than by adults.[66] The acceptances of Q46 and of Q43 are both examples of the unbound distributive interpretation.

With the **every/a**-type picture, Q48 ("Did every parrot brush them?") was accepted by 57% of the children and 27% of the adults. A Chi-square test comparing child and adult responses to Q48 was

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[66]For Q46, the Chi-square test was significant: Chi-square = 7.327, df=1, $p<.01$.
For Q42, Chi-square = .091, df=1, $p=.763$.
For Q43, Chi-square = 1.836, df=1, $p=.175$.
For Q44, Chi-square = 3.664, df=1, $p=.056$.
For Q45, Chi-square = 2.680, df=1, $p=.102$.

marginally significant.[67] Q49 ("Did every parrot brush him?"), another example of the unbound distributive, was accepted by 36% of the children and 9% of the adults. A Chi-square test comparing child and adult responses to this question was also significant.[68] Q50 ("Did the mice tickle a giraffe?") was accepted by 67% of the children and 77% of the adults. Q51 ("Did the mice tickle them?") was accepted by 77% of the children and 73% of the adults. Finally, Q52 ("Did the mice tickle him?" was accepted by 27% of the children and 9% of the adults. Chi-square tests comparing child and adult responses to these last three questions were not significant.[69]

These results are summarized in (37).

(37) Child & Adult Acceptance of Q42, Q43, Q45, Q46 and Q48, Q49, Q50, Q51

	children		adults	
a/every picture				
Q42 **they/every**	10/22	45%	11/22	50%
Q43 **he/every**	7/22	30%	3/22	14%
Q44 **a/the**	12/24	50%	5/22	23%
Q45 **they/the**	16/23	70%	10/22	45%
Q46 **he/the**	9/24	38%	1/22	5% **
every/a picture				
Q48 **every/them**	13/23	57%	6/22	27% *
Q49 **every/him**	8/22	36%	2/22	9% *
Q50 **the/a**	14/21	67%	17/22	77%
Q51 **the/them**	17/22	77%	16/22	73%
Q52 **the/him**	6/22	27%	2/22	9%

significant at * $p<.05$ ** $p<.01$

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[67] Chi-square = 3.943, df=1, $p<.05$ [p=.047].

[68] Chi-square = 4.659, df=1, $p<.05$.

[69] For Q50, Chi-square = .601, df=1, p=.438.
For Q51, Chi-square = .121, df=1, p=.728.
For Q52, Chi-square = 2.444, df=1, p=.118.

The most important questions in these sections were Q41 and Q47. The picture for Q41 showed two parrots, each brushing a different elephant, and an "extra" parrot. The question was "Did a parrot brush every elephant?" This was accepted by 22% of the children and 45% of the adults.[70] This means that 78% of the children and 55% of adults rejected this question and potentially gave spreading responses. Actual responses will be discussed in detail in the next section.

The picture for Q47 showed two parrots, each brushing a different elephant, and an "extra" elephant. The question was "Did every parrot brush an elephant?" This was accepted by 57% of the children and 91% of the adults. In other words, 43% of the children and 9% of the adults rejected this question and potentially gave spreading responses. A Chi-square test comparing child and adult responses to Q47 was significant.[71]

Responses to Q47 and Q41 are summarized in (38). They can be compared to responses to Q25 and Q30 (whose picture showed a one-to-one mapping of subjects and objects).

(38) Child & Adult Acceptance of Q47, Q41, Q25, Q30

	children		adults	
spread picture				
Q47 **every/a**	13/23	57%	20/22	91%
Q41 **a/every**	5/23	22%	10/22	45%
one-to-one mapping				
Q25 **every/a**	24/24	100%	22/22	100%
Q30 **a/every**	20/22	91%	10/22	45%

If we compare these two sets of questions, with Q47 and Q41 in

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[70]A Chi-square test comparing child and adult responses to Q41 was not significant: Chi-square = 2.846, df=1, p=.092.

[71]Chi-square =6.799, df=1, p<.01.

quantifier spread contexts, and Q25 and Q30 in one-to-one mapping contexts, we see almost no differences for adults (45% acceptance for both Q41 and Q30, and 91% vs. 100% acceptance for Q47 and Q25). However, for children the differences are greater (22% vs. 91% for Q41 and Q30, and 57% vs. 100% for Q47 and Q25).[72] This suggests that while adult rejections of these questions were due to some other factors, child rejections of Q47 and Q41 may have in part due to the different situations depicted by the pictures.

5.2.6.2 Classification of Responses

To decide whether or not a rejection of Q41 or Q47 could be a quantifier spreading response, we need to look carefully at the answers to the question "Why not?". Altogether there were fifty-five relevant responses (from children and adults, combined). Thirty-one were responses to Q41, thirteen were responses to Q47, and eleven were spontaneously produced responses to spreading fillers in Part 2. Twelve of the responses to Q41 and two of the responses to Q47 were given by adults; all of the other responses were from children. These responses were coded by three coders; coder agreement was significantly better

[72]Paired samples t-tests on children's acceptances of Q25 vs. Q47 and Q30 vs. Q41 were significant:

	means		t	df	2-tail p
Q25 vs. Q47	1.0000	.5652	4.11	22	**p<.001**
Q30 vs. Q41	.9091	.2273	6.71	21	**p<.001**

[Note that these means only include children who responded to both questions in each pair, and thus are slightly different from the means given in the text.]

than chance.[13]

Responses were classified as spreading responses, specific responses, and ambiguous or unclassifiable responses. A spreading response generally referred to the "missing" animal or to the "extra" animal. Some examples are given in (39).

(39) Sample Spreading Responses

CA (6;1) Q41 Did a parrot brush every elephant?
CA: No.
E: Ok. Why not?
CA: **Because there's only two elephants and three parrots.**

VN (6;7) Q41 Did a parrot brush every elephant?
VN: No.
E: Ok, why not?
VN: **Because one parrot doesn't have, um, a brush.**

A specific response showed that the indefinite expression (e.g., **a parrot**) was taken to refer to one animal, so that the picture was rejected because it shows more than one such animal. An example is given in (40).

(40) Sample Specific Response

AM (adult) Q41 Did a parrot brush every elephant?
AM: Did a parrot brush every elephant?
E: Did a parrot brush every elephant?
AM: No.
E: Ok, why not?
AM: **Two of the parrots brushed every elephant.**

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[13]For each pair of coders, Cohen's kappa statistic was determined (see Fleiss, 1973, p.143). Kappa is a coefficient of agreement for nominally scaled data (it is the ratio of the proportion of times that the coders agree, corrected for chance agreement, to the maximum proportion of times that the coders could agree, corrected for chance agreement). The overall kappa was .4549. The z values for each coder pair were 2.2279, 5.7261, and 5.4380 (where z values are the number of standard deviations above the mean). In the first case, $p<.05$; in the second two cases, $p<.0001$. In all three cases, therefore, coder agreement was significantly better than chance.

The counts of responses are given in (41).

(41) **Numbers of Each Type of Coded Response**

	spreading		specific		unclassifiable	
adults						
Q41 **a/every**	6	50%	4	33%	2	17%
Q47 **every/a**	2	100%	0		0	
children						
Q41 **a/every**	13	65%	1	5%	6	30%[74]
Q47 **every/a**	11	100%	0		0	
Part 2[75]	11	100%	0		0	

5.2.6.3 Every/a and A/every

What percentages of adults and children gave clear spreading responses? Twenty-two adults responded to Q41; twelve (55%) rejected this question. As we can see in (41), six of these responses were clearly spreading responses. Therefore, six out of twenty-two, or 27%, of adults gave spreading responses to the **a/every** sentence; these adults were KK, RM, JG, RL, MR, and DD. Twenty-two adults also responded to Q47. Two adults (9%) rejected Q47, and both gave spreading responses; these adults were RL and MR.

Again, we can compare these responses to those given for Q30 and

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[74]One child's response to Q41 contained two parts. The first part was classified as a specific response, while the second was classified as a spreading response:

Q41 Did a parrot brush every elephant?
C: NO.
E: Why not?
C: **Because there isn't one parrot, there are two. Three, but one doesn't have a paintbrush.**

[75]The spreading fillers in Part 2 were **every/a** sentences or **all/a** sentences.

Q25 (whose picture showed a one-to-one mapping of subjects and objects). Q30, an **a/every** sentence, was rejected by twelve adults (55%); they were DU, KP, AM, RM, SG, JR, DY, MP, JG, MB, JC, and MR. Thus, all four of the adults who gave specific responses to Q41 (KP, AM, SG, and JR) also rejected Q30, and three of the six adults who gave spread responses to Q41 (RM, JG, and MR) also rejected Q30. For comparison, reasons for rejection for these adults are given in (42).

(42) Adult Reasons for Rejection for Q30 vs. Q41

Q30 Did an elephant brush every tiger? Response: No.
Q41 Did a parrot brush every elephant? Response: No.

specific responses to Q41 vs. Q30

KP (AD)
- Q30 **They're brushing separate tigers.**
- Q41 **There's more than one parrot.**

AM (AD)
- Q30 **Each elephant brushed one tiger.**
- Q41 Did <u>a</u> parrot brush every elephant?
  - E: Did a parrot brush every elephant?
  - AM: **No.**
  - E: Ok, why not?
  - AM: **Two of the parrots brushed every elephant.**

SG (AD)
- Q30 **There was only, um, each, each, each elephant is only brushing one tiger.**
- Q41 **A parrot is only brushing one elephant.**

JR (AD)
- Q30 **Each elephant only brushes one tiger.**
- Q41 **'Cause each elephant has its own parrot.**

spread responses to Q41 vs. Q30

RM (AD)
- Q30 **One elephant brushed this tiger, one elephant brushed this tiger, and another elephant brushed that tiger.**
- Q41 **'Cause this parrot didn't brush anybody.**

JG (AD)
- Q30 **An elephant brushed a tiger.**
- Q41 **The one in the top left hand corner is not brushing anybody.**

MR (AD)
- Q30 **Because there's three elephants.**
- Q41 **Because there's two parrots brushing (the) elephants, and there's one that's by himself.**

While the specific responses to Q41 are very similar to the responses to Q30, the spread responses to Q41 differ from the corresponding responses to Q30, focusing on the "extra" animal.

Q25, the **every/a** sentence with the one-to-one mapping picture, was accepted by 100% of adults, including the two who rejected Q47. The spreading responses to Q47 given by these adults are shown in (43).

(43) Adult Reasons for Rejection of Q47 (Spread Responses)

Q47 Did every parrot brush an elephant? Response: No.

RL (AD) **Only two parrots brushed two of the elephants.**
MR (AD) **Because there's an elephant without a parrot.**

We can also examine the adult spreaders' responses to the **every/every** and **all/all** sentences. Eleven adults had accepted the one-to-one mapping interpretation of Q28 with **every/every**, and eight adults had accepted Q29 with **all/all** (the eight who accepted Q29 were a subset of the eleven who accepted Q28). Of the six adults who gave spreading responses to Q41 (**a/every**), three (KK, RL, and MR) also accepted both Q28 and Q29. Two of these adults (RL and MR) are the two adults who gave spreading responses to Q47 (**every/a**).

Turning to child results, we find that twenty-three children responded to Q41; eighteen (78%) rejected this question.[76] As we can see in (41), thirteen of these responses were clearly spreading responses. Therefore, thirteen out of twenty-three, or 57%, of children gave spreading responses to the **a/every** sentence; these children were

[76]Another child, AE, responded both yes and no to Q41; she is therefore excluded from counts of acceptance of Q41, but her reason for rejecting Q41 is included in the counts given in (41). However, AE's response was one of the six unclassifiable responses. Also, as noted in (41), EB gave both a spread and a specific response to Q41, and is therefore counted twice in (41).

EW, AL, AT, KV, CZ, EB, AG, JG, KL, CA, JE, CM, and VN. Twenty-three children also responded to Q47. Ten children (43%) rejected Q47 and gave spreading responses; these children were AM, EW, AL, TM, AT, KV, KL, JE, BH, and TO. In addition, EB accepted Q47, but gave the response shown in (44), which was classified as a spreading response.

(44) Q47 Did every parrot brush an elephant?

EB: **Yes. But they didn't brush this one. So I'm not quite sure.**

This brings the total of children who gave spreading responses to Q47 to eleven out of twenty-three (48%). Furthermore, two children who rejected Q47 but did not give spread responses to it had given unsolicited spread responses in Part 2; these children were CS and MT. Finally, two children, KB and EC, who were not included in Part 3, had given unsolicited spread responses in Part 2. This brings the total of children who gave some spreading response to fifteen out of twenty-five, or 60%. The percentages of adults and children giving spreading responses are summarized in (45).

(45) Percentages of Children or Adults Giving Spreading Responses

	children		adults	
Q41 **a/every**	13/23	57%	6/22	27%
Q47 **every/a**	15/25	60%	2/22	9%
overall spread[7]	21/25	84%	6/22	27%

The rates of **a/every** and **every/a** spreading are very similar for children.[8] For adults, however, there were marginally significant

[7] Overall spread = at least one spread response (**every/a** or **a/every**).

[8] If we exclude the two children who were not included in Part 3, then the rate of spreading for Q41 and Q47 is identical, 13/23, or 57%.

differences between rates of **a/every** and **every/a** spreading.[79] A t-test comparing adult and child spreading response rates for Q41 (**a/every** spreading) was not significant, but t-tests comparing adult and child spreading response rates for Q47 (**every/a**) and for overall spreading were both significant.[80]

As with adults, we can compare these responses to those given for Q30 and Q25 (whose picture showed a one-to-one mapping of subjects and objects). Q30, an **a/every** sentence, was rejected by two children (9%); they were KV and EB. EB was the one child who gave a specific response to Q41 (and also a spread response); KV and EB both gave spread responses to Q41. For comparison, reasons for rejection for these children are given in (46).

(46) Child Reasons for Rejection for Q30 vs. Q41

Q30 Did an elephant brush every tiger? Response: No.
Q41 Did a parrot brush every elephant? Response: No.

KV (5;7)
- Q30 **Because there's three elephant--**
- E: Ok. Elephants?
- KV: **Elephants. There's not just one.**
- Q41 **Um, one of them isn't, and two of them (still) are.**

EB (5;11)
- Q30 **'Cause there is no elephant. There's three of them.**
- Q41 [specific:] **Because there isn't one parrot, there are two.** [spread:] **Three, but one doesn't have a paintbrush.**

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[79]A paired samples t-test comparing adult rates of **every/a** and **a/every** spreading was marginally significant:

every/a	**a/every**	t	df	2-tail p
.0909	.2727	-2.16	21	**p<.05 [.042]**

[80]

	children	adults	t	df	2-tail p
a/every	.5417	.2727	1.88	44	p=.067
every/a	.5909	.0909	4.02	33.86	**p<.001**
overall	.7000	.2727	3.30	50	**p<.005**

Note that EB's specific response to Q41 is very similar to the responses to Q30, but the spread responses to Q41 differ from the corresponding responses to Q30, focusing on the "extra" animal.

As with adults, Q25, the **every/a** sentence with the one-to-one mapping picture, was accepted by 100% of children, including the ten who rejected Q47. The spreading responses to Q47 given by these children are shown in (47).

(47) Child Reasons for Rejection of Q47 (Spread Responses)

Q47 Did every parrot brush an elephant? Response: No.

AM (5;1)	**Because one wa-- one parrot wasn't there.**
EW (5;4)	**'Cause one, 'cause of, one, one parrot is somewhere else, and the other, the other elephant didn't get, uh, brushed.**
AL (5;4)	**Because all the elephants (were) away and no more parrot and there was three elephants and two parrots.**
TM (5;5)	**Because there was only two parrots.**
AT (5;5)	**Because there wasn't enough parrots.**
KV (5;7)	**There's one there, and there's only two, um, parrots.**
KL (6;1)	**'Cause the other one was going to get some peanuts.**
E:	The other what? The other parrot?
KL:	**Elephant.**
JE (6;3)	**'Cause, because one's standing. That one could have brushed with his (back), but, and one bird could have brushed with his back feather, but (it didn't exactly work), madame.**
BH (7;2)	**'Cause one elephant isn't getting brushed.**
TO (7;7)	**'Cause one of the elephants is standing by itself.**

Recall also that 100% of the children accepted both the **every/every** and the **all/all** sentences.

5.2.6.4 Other Spreading Responses

In addition to sentences with a universal quantifier and an existential quantifier, these sections included sentences with singular and plural pronouns in the place of the existential quantifier and plurals in the place of the universal quantifier. Here I will focus on the sentences with singular pronouns in the place of the existential quantifier.

In section 5.2.5.1 we saw that some children are treating pronouns as in some sense [-definite], accepting sentences like "The bears sprayed him" or "Every bear sprayed him" with a picture that showed three bears, each spraying a different tiger. Since quantifier spreading takes place with a universal quantifier and an indefinite, we might expect that children who accepted this unbound distributive interpretation might also quantifier spread with a pronoun in place of the indefinite NP.

Q49 ("Did every parrot brush him?) tested sentences of this sort in a spreading context. The picture for Q49 showed two parrots, each brushing a different elephant, plus a third, "extra" elephant. There are two responses to this question that are of interest here. First, acceptance of this demonstrates that children have the [-definite] **him** (since there is no single elephant that every parrot brushed; each parrot brushed an elephant, but not the same elephant). This is in fact a better test for this interpretation than item 20/Q20 or Q27 (discussed in section 5.2.5.1), since there is a salient singular entity (the extra elephant) that **him** could refer to. As mentioned in section 5.2.6.1, Q49 was accepted by 36% (8 out of 22) of the children and 9% of the adults.

Second, if children accept the [-definite] **him** and are spreaders, they may give a spreading response to Q49. Of the 14 "no" responses, at least two were clear spreading responses (by the criteria described in

5.2.6.2). These responses are given in (48).

(48) Spreading Responses to Q49[81]

Q49 Did every parrot brush him? Response: No.

AM (5;1) **'Cause one wasn't, one wasn't there.**
E: Ok. One what?
AM: **One parrot.**
EW (5;4) **'Cause one, 'cause of, one, one parrot is somewhere else, and the other, the other elephant didn't get, uh, brushed.**

Several other responses to Q49 could also be spreading responses, but with this picture were ambiguous.[82]

Note that both of the **every/him** spreaders (AM and EW) gave spreading responses to **every/a** sentences, accepted the unbound distributive **him**, and accepted the bound distributive **him** at chance or worse than chance levels.

5.2.7 [-Distributive] Him and the Bound Distributive Interpretation

As discussed in Chapter 3, children who accept the apparent Principle B violations should give other evidence of treating pronouns as [-definite]. For example, children who accept the bound distributive interpretation of **him** (e.g., "Did every bear spray him?", when the picture shows three bears, each spraying himself) should also accept the

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[81]Compare to (47).

[82]For example, several children gave responses similar to that given by JG.

Did every parrot brush him? No.
E: Why not?
JG: 'Cause there was three elephants.

Here JG could mean that every parrot didn't brush **him** because there was an "extra" elephant that didn't get brushed (a spread response), or she could mean that every parrot brushed him because there wasn't one elephant (a singular referent for **him**), there were three.

unbound distributive interpretation of **him** (e.g., "Did every bear spray him?", when the picture shows three bears, each spraying a different baby tiger).

There were four measures of the bound distributive interpretation of **him**. The first consisted of the three tokens of item 20 plus Q20 (sentences such as "Did the bears spray him?", where each of three bears sprayed a different tiger, for a total of three tigers). The second was Q27 ("Did every bear spray him?", with the same picture as just described). The third was Q49, the spread picture ("Did every bear spray him?", with two bears, each spraying a different tiger, plus a third, unsprayed tiger).

(49) Children's Acceptance of Unbound Distributive **Him** with Acceptance of Bound Distributive **Him**

subject (age)	dist. **him** (item20/Q20)[83]	every dist. **him** (Q27)	spread-picture **every-him** (Q49)	bound dist. **him**
ET (3;4)	3/3	1/1	---	>.05
AE (3;9)	3/4	1/1	1/1	>.05
AM (5;1)	4/4	1/1	spread	chance
AL (5;4)	4/4	1/1	0/1	>.05
EW (5;4)	3/4	1/1	spread	**67%**
TM (5;5)	2/4	1/1	1/1	chance
AT (5;5)	3/4	1/1	1/1	**67%**
KV (5;7)	3/4	0/1	0/1	>.05
KY (5;7)	1/4	1/1	0/1	chance
CZ (5;10)	1/4	1/1	0/1	**83%**
EB (5;11)	0/4	0/1	---	>.05
AG (5;11)	2/4	1/1	1/1	**75%**
JG (5;11)	3/4	0/1	0/1	**92%**
KL (6;0)	2/4	1/1	0/1	**75%**
CS (6;1)	2/4	1/1	0/1	chance
MT (6;1)	4/4	1/1	0/1	>.05

[83]Note that there are two possible denominators for the figures in this column. This column consists of the three tokens of item 20 plus Q20. However, six children (KB, EC, CQ, JF, JS, and JR) were not included in Part 3, and so were not asked to respond to Q20; a seventh child (ET), while included in Part 3, also did not respond to Q20.

-continued-

subject (age)	dist. him (item20/Q20)	every dist. him (Q27)	spread-picture every-him (Q49)	bound dist. him
CA (6;1)	1/4	0/1	1/1	**92%**
JE (6;3)	0/4	0/1	0/1	>.05
CM (6;5)	1/4	0/1	0/1	>.05
VN (6;7)	2/4	0/1	1/1	**75%**
KB (6;9)	0/3	---	---	>.05
EC (6;10)	0/3	---	---	>.05
RR (6;11)	3/4	1/1	1/1	**83%**
CQ (7;0)	1/3	---	---	>.05
BH (7;0)	3/4	1/1	0/1	**75%**
MM (7;1)	1/4	0/1	1/1	>.05
JF (7;3)	0/3	---	---	>.05
TO (7;7)	2/4	1/1	0/1	>.05
JS (7;9)	0/3	---	---	>.05
JR (9;5)	0/3	---	---	>.05

Note that the seven children who never accepted an instance of unbound distributive **him** (EB, JE, KB, EC, JF, JS, and JR) were all significantly better than chance at rejecting the bound distributive **him**.

Since several children were not included in Part 3, it is best here to compare only results from Part 2. Children were divided into two groups: those who rejected all three tokens of item 20 (the unbound distributive interpretation of "Did the bears spray him?"), and those who accepted at least one token of item 20. There were eight children in the first group (the seven children listed above, plus CA), and twenty-three children in the second group.[M]

An ANOVA with group (first group vs. second group) as the independent variable and age as a continuous covariate was conducted on

[M]Since CA did accept Q20 and Q49 in Part 3, and so demonstrates some acceptance of the unbound distributive interpretation, it may not be appropriate to include CA in the first group. I will give two sets of results: including CA in the first group, and excluding CA altogether.

the dependent measure, the number of acceptances of bound distributive **him** in Part 2 (ranging from 0 to 9 acceptances). With CA included, the group mean for the eight children in the first group was 1.25, and the group mean for the twenty-two children in the second group was 4.05. In this case, there was no significant main effect.[85] However, when CA was not included, the group mean for the seven children in the first group was 0.29 (and the group mean for the twenty-two children in the second group remained the same, 4.05). In this case, there was a significant main effect.[86] In both cases, there was no significant effect of age.[87]

Thus, children's acceptance of the unbound distributive interpretation of **him** appears to predict their acceptance of the bound distributive interpretation of **him** (apparent violations of Principle B).

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[85]$F(1,29) = 3.643$, $p=.067$.

[86]$F(1,28) = 8.430$, $p<.01$.

[87]When CA is included, for age, $F(1,29) = 1.382$, $p =.250$. When CA is excluded, for age, $F(1,28) = 1.613$, $p =.215$.

CHAPTER 6: DISCUSSION AND CONCLUSIONS

In this final chapter I summarize the results of the experimental study discussed in the previous chapter and relate these results to the findings in the literature, discussed in Chapters 2 and 3. Finally, I will describe possible future directions of research.

6.1 Summary of findings

First, the number pretest eliminated 40% of child subjects; of the fifty-seven children included in the number pretest, twenty-three children failed the object pronoun section (see section 5.1). Those children did not reliably distinguish between **him** and **them**. The number pretest showed that children can distinguish between singular and plural subject pronouns and object pronouns around age five (but appear to be slower at distinguishing between singular and plural possessive pronouns, though additional factors may have contributed to this relative delay).

This result is important because it shows that the remaining 60% of child subjects (thirty-four children)[1] could distinguish between singular and plural pronouns; therefore, any problems that the children in Part 2 and Part 3 had with pronominal number should be attributed to something other than pronominal number.

The children in this study were found to obey Principle A of the binding theory, and to accept both distributive and collective

[1]Four of these children (ages 3;9, 5;3, 5;4, and 6;5) were later excluded from Part 2 and Part 3 because they failed on the quantifier fillers in Part 2.

interpretations of the reflexive **themselves** (section 5.2.1). In addition, children generally accepted both a distributive and a collective interpretation with bound possessive pronouns, although a group of seven children did not like the possessive pronouns alone to take internal reference, responding to questions such as "Did the monkeys cut their hair?" with, "No, they cut **their own** hair" (section 5.2.2.1). In a prompted production task, the children (including the seven mentioned above) showed a strong preference for a distributive interpretation of possessive pronouns, with variation in pronominal number (section 5.2.2.2).

On tests of quantification, the children demonstrated that they understood the universal force of the quantifiers **every** and **all**. In addition, about a third of the children took definite plurals (like **the parrots**) to have the force of a universal quantifier (section 5.2.3).

One major finding in the main body of the experiment is that slightly more than a third of the thirty children tested accepted pronouns with a bound distributive interpretation, in apparent violation of Principle B of the binding theory. This was true whether the antecedent for the pronoun was **every**, **all**, or a plural, and whether the pronoun was **them** or **him**. There were no significant differences based on antecedent type, pronoun number, or distributive or collective interpretation (see section 5.2.4.5 for discussion).

It could be argued that those children who accepted a locally bound pronoun were in fact accepting it as a collective interpretation. This is possible, though it seems unlikely. First, the fact that there were two pictures types, distributive and collective, would have focused the children's attention on this distinction. Second, these children accepted the bound distributive interpretation with quantified antecedents (e.g., with **every** and **all**), which, in previous studies (e.g. those of Wexler and Chien) has been taken as sufficient evidence of binding (as opposed to coreference). Third, the work of Miyamoto suggests that the distributive interpretation is generally preferred by children (at least between the ages of 3 and 5), which suggests that children are likely to interpret a sentence as distributive if possible.[7] Fourth, it is hard to imagine that the singular pronoun **him** was interpreted as collective (particularly since all of these children had passed the number pretest, and so understood the difference between **him** and **them**). Yet these children also accepted the bound distributive interpretation with **him**.[8] Furthermore, evidence from the elicited production task with possessive pronouns also showed a strong preference for the distributive interpretation (especially with **every**, but also with **all**). Finally, the children who accepted the bound distributive interpretation were just those children who accepted the unbound distributive **him** (but this relationship between acceptance of the bound distributive interpretation and acceptance of the unbound distributive **him** does not appear to depend on age; see section 5.2.7).

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[7]Miyamoto notes that "In the picture verification task, unlike the truth value judgment task, there are no separate actions involved. Hence, a bias toward the distributive interpretation seems to be less prominent." (Miyamoto, 1992, p.21). Recall, however, that even in the picture verification task, Miyamoto found a statistically significant preference for the distributive interpretation over the collective in children between 3 and 5.

[8]The exception to this was MM, who only accepted the bound distributive interpretation with **them**.

As mentioned, children were found to accept a singular definite pronoun with an unbound distributive interpretation (section 5.2.5.1 and section 5.2.6.4). For example, children said "yes" to "Did the bears spray him?" when each of three bears sprayed a different tiger. It appears that the children who never accepted this [-definite] **him** also did not accept the Principle B violations, and the children who accepted the [-definite] **him** the most accepted the Principle B violations most often (see section 5.2.7).

A number of children (57 to 59%) also accepted the subject pronoun **he** with an unbound distributive interpretation (section 5.2.5.2). For example, these children said "yes" to "Did he wash the giraffes?" when each of three mice washed a different giraffe.

With pictures which showed a one-to-one mapping between subjects and objects, both children and adults accepted **every/a** sentences. However, when the order was reversed to **a/every**, fewer than half of the adults continued to accept this picture-sentence pair (confirming the results of Kurtzman & MacDonald, 1993, who found that for active sentences, there is a general preference for the interpretation in which the leftward quantified phrase has wide scope, and there is also a stronger preference for a wide scope interpretation of the indefinite in the **a/every** order). However, 91% of children accepted this picture-sentence pair, showing that they don't have the same scope interpretation biases as adults (see section 5.2.5.3).

With sentences with two quantifiers (**every/every** or **all/all**) all of the children, and one third to half of adults, accepted a one-to-one mapping interpretation (i.e., an exhaustive interpretation of the universal quantifier-- see section 5.2.5.4 and section 3.2).

Finally, 15/25 (60%) of children (and 2/22, or 9% of adults) gave spreading responses to **every/a** sentences. For **a/every** sentences, 13/23 (57%) of children (and 6/22, or 27% of adults) gave spreading responses. And interestingly, at least two of the children who demonstrated both quantifier spreading and the [-definite] **him** also gave spreading responses (referring to a missing parrot) to the sentence, "Did every parrot brush him?" when the picture showed two parrots, each brushing a different elephant, plus an "extra" elephant.

6.2 Comparison to Previous Results

The pronoun results here are most comparable to the results of Boster (1991), who found that children accepted sentences with both **him** and **them** locally bound to NPs with **every**. However, one difference between Boster's study (and also the studies of Wexler and Chien) and the study presented here involves the pictures. Take, for example, the sentence, "Is every bear touching her?" from Chien & Wexler (1988, 1990). The picture that went with this sentence for the Quantifier-Pronoun mismatch case showed three (female) bears, each touching herself, and Goldilocks (not being touched). Boster's pictures for the singular pronoun were similar, although the pictures for the sentences which included the pronoun **them** included two extra characters instead of a single character like Goldilocks.

The pictures for the present study, for sentences with the singular pronoun **him** or the plural pronoun **them** (e.g., "Did every bear spray him?" or "Did every bear spray them?"), showed, for example, three bears, each one spraying himself, and three baby tigers (not being sprayed). In previous tests of such sentences with **every** (except for Boster's sentences with **them**) the picture showed one extra character. Here, for both, "Did every bear spray them?" and "Did every bear spray him?", the picture showed three characters not being sprayed. On the adult interpretation, then, there was no possible referent for the pronoun **him**. However, we have seen here that children will take **him** to vary in reference when it is not bound; this would allow them also to accept an interpretation in which **him** varies in reference (e.g., where each bear sprayed himself).

The other study which the present study should be compared to is that of Avrutin & Thornton (1993, 1994). In section **2.2.2.2** we saw that there are some doubts about the conclusiveness of Avrutin and Thornton's study. However, even if we accept Avrutin and Thornton's results, there are differences between this study and that of Avrutin and Thornton which could account for the differing conclusions. The present study involved a picture judgment task, with unindividuated animals (e.g., **the bears**) as the subjects of the sentences. Avrutin and Thornton's study involved a truth value judgment task, with a conjoined NP (e.g. **the Smurf and the clown**) as subject of the sentences. These differences could have contributed to the difference in results.

6.3 Conclusions

There are two conclusions that I wish to draw here. The first relates primarily to quantifier spreading, while the second has broader consequences. Although these two conclusions are independent, they are related, since both rely on the distinction between varying and unique interpretations. If children have not fully determined which expressions are definite and which expressions are indefinite, it would be expected that definites may sometimes be taken as varying in reference (even when they are not bound variable pronouns) and indefinites may be required to be unique. Examples of the first case (definites interpreted as varying in reference) are the cases of the [-definite] pronouns, while the phenomenon of quantifier spreading appears to be an example of the second (indefinites with a uniqueness requirement-- exhaustiveness).

The first conclusion relates to quantifier spreading. In Chapter 3 I suggested that there is a relationship between quantifier spreading and the acceptance of **every-every** sentences with a one-to-one mapping interpretation. I suggested an alternative to the event quantification explanation of quantifier spreading, based on a resumptive quantification analysis with a requirement for exhaustiveness.

The second conclusion relates to definiteness. I have provided evidence that some children treat pronouns as [-definite] (in some sense like the indefinite pronoun **someone**). It is these children who appear to violate Principle B of the binding theory. I propose that children do in fact "have" the binding principles, but that coreference restrictions do not prohibit NPs which are [-definite] from coreferring locally (so a sentence like "Every boy praised someone" is consistent a situation in which each boy praised himself).

This proposal also accounts for the finding of Thornton and Wexler that children who appear to violate principle B in VP ellipsis constructions appear to lack Independent Index Copying. My suggestion is that children who can treat definite pronouns as [-definite] index pronouns in whatever way indefinites are indexed, and so can allow them to refer freely in VP ellipsis contexts.

It should be noted that these proposals are not incompatible with theories involving Principle P/Rule I -- in fact, they rely on the distinction between binding and coreference. However, the [-definite] pronoun proposal has broader empirical coverage, since it can account for the VP ellipsis facts without having to say that children lack Independent Index Copying, and it can account for acceptance of unbound distributive **him**.

One important question that remains is how children learn that definite pronouns like **him** or **them** must be [+definite]. This area requires further investigation; however, this investigation is also required by the other proposals discussed here (e.g., the theories involving Principle P need to explain how children acquire the pragmatic Principle P, and the event quantificational analysis of quantifier spreading has to explain how children learn that quantification over objects is obligatory for determiner quantifiers like **every**).

6.4 Directions for Future Research

One clear prediction is that children who appear to lack "Independent Index Copying" in VP ellipsis sentences should also accept sentences such as "The bears sprayed him" or "Every bear sprayed him" (where each bear sprayed a different tiger). There should also be further investigation of children's interpretation of indefinites in VP ellipsis sentences. Is a sentence such as (1) (taken from Thornton & Wexler, 1993) interpreted in the same way as a sentence like (2)?

(1) The Indian with a spear captured him and the Indian on a horse did too.

(2) The Indian with a spear captured someone and the Indian on a horse did too.

More generally, there needs to be more investigation of children's interpretation of indefinite pronouns such as **someone** or **one**. Also, since apparent Principle B violations with the plural pronoun **them** were accepted, it would be good to devise other tests of the definiteness of **them** for these children.

Since there was also evidence that subject pronouns may be interpreted as [-definite], the consequences of this for the obedience of Principle C of the binding theory should also be investigated.

We might also test local coreference with indefinites. Will children accept sentences like (3) in a situation in which Snoopy kissed himself?

(3) Snoopy kissed a dog.

(3) would also require testing children's understanding of kind relationships (i.e., children would have to know that Snoopy is a dog).

In addition, there needs to be further investigation of the difference between spreading in **a/every** sentences and **every/a** sentences. In particular, we need to control for the specific interpretation of the indefinite.

As noted, there remain several areas which require further investigation. The research presented here provides new data which reveal previously unnoticed features of children's understanding of pronouns and reinterprets existing research in a way which furnishes broader empirical coverage. In this way, this thesis contributes to a greater understanding of the acquisition of the logical properties of pronouns.

Appendix Listing

Appendix A1: Number Pretest Experimental Sentences[1]

Object Pronouns

sentence	pictured object	picture type
A 1. Did the bear spray him?	[the parrot]	MATCH
A 2. Did the bear spray them?	[the tiger cubs]	MATCH
A 3. Did the elephant brush him?	[the tiger]	MATCH
A 4. Did the elephant brush them?	[the monkeys]	MATCH
A 5. Did the bear spray him?	[the tiger cubs]	MISMATCH
A 6. Did the bear spray them?	[the parrot]	MISMATCH
A 7. Did the elephant brush him?	[the monkeys]	MISMATCH
A 8. Did the elephant brush them?	[the tiger]	MISMATCH

Subject Pronouns

sentence	pictured subject	picture type
B 1. Did he brush the elephant?	[the mouse]	MATCH
B 2. Did they brush the elephant?	[the parrots]	MATCH
B 3. Did he pour water on the elephant?	[the parrot]	MATCH
B 4. Did they pour water on the elephant?	[the monkeys]	MATCH
B 5. Did he brush the elephant?	[the parrots]	MISMATCH
B 6. Did they brush the elephant?	[the mouse]	MISMATCH
B 7. Did he pour water on the elephant?	[the monkeys]	MISMATCH
B 8. Did they pour water on the elephant?	[the parrot]	MISMATCH

Possessive Pronouns

sentence	pictured possessor	sentence type
C 1. Did the parrot wipe his glasses?	[the elephant]	MATCH
C 2. Did the parrot wipe their glasses?	[the tigers]	MATCH
C 3. Did the monkey cut his hair?	[the monkey]	MATCH
C 4. Did the monkeys cut their hair?	[the monkeys]	MATCH
C 5. Did the parrot wipe his glasses?	[the tigers]	MISMATCH
C 6. Did the parrot wipe their glasses?	[the elephant]	MISMATCH
C 7. Did the monkey cut their hair?	[the monkey]	MISMATCH
C 8. Did the monkeys cut his hair?	[the monkeys]	MISMATCH

---

[1]The orders for Form 1 and Form 2 are given here. F = filler. Yes and no indicate the expected responses for fillers.

FORM 1: A1, F 11 (no), B3, F 12 (no), C4, A7, F 13 (no), C5, F 2 (yes), B1, A5, F 5 (yes), C3, F 15 (no), B6, A2, F 7 (no), C1, B8, F 1 (yes), A8, C2, F 4 (no), B2, F 16 (no), A3, C8, F 10 (yes), B7, A4, F 14 (no), C6, F 6 (yes), B5, F 8 (no), C7, F 9 (yes), A6, F 3 (no), B4.

FORM 2: B4, F 3 (no), A6, F 9 (yes), C7, F 8 (no), B5, F 6 (yes), C6, F 14 (no), A4, B7, F 10 (yes), C8, A3, F 16 (no), B2, F 4 (no), C2, A8, F 1 (yes), B8, C1, F 7 (no), A2, B6, F 15 (no), C3, F 5 (yes), A5, B1, F 2 (yes), C5, F 13 (no), A7, C4, F 12 (no), B3, F 11 (no), A1.

Appendix A2: Number Pretest Experimental Sentences

Training [2 yes, 2 no]

1.	Did the parrot step on the cake?	(yes)
2.	Did the parrot climb the ladder?	(no)
3.	Did the mouse wash the giraffe?	(yes)
4.	Did the bear pour water on the monkey?	(no)

Fillers

singular-singular (yes)

1. Did the bear spray the baby tiger?
2. Did the monkey point to the parrot?

singular-singular (no)

3. Did the tiger brush the elephant?
4. Did the bear spray the monkey?

singular-plural (yes)

5. Did the monkey pour water on the parrots?
6. Did the monkey spray the bears?

singular-plural (no)

7. Did the baby tigers point at the monkey?
8. Did the monkeys pour water on the elephant?

plural-singular (yes)

9. Did the parrots brush the elephant?
10. Did the bears spray the pig?

plural-singular (no)

11. Did the giraffe tickle the mice?
12. Did the baby tiger point at the monkeys?

mixed (no)

13. Did the giraffes wash the mice?
14. Did the parrots point to the monkeys?
15. Did the tiger wipe the glasses?
16. Did the parrot drink the juice?

Appendix B1: Part 2 Experimental Sentence Types

item 1	Did **the bear** spray **himself**?	A< B[7]
item 2	Did **the bear** spray **himself**?	A ---> B
item 3	Did **the bears** spray **themselves**?	A< B A< B A< B
item 4	Did **the bears** spray **themselves**?	A| B A|< B A| B
item 5	Did **the bear** spray **him**?	A ---> B
item 6	Did **the bear** spray **him**?	A< B
item 7	Did **every monkey** cut **his** hair?	A.< .B A.< .B A.< .B
item 8	Did **every monkey** cut **their** hair?	A.< .B A.< .B A.< .B
item 9	Did **every monkey** cut **their** hair?	A| |B A|.< .|B A| |B
item 10	Did **every bear** spray **him**?	A< B A< B A< B
item 11	Did **every bear** spray **them**?	A< B A< B A< B

---

[7] For the diagrams, A = the first-mentioned NP. Other symbols:

A< = reflexive action; e.g., "A sprayed A"

A-->B = transitive action; e.g., "A sprayed B"

A|
A| = collective, so **A|**
A| **A|**< = e.g.,"The As sprayed the As (collectively)."
A|

A. = possessive, so **A.<** = e.g., "A cut A's hair"

item 12 Did **every bear** spray **them**?
A| B
A| < B
A| B

item 13 Did **all the bears** spray **him**?
A< B
A< B
A< B

item 14 Did **all the bears** spray **them**?
A< B
A< B
A< B

item 15 Did **all the bears** spray **them**?
A| B
A| < B
A| B

item 16 Did **the monkeys** cut **his** hair?
A.< .B
A.< .B
A.< .B

item 17 Did **the monkeys** cut **their** hair?
A.< .B
A.< .B
A.< .B

item 18 Did **the monkeys** cut **their** hair?
A| |B
A| .< . |B
A| |B

item 19 Did **the bears** spray **them**?
A ---> B
A ---> B
A ---> B

item 20 Did **the bears** spray **him**?
A ---> B
A ---> B
A ---> B

item 21 Did **the bears** spray **him**?
A< B
A< B
A< B

item 22 Did **the bears** spray **them**?
A< B
A< B
A< B

item 23 Did **the bears** spray **them**?
A| B
A| < B
A| B[3]

---

[3]The orders for Form 1 and Form 2 are given here. F = filler. Yes and no indicate the expected responses for fillers.

(continued...)

Appendix B2: Part 2 Filler Sentences

Training [2 yes, 2 no]

1.	Did the mouse climb the ladder?	(yes)
2.	Did the monkey step on the cake?	(no)
3.	Did the monkey spray the bear?	(yes)
4.	Did the bear tickle the mouse?	(no)

Simple "yes" fillers (1-10)

1. Did the monkey pour water on the elephant?
2. Did the mice wash the giraffes?
3. Did the monkeys point to the parrots?
4. Did the bear spray the giraffe?
5. Did the monkey point to the parrot?
6. Did the mouse wash the giraffe?
7. Did the parrot step on the cake?
8. Did the parrots hold the balloons?
9. Did the pig hold the carrot?
10. Did the bear hold the balloons?

Simple "no" fillers (11-30)

[in 11-13, there are three animals in the picture; the action is performed on the third, unnamed animal]

---

[3](...continued)
FORM 1: 6A, F19 (no), 17A, 20B, F46 (yes), 14C, F17 (no), 4A, 10B, F30 (no), 22C, 2A, F33 (yes), 17C, F41 (no), 18B, 12A, F18 (no), 20C, 1B, F37 (no), 3A, 23C, F24 (no), 13B, F44 (yes), 16A, 19C, F20 (no), 5B, 15A, F40 (yes), 21C, 9B, F16 (no), 7A, F4 (yes), 8C, F42 (yes), 11B, 8A, F15 (no), 23A, F7 (yes), 11C, F45 (no), 19B, 14A, F14 (no), 18A, F31 (yes), 2C, 10A, F9 (yes), 17B, F39 (no), 22A, F21 (no), 4C, 21B, F13 (no), 1A, 16C, F6 (yes), 2B, 9A, F34 (yes), 3C, F27 (no), 5A, 15B, F43 (no), 6C, 7C, F23 (no), 13A, 16B, F36 (yes), 22B, F25 (no), 12C, 18C, F22 (no), 21A, F2 (yes), 14B, 1C, F12 (no), 7B, F3 (yes), 20A, F32 (yes), 9C, 23B, F11 (no), 11A, F8 (yes), 4B, 10C, F28 (no), 6B, F1 (yes), 19A, 3B, F29 (no), 13C, F10 (yes), 12B, F38 (yes), 5C, F26 (no), 8B, F5 (yes), F35 (no), 15C.

FORM 2: 15C, F35 (no), F5 (yes), 8B, F26 (no), 5C, F38 (yes), 12B, F10 (yes), 13C, F29 (no), 3B, 19A, F1 (yes), 6B, F28 (no), 10C, 4B, F8 (yes), 11A, F11 (no), 23B, 9C, F32 (yes), 20A, F3 (yes), 7B, F12 (no), 1C, 14B, F2 (yes), 21A, F22 (no), 18C, 12C, F25 (no), 22B, F36 (yes), 16B, 13A, F23 (no), 7C, 6C, F43 (no), 15B, 5A, F27 (no), 3C, F34 (yes), 9A, 2B, F6 (yes), 16C, 1A, F13 (no), 21B, 4C, F21 (no), 22A, F39 (no), 17B, F9 (yes), 10A, 2C, F31 (yes), 18A, F14 (no), 14A, 19B, F45 (no), 11C, F7 (yes), 23A, F15 (no), 8A, 11B, F42 (yes), 8C, F4 (yes), 7A, F16 (no), 9B, 21C, F40 (yes), 15A, 5B, F20 (no), 19C, 16A, F44 (yes), 13B, F24 (no), 23C, 3A, F37 (no), 1B, 20C, F18 (no), 12A, 18B, F41 (no), 17C, F33 (yes), 2A, 22C, F30 (no), 10B, 4A, F17 (no), 14C, F46 (yes), 20B, 17A, F19 (no), 6A.

11. Did the monkey pour water on the pig?
12. Did the bear spray the tiger?
13. Did the monkey point to the mouse?

[in 14-16 the plural subjects perform the action on themselves]

14. Did the pigs wash the baby tigers?
15. Did the mice wash the giraffes?
16. Did the monkeys point to the parrots?

[in 17-19 the singular subjects perform the action on themselves]

17. Did the mouse wash the giraffe?
18. Did the monkey point to the parrot?
19. Did the pig point to the mouse?

[miscellaneous simple "no" fillers]

20. Did the parrot climb the ladder?
21. Did the tiger hold the balloons?
22. Did the parrot hold the ice cream cone?
23. Did the tiger hold the apple?
24. Did the monkeys hold the balloons?
25. Did the giraffe hold the carrot?
26. Did the bear spray the monkey?
27. Did the giraffe wash the mouse?
28. Did the elephant tickle the pig?
29. Did the monkey wipe the glasses?
30. Did the pig drink the juice?

Spreading fillers (31-34)

31. Did every parrot brush an elephant?
32. Did all the parrots brush an elephant?
33. Did every mouse tickle a giraffe?
34. Did all the mice tickle a giraffe?

Quantifier fillers (35-46)

35. Did every bear spray the pig?	[no]
36. Did every bear spray the pig?	[yes]
37. Did all the bears spray the pig?	[no]
38. Did all the bears spray the pig?	[yes]
39. Did every parrot brush the elephant?	[no]
40. Did every parrot brush the elephant?	[yes]
41. Did all the parrots brush the elephant?	[no]
42. Did all the parrots brush the elephant?	[yes]
43. Did every mouse tickle the giraffe?	[no]
44. Did every mouse tickle the giraffe?	[yes]
45. Did all the mice tickle the giraffe?	[no]
46. Did all the mice tickle the giraffe?	[yes]

Appendix C: Part 3 Experimental Sentences[4]

Section 1

Picture 1 A-->B

Q1 Did the bear spray the baby tiger?
Q2 Did the bear spray him?
Q3 Did he spray the baby tiger?
Q4 Did the baby tiger spray the bear?

Picture 2 A< B

Q5 Did the elephant brush the tiger?
Q6 Did the elephant brush him?
Q7 Did the tiger brush the elephant?

Section 2

Picture 3

```
A-->
A-->   B
A-->
```

Q8 Did every mouse tickle the giraffe?
Q9 Did all the mice tickle the giraffe?
Q10 Did the mice tickle the giraffe?

Picture 4

```
A-->
A-->  B

A
```

Q11 Did every parrot brush the elephant?
Q12 Did all the parrots brush the elephant?
Q13 Did the parrots brush the elephant?

---

[4]The order of presentation of pictures was 1, 2, 8A, 7A, 4, 3, 8B, 9A, 7B, 9B, 6, 10B, 5, 10A.

Section 3

Picture 5

B[5]
A --> B
B

Q14 Did the monkey spray every bear?
Q15 Did the monkey spray all the bears?
Q16 Did the monkey spray the bears?

Picture 6

B[6]
A--> B

B

Q17 Did the bear spray every baby tiger?
Q18 Did the bear spray all the baby tigers?
Q19 Did the bear spray the baby tigers?

Section 4

Picture 7

A--> B
A--> B
A--> B

picture 7 A

Q20 Did the mice wash him?
Q21 Did the mice wash them?
Q22 Did a mouse wash the giraffes?
Q23 Did he wash the giraffes?
Q24 Did they wash the giraffes?

picture 7 B

Q25 Did every bear spray a baby tiger?
Q26 Did every bear spray them?
Q27 Did every bear spray him?
Q28 Did every bear spray every baby tiger?
Q29 Did all the bears spray all the baby tigers?

picture 7 C

Q30 Did an elephant brush every tiger?
Q31 Did they brush every tiger?
Q32 Did he brush every tiger?
Q33 Did the elephants brush the tigers?
Q34 Did the elephants brush a tiger?

[5] A is spraying all three Bs.

[6] A is spraying two out of three Bs.

Section 5

Picture 8

A< B
A< B
A< B

picture 8 A

Q35 Did every bear spray him?
Q36 Did every bear spray them?
Q37 Did all the bears spray him?

picture 8 B

Q38 Did the elephants brush him?
Q39 Did the elephants brush them?
Q40 Did all the elephants brush them?

Section 6

Picture 9

A--> B
A--> B
A

picture 9 A

Q41 Did a parrot brush every elephant?
Q42 Did they brush every elephant?
Q43 Did he brush every elephant?

picture 9 B

Q44 Did a mouse tickle the giraffes?
Q45 Did they tickle the giraffes?
Q46 Did he tickle the giraffes?

Section 7

Picture 10

A--> B
A--> B

B

picture 10 A

Q47 Did every parrot brush an elephant?
Q48 Did every parrot brush them?
Q49 Did every parrot brush him?

picture 10 B

Q50 Did the mice tickle a giraffe?
Q51 Did the mice tickle them?
Q52 Did the mice tickle him?

Appendix D: Number Test Results for Individual Sentences

Adults and Children Responding Correctly to Each Sentence

item

Object Pronouns	picture type	adults		children	
A1	MATCH	95%	(21/22)	91%	(52/57)
A2	MATCH	82%	(18/22)	93%	(53/57)
A3	MATCH	91%	(20/22)	93%	(53/57)
A4	MATCH	73%	(16/22)	91%	(52/57)
A5	MISMATCH	100%	(22/22)	72%	(41/57)
A6	MISMATCH	100%	(22/22)	72%	(41/57)
A7	MISMATCH	100%	(22/22)	65%	(37/57)
A8	MISMATCH	100%	(22/22)	79%	(45/57)
Subject Pronouns					
B1	MATCH	91%	(20/22)	91%	(52/57)
B2	MATCH	68%	(15/22)	96%	(55/57)
B3	MATCH	86%	(19/22)	93%	(53/57)
B4	MATCH	73%	(16/22)	96%	(55/57)
B5	MISMATCH	100%	(22/22)	68%	(39/57)
B6	MISMATCH	100%	(22/22)	65%	(37/57)
B7	MISMATCH	100%	(22/22)	65%	(37/57)
B8	MISMATCH	100%	(22/22)	75%	(43/57)
Possessive Pronouns					
C1	MATCH	82%	(18/22)	82%	(47/57)
C2	MATCH	73%	(16/22)	91%	(52/57)
C3	MATCH	77%	(17/22)	70%	(40/57)
C4	MATCH	77%	(17/22)	65%	(37/57)
C5	MISMATCH	95%	(21/22)	63%	(36/57)
C6	MISMATCH	95%	(21/22)	54%	(31/57)
C7	MISMATCH	100%	(22/22)	88%	(50/57)
C8	MISMATCH	91%	(20/22)	68%	(39/57)

Appendix E: Secondary Findings for Part 2

Results from thirty children and twenty-two adults can be included for Part 2. These subjects all passed the object pronoun section of the number pretest and demonstrated an understanding of the universal nature of the quantifiers **every** and **all**.[7]

The children were nine boys and twenty-one girls, ranging in age from 3;4 to 9;5 (mean age 6;2). Children's ages and identifying codes are given in (E1).

(E1) Children's Ages in Part 2

below 5:	3;4	ET
	3;9	AE
five-year-olds:	5;1	AM
	5;4	EW, AL
	5;5	AT, TM
	5;7	KV, KY
	5;10	CZ
	5;11	EB, AG, JG
six-year-olds:	6;0	KL
	6;1	CS, CA, MT
	6;3	JE
	6;5	CM
	6;7	VN
	6;9	KB
	6;10	EC
	6;11	RR
seven-year-olds:	7;0	CQ, BH
	7;1	MM
	7;3	JF
	7;7	TO
	7;9	JS
over 8:		
	9;5	JR

The mean overall percentages of correct acceptances, correct rejections, and total correct responses for children and adults are

[7]Four subjects (ages 3;9, 5;3, 5;4 and 6;5) were excluded from Part 2 and Part 3 because they failed on the quantifier fillers in Part 2.

given in (E2).

(E2) Overall Responses for Part 2

	Correct Acceptances	Correct Rejections	Total Correct
Children	86%	63%	73%
Adults	90%	93%	92%

Differences between child and adult correct acceptances were not significant. However, differences between child and adult correct rejections and child and adult total correct responses were both highly significant ($p<.001$).[8]

E.1 Order Effects

Items in Part 2 were presented in one of two orders. Fifteen children responded to items from Form 1, with an overall average of 71% correct[9]; fourteen children responded to items from Form 2, with an overall average of 74% correct.[10] Additionally, there were twelve adults who responded to items from Form 1, with an overall average of 94% correct; ten adults responded to Form 2, with an overall average of 90% correct. For both adults and children, ANOVAs on the overall number

[8]For correct acceptance, $F(1,50) = 2.018$, $p=.162$. For correct rejection, $F(1,50) = 22.588$, $p<.001$. For total correct, $F(1,50) = 35.286$, $p<.001$.

[9]The overall correct score was obtained by adding together the acceptance of items 1, 3, 4, 5, 7, 8, 9, 17, 18 and 19 and the rejection of items 2, 6, 10, 11, 12, 13, 14, 15, 16, 20, 21, 22, 23, for a possible total of 69 (three tokens of each item).

Note that item 8 (e.g. "Did every monkey cut their hair?" with the distributive interpretation) was counted as correct, in spite of prescriptive grammar. Among adults, item 8 was accepted 85% of the time, and no adult rejected all three tokens of item 8. For related results, see Newman (1993).

[10]One child, TO, responded to items presented in a mixed order. His results are not included in these calculations of the effect of order.

of correct responses by form were not significant.[11]

E.2 Sex Effects

There were no significant differences based on sex in Part 2. Nine boys were included in Part 2, with an overall average of 80% correct; twenty-one girls were included, with an overall average of 70% correct. For adults, there were seven men, with an overall average of 94% correct, and fifteen women, with an overall average of 91% correct. ANOVAs on these comparisons were not significant for children or for adults.[12]

E.3 Effects of Verb Type

There were two different sets of verbs. One set consisted of the verbs **spray**, **brush**, and **pour (water) on** for sentences with object or reflexive pronouns[13], and the other set consisted of the verbs **cut (his/their hair)**, **wipe (his/their glasses)**, and **drink (his/their juice)** for sentences with possessive pronouns.[14] There were some significant differences based on verb in the second set of verbs, but not in the first.

For the first set of verbs (**spray**, **brush**, and **pour (water) on**),

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[11]For children, $F(1,27) = .332$, $p = .569$. For adults, $F(1,20) = 1.434$, $p = .245$.

[12]For children, $F(1,28) = 3.952$, $p = .057$. For adults, $F(1,20) = .812$, $p = .378$.

[13]These included items 1, 2, 3, 4, 5, 6, 10, 11, 12, 13, 14, 15, 19, 20, 21, 22, and 23.

[14]These were items 7, 8, 9, 16, 17, and 18.

there were no significant differences in adult acceptance or in adult correct responses. There was a total of 374 adult responses to each of these verbs. Adults accepted items with **spray** 31% of the time, accepted items with **brush** 32% of the time, and accepted items with **pour (water) on** 36% of the time. Adults responded to items with **spray** correctly 97% of the time, responded to items with **brush** correctly 95% of the time, and responded to items with **pour (water) on** correctly 93% of the time.[15]

For children, there were also no significant differences in either acceptance or correctness of responses to these items. There was a total of 510 child responses to each of these verbs. Children accepted items with **spray** 47% of the time, items with **brush** 52% of the time, and items with **pour (water) on** 58% of the time. With respect to children's correctness with these items, responses to **spray** were correct 76% of the time, responses to **brush** were correct 72% of the time, and responses to **pour (water) on** were correct 67% of the time.[16]

For the second set of verbs (**cut (his/their hair)**, **wipe (his/their glasses)**, and **drink (his/their juice)**), there were some differences. There was a total of 132 adult responses for each of these verbs. Adults accepted items with **cut** 61% of the time, items with **wipe** 78% of the time, and items with **drink** 78% of the time. With respect to adults' correctness with these items, responses to **cut** were correct 73% of the

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[15]Responses to the three verbs were compared with univariate MANOVAs. For adult acceptance, $F(2,63) = 1.12$, $p=.333$. For adult correct responses, $F(2,63) =.86$, $p=.430$.

[16]For child acceptance, $F(2,87) = 1.97$, $p=.145$. For child correct responses, $F(2,87) = 1.15$, $p=.322$.

time, responses to **wipe** were correct 87% of the time, and responses to **drink** were correct 87% of the time. In both cases, these differences were significant.[17]

For child acceptance of these verbs, there were no significant differences, but for child correct responses the differences were significant. There was a total of 180 child responses for each of these verbs. Children accepted items with **cut** 67% of the time, items with **wipe** 74% of the time, and items with **drink** 83% of the time. With respect to children's correctness with these items, responses to **cut** were correct 68% of the time, responses to **wipe** were correct 77% of the time, and responses to **drink** were correct 83% of the time.[18]

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[17]For adult acceptance of these verbs, $F(2,63) = 6.42$, $p<.005$. For adult correct responses, $F(2,63) = 3.97$, $p<.05$.

[18]For child acceptance of these verbs, $F(2,87) = 2.39$, $p=.098$. For child correct responses, $F(2,87) = 3.69$, $p<.05$.

Appendix F: Secondary Findings for Part 3

In Part 3, there was a total of fifty-two questions.[19] Subjects were shown fifteen different pictures, and asked from three to five questions for each picture. There was only one token of each sentence type. When a subject responded "no" to a question, he or she was asked "Why not?".

The data from twenty-four children and twenty-two adults can be included for Part 3.[20] The children ranged in age from 3;4 to 7;7[21] (mean age 5;10). Subjects' age data are repeated in (F1), adjusted to their age when they participated in Part 3.

(F1) Children's Ages in Part 3

below 5:	3;4	ET (partial data)
	3;9	AE (partial data)
five-year-olds:	5;1	AM
	5;4	EW, AL
	5;5	AT, TM
	5;7	KV, KY
	5;11	CZ, EB, AG
six-year-olds:	6;1	JG, KL, CA, MT
	6;2	CS
	6;3	JE
	6;5	CM
	6;7	VN
	6;11	RR

[19] Two adults and eleven children were asked an additional twelve pilot questions (with four additional pictures), which were added on at the end of Part 3. These additional questions tested bound distributive interpretations and **every/a** quantifier spreading, with variations in the pictures. These questions will not be discussed further here.

[20] However, for the two youngest children, ET and AE, only partial data is available.

[21] Recall that some subjects participated in Part 3 about a month and a half after Part 2. In addition, there were six children (KB, EC, CQ, JF, JS, and JR) who participated in Part 2 but could not be included in Part 3.

seven-year-olds:	7;2	BH, MM
	7;7	TO

There were no differences based on sex in Part 3. Six boys and eighteen girls were included. Chi-square tests on crosstabulations of acceptance of each individual question showed no significant differences between boys and girls. For adults, as in the previous sections, there were seven men and fifteen women. Again, Chi-square tests on crosstabulations of acceptance of each individual question by sex showed no significant differences.

Section 1 in Part 3 was a warm-up to the task. Q1, Q4, Q5, and Q7 were all simple questions containing no pronouns. Q1 was correctly accepted by 100% of both adults and children. Q4, which reversed the subject and object in the sentence relative to the picture, was correctly rejected by 100% of both adults and children. Q5 and Q7 went with a picture which showed a reflexive action (an elephant brushing himself). Q5, "Did the elephant brush the tiger?", was correctly rejected by 96% of children and 100% of adults; Q7, "Did the tiger brush the elephant?", was correctly rejected by 100% of children and adults.

Appendix G: Comparison of Results from Part 2 and Part 3

Some of the questions in Part 3 duplicate those in Part 2. There are five areas of overlap: simple sentences with pronouns, simple sentences with quantifiers, outside distributive interpretations with **him** and **them**, bound distributive cases with pronouns, and cases of quantifier spreading.

The simple sentences with quantifiers are sentences such as "Did all the mice tickle the giraffe?", where either three out of three mice tickled the giraffe, or two out of three mice tickled the giraffe. These are tested by Q8, Q9, Q11 and Q12 in Part 3, and by the quantifier fillers in Part 2. These results are discussed in Section 5.2.3.

The simple sentences with pronouns are sentences like, "Did the bear spray him?", where the bear either sprayed a baby tiger (item 5 in Part 2, Q2 in Part 3) or the bear sprayed himself (item 6 in Part 2, Q6 in Part 3). These results are discussed in Section 5.2.4.1 and below.

The outside distributive interpretations with **him** and **them** were tested by items 19 and 20 in Part 2, and Q21 and Q20 in Part 3. These results are discussed in Section 5.2.5.1.

Recall that in Part 2 there were three tokens of each item, while in Part 3, there was only one token of each item. Here I compare the identical sentence/picture pairs from Part 2 and Part 3, in order to see if the differences in task affected results. The results from paired samples t-tests on the means of acceptance for the children and adults who were included in both Parts 2 and 3[77] are shown in (G1) and (G2).

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[77]Recall that six children who were included in Part 2 were not available to be included in Part 3.

(G1) Comparison of Adult Results from Part 2 and Part 3[73]

Part 2 question	expected response	mean adult acceptance	Part 3 question	mean adult acceptance	t	2-tail probability
item 5A	accept	1.0000	Q2	.9545	-1.00	.329
item 6B	reject	.0909	Q6	.0909	.00	1.000
item 10A	reject	.0909	Q35	.1364	1.45	.162
item 11A	reject	.0455	Q36	.0000	-1.00	.329
item 13A	reject	.0000	Q37	.0455	1.00	.329
item 14B	reject	.0455	Q40	.0909	1.00	.329
item 21B	reject	.0000	Q38	.0455	1.00	.329
item 22B	reject	.0000	Q39	.0455	1.00	.329

(G2) Comparison of Child Results from Part 2 and Part 3[74]

Part 2 question	expected response	mean child acceptance	Part 3 question	mean child acceptance	t	2-tail probability
item 5A	accept	.8750	Q2	.7083	-1.70	.103
item 6B	reject	.4167	Q6	.5417	1.00	.328
item 10	reject	.3750	Q35	.5417	1.70	.103
item 11A	reject	.4583	Q36	.2500	-1.55	.135
item 13A	reject	.4167	Q37	.5000	1.00	.328
item 14B	reject	.3333	Q40	.6250	3.08	.005
item 21B	reject	.3750	Q38	.4167	.37	.714
item 22B	reject	.5417	Q39	.4583	.37	.714

Because of the lack of fillers in Part 3, we might expect performance there to be worse than in Part 2. However, none of the paired t-tests of adult means for Part 2 and Part 3 were significant, and the paired t-tests of child means for Part 2 and Part 3 were significant for only one cases: item 14B/Q40 ($p<.005$). These items tested the bound distributive interpretation with **all** and **them** (e.g., the picture showed three elephants, each spraying himself, and the question was "Did all the elephants brush them?"). As we might expect, Q40B (in Part 3) was incorrectly accepted significantly more often than item 14B (in Part 2).

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[73]df = 21.

[74]df = 23.

Appendix H: Individual Results for Possessive Pronoun Sentences

H1: adults

Numbers of Acceptances of Possessive Pronoun Sentences

subject	every-his (dist.[a]) (item 7)	every-their (dist.) (item 8)	every-their (coll.[b]) (item 9)	*Xs-his (dist.) (item 16)	Xs-their (dist.) (item 17)	Xs-their (coll.) (item 18)
DU	3/3	2/3	1/3	0/3	3/3	3/3
BC	3/3	3/3	3/3	0/3	3/3	3/3
KK	3/3	3/3	3/3	0/3	3/3	2/3
KP	3/3	2/3	2/3	1/3	0/3	1/3
AM	1/3	1/3	1/3	0/3	0/3	1/3
RM	3/3	3/3	3/3	1/3	3/3	3/3
SG	3/3	3/3	3/3	0/3	3/3	3/3
HL	3/3	3/3	3/3	1/3	3/3	3/3
XG	3/3	3/3	3/3	2/3	3/3	3/3
JR	3/3	3/3	2/3	0/3	3/3	2/3
DY	2/3	2/3	3/3	0/3	2/3	2/3
MP	2/3	3/3	2/3	1/3	3/3	3/3
JG	3/3	3/3	2/3	1/3	2/3	2/3
MB	3/3	2/3	2/3	0/3	2/3	3/3
JC	3/3	1/3	2/3	0/3	2/3	1/3
BY	2/3	2/3	3/3	0/3	3/3	3/3
CC	3/3	1/3	3/3	3/3	2/3	2/3
PK	3/3	3/3	2/3	1/3	2/3	3/3
RL	3/3	3/3	3/3	0/3	3/3	1/3
PX	3/3	3/3	2/3	2/3	1/3	3/3
MR	2/3	3/3	3/3	0/3	3/3	2/3
DD	3/3	3/3	3/3	0/3	3/3	3/3

Results of 2 group t-tests comparing adult and child acceptance

	adult mean	child mean	t	df	p
item 7	2.7273	2.2000	-2.50	47.59	**p<.05**
item 8	2.5000	2.4000	- .44	50	p=.661
item 9	2.4545	2.5667	.62	50	p=.539
item 16	.5909	1.4000	2.76	50	**p<.01**
item 17	2.3636	2.3667	.01	50	p=.990
item 18	2.3636	2.5667	.99	50	p=.325

---

[a]Dist. = distributive

A.<   .B
A.<   .B
A.<   .B

[b]Coll. = collective

A| |B
A| .< . |B
A| |B

Appendix H: Individual Results for Possessive Pronoun Sentences

H2: children

Numbers of Acceptances of Possessive Pronoun Sentences

subject (age)	**every-his** (dist.[77]) (item 7)	**every-their** (dist.) (item 8)	**every-their** (coll.[78]) (item 9)	***Xs-his** (dist.) (item 16)	**Xs-their** (dist.) (item 17)	**Xs-their** (coll.) (item 18)
ET (3;4)	1/3	1/3	2/3	1/3	2/3	2/3
AE (3;9)	1/3	2/3	3/3	0/3	3/3	3/3
AM (5;1)	3/3	3/3	3/3	2/3	3/3	2/3
AL (5;4)	2/3	2/3	3/3	1/3	1/3	3/3
EW (5;4)	3/3	3/3	3/3	1/3	3/3	3/3
TM (5;5)	2/3	3/3	3/3	3/3	2/3	3/3
AT (5;5)	3/3	3/3	2/3	1/3	1/3	2/3
KV (5;7)	3/3	3/3	3/3	3/3	3/3	3/3
KY (5;7)	3/3	3/3	3/3	2/3	3/3	3/3
CZ (5;10)	3/3	3/3	3/3	2/3	3/3	3/3
EB (5;11)	2/3	2/3	2/3	1/3	2/3	2/3
AG (5;11)	3/3	3/3	3/3	3/3	3/3	3/3
JG (5;11)	3/3	3/3	3/3	3/3	3/3	3/3
KL (6;0)	3/3	3/3	3/3	2/3	3/3	3/3
CS (6;1)	3/3	3/3	2/3	2/3	3/3	2/3
MT (6;1)	2/3	2/3	3/3	2/3	2/3	2/3
CA (6;1)	3/3	3/3	3/3	3/3	3/3	3/3
JE (6;3)	0/3	1/3	2/3	0/3	1/3	3/3
CM (6;5)	2/3	3/3	3/3	1/3	2/3	3/3
VN (6;7)	3/3	2/3	3/3	3/3	2/3	3/3
KB (6;9)	0/3	0/3	1/3	0/3	0/3	1/3
EC (6;10)	2/3	3/3	2/3	0/3	3/3	3/3
RR (6;11)	3/3	3/3	3/3	3/3	3/3	3/3
CQ (7;0)	1/3	1/3	2/3	0/3	1/3	1/3
BH (7;0)	3/3	3/3	2/3	2/3	3/3	3/3
MM (7;1)	2/3	2/3	3/3	0/3	3/3	3/3
JF (7;3)	1/3	2/3	2/3	0/3	2/3	2/3
TO (7;7)	1/3	1/3	1/3	1/3	2/3	1/3
JS (7;9)	3/3	3/3	3/3	0/3	3/3	3/3
JR (9;5)	2/3	3/3	3/3	0/3	3/3	3/3

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[77] Dist. = distributive

```
A.<     .B
A.<     .B
A.<     .B
```

[78] Coll. = collective

```
A|        |B
A| .<   . |B
A|        |B
```

Appendix I: Individual Results for Pronoun Sentences

I1: Adults

Numbers of Incorrect Acceptances

subject	local him[29] (item 6/Q6)	every-them (coll.[30]) (item 12)	all-them (coll.) (item 15)	Xs-them (coll.) (item 23)
DU	0/4	0/3	0/3	0/3
BC	0/4	0/3	0/3	0/3
KK	**3/4**	**1/3**	**1/3**	**1/3**
KP	0/4	0/3	0/3	0/3
AM	0/4	0/3	0/3	0/3
RM	0/4	0/3	0/3	0/3
SG	0/4	0/3	0/3	0/3
HL	0/4	0/3	0/3	0/3
XG	**2/4**	**3/3**	**2/3**	**2/3**
JR	0/4	0/3	0/3	0/3
DY	0/4	0/3	0/3	0/3
MP	0/4	0/3	0/3	0/3
JG	0/4	0/3	0/3	0/3
MB	0/4	0/3	0/3	0/3
JC	0/4	0/3	**1/3**	0/3
BY	0/4	0/3	0/3	0/3
CC	0/4	0/3	0/3	0/3
PK	0/4	0/3	0/3	0/3
RL	0/4	0/3	0/3	0/3
PX	0/4	0/3	0/3	0/3
MR	0/4	0/3	0/3	0/3
DD	0/4	0/3	0/3	0/3

Results of 2 group t-tests comparing adult and child acceptance

	adult mean	child mean	t	df	p
item 6/Q6	.2273	1.5833	4.26	36.62	**p<.001**
item 12	.1818	1.1667	4.05	50	**p<.001**
item 15	.1818	1.1333	4.47	44.81	**p<.001**
item 23	.1364	1.1667	4.54	41.27	**p<.001**

---

[29] A< B

[30] Coll. = collective

A| B
A|< B
A| B

Appendix I: Individual Results for Pronoun Sentences

I1: Adults-continued

Numbers of Incorrect Acceptances

subject	every-them (dist.[31]) (it[32]11/Q36)	all-them (dist.) (it14/Q40)	Xs-them (dist.) (it22/Q39)	every-him (dist.) (it10/Q35)	all-him (dist.) (it13/Q37)	Xs-him (dist.) (it21/Q38)
DU	0/4	0/4	0/4	0/4	0/4	0/4
BC	0/4	**2/4**	0/4	0/4	0/4	0/4
KK	0/4	**1/4**	0/4	**3/4**	**1/4**	0/4
KP	0/4	0/4	0/4	0/4	0/4	0/4
AM	0/4	0/4	0/4	0/4	0/4	0/4
RM	0/4	0/4	0/4	0/4	0/4	0/4
SG	0/4	**2/4**	0/4	0/4	0/4	0/4
HL	0/4	0/4	0/4	**1/4**	0/4	0/4
XG	**2/4**	**3/4**	**2/4**	**4/4**	**2/4**	**1/4**
JR	0/4	0/4	0/4	0/4	0/4	0/4
DY	**1/4**	0/4	0/4	0/4	**1/4**	0/4
MP	0/4	0/4	0/4	0/4	0/4	0/4
JG	0/4	0/4	0/4	0/4	0/4	0/4
MB	0/4	0/4	0/4	0/4	0/4	0/4
JC	0/4	0/4	0/4	0/4	0/4	0/4
BY	0/4	0/4	0/4	0/4	0/4	0/4
CC	0/4	0/4	0/4	**2/4**	**2/4**	**1/4**
PK	0/4	0/4	0/4	0/4	0/4	0/4
RL	0/4	0/4	0/4	0/4	0/4	0/4
PX	0/4	0/4	0/4	0/4	0/4	0/4
MR	0/4	0/4	0/4	0/4	0/4	0/4
DD	**1/4**	0/4	0/4	0/4	0/4	0/4

Results of 2 group t-tests comparing adult and child acceptance

	adult mean	child mean	t	df	p
item 11/Q36	.1818	1.7917	5.44	29.69	p<.001
item 14/Q40	.3636	1.9583	4.58	37.49	p<.001
item 22/Q39	.0909	1.8750	5.86	27.43	p<.001
item 10/Q35	.4545	1.8750	3.71	44	p<.005
item 13/Q37	.2727	1.8750	5.09	32.66	p<.001
item 21/Q38	.0909	1.7500	5.37	24.97	p<.001

---

[31]Dist. = distributive A< B
A< B
A< B

[32]it = item

Appendix I: Individual Results for Pronoun Sentences

I2: Children

Numbers of Incorrect Acceptances

subject (age)[35]	local **him**[33] (item 6/Q6)	**every-them** (coll.[34]) (item 12)	**all-them** (coll.) (item 15)	**Xs-them** (coll.) (item 23)
ET (3;4)	0/4	0/3	0/3	1/3
AE (3;9)	2/4	1/3	1/3	3/3
AM (5;1)	1/4	1/3	2/3	1/3
AL (5;4)	0/4	1/3	1/3	1/3
EW (5;4)	2/4	3/3	2/3	2/3
TM (5;5)	1/4	1/3	0/3	2/3
AT (5;5)	0/4	1/3	2/3	1/3
KV (5;7)	0/4	0/3	0/3	1/3
KY (5;7)	3/4	2/3	2/3	2/3
CZ (5;10)	3/4	1/3	2/3	2/3
EB (5;11)	1/4	1/3	1/3	0/3
AG (5;11)	3/4	3/3	3/3	3/3
JG (5;11)	4/4	2/3	2/3	3/3
KL (6;0)	4/4	3/3	1/3	2/3
CS (6;1)	1/4	1/3	1/3	0/3
MT (6;1)	0/4	1/3	0/3	0/3
CA (6;1)	3/4	3/3	3/3	3/3
JE (6;3)	0/4	0/3	0/3	0/3
CM (6;5)	1/4	1/3	1/3	1/3
VN (6;7)	2/4	2/3	2/3	2/3
KB (6;9)	0/3	0/3	0/3	0/3
EC (6;10)	0/3	0/3	0/3	0/3
RR (6;11)	3/4	2/3	2/3	3/3
CQ (7;0)	0/3	0/3	0/3	0/3
BH (7;0)	2/4	2/3	3/3	1/3
MM (7;1)	2/4	0/3	0/3	1/3
JF (7;3)	1/3	1/3	0/3	0/3
TO (7;7)	0/4	0/3	1/3	0/3
JS (7;9)	2/3	1/3	1/3	0/3
JR (9;5)	1/3	1/3	1/3	0/3

---

[33] A< B

[34] Coll. = collective

A| B
A|< B
A| B

[35] Age at the time of Part 2.

Appendix I: Individual Results for Pronoun Sentences

I2: Children-continued

Numbers of Incorrect Acceptances

subject (age)	every-them (dist.[*]) (it[?]11/Q36)	all-them (dist.) (it14/Q40)	Xs-them (dist.) (it22/Q39)	every-him (dist.) (it10/Q35)	all-him (dist.) (it13/Q37)	Xs-him (dist.) (it21/Q38)
ET (3;4)	1/4	0/4	1/4	0/4	0/4	0/4
AE (3;9)	1/4	3/4	2/4	2/4	2/4	0/4
AM (5;1)	0/4	1/4	0/4	2/4	2/4	1/4
AL (5;4)	0/4	0/4	0/4	1/4	1/4	0/4
EW (5;4)	2/4	4/4	2/4	3/4	2/4	3/4
TM (5;5)	2/4	2/4	3/4	1/4	2/4	3/4
AT (5;5)	2/4	1/4	3/4	3/4	3/4	2/4
KV (5;7)	0/4	1/4	1/4	2/4	1/4	1/4
KY (5;7)	2/4	3/4	3/4	2/4	2/4	3/4
CZ (5;10)	3/4	3/4	3/4	4/4	3/4	3/4
EB (5;11)	0/4	0/4	0/4	0/4	0/4	0/4
AG (5;11)	3/4	4/4	4/4	3/4	2/4	4/4
JG (5;11)	3/4	3/4	4/4	4/4	4/4	3/4
KL (6;0)	4/4	3/4	2/4	2/4	4/4	3/4
CS (6;1)	2/4	2/4	0/4	3/4	3/4	1/4
MT (6;1)	1/4	0/4	1/4	0/4	1/4	2/4
CA (6;1)	4/4	4/4	4/4	4/4	4/4	3/4
JE (6;3)	0/4	1/4	0/4	0/4	0/4	0/4
CM (6;5)	1/4	1/4	1/4	0/4	0/4	0/4
VN (6;7)	1/4	1/4	1/4	3/4	3/4	3/4
KB (6;9)	0/3	0/3	1/3	0/3	0/3	0/3
EC (6;10)	0/3	0/3	0/3	0/3	0/3	0/3
RR (6;11)	4/4	3/4	3/4	3/4	3/4	4/4
CQ (7;0)	0/3	0/3	0/3	0/3	0/3	0/3
BH (7;0)	3/4	4/4	4/4	3/4	3/4	3/4
MM (7;1)	3/4	3/4	2/4	0/4	0/4	0/4
JF (7;3)	0/3	0/3	1/3	0/3	0/3	0/3
TO (7;7)	1/4	0/4	1/4	0/4	0/4	0/4
JS (7;9)	1/3	1/3	1/3	1/3	1/3	0/3
JR (9;5)	2/3	0/3	0/3	0/3	0/3	0/3

[*]Dist. = distributive   A<   B
A<   B
A<   B

[?]it = item

Appendix J: Individual Results for Unbound Pronoun Sentences

J1: Adults

Numbers of Acceptances

subject	**him** (item5/Q2)	dist. **them** (item19/Q21)	every dist. **him** (item20/Q20)	spread-picture dist. **him** (Q27)	every-**him** (Q49)
DU	4/4	4/4	0/4	0/1	0/1
BC	4/4	4/4	0/4	0/1	0/1
KK	4/4	4/4	1/4	1/1	1/1
KP	4/4	2/4	0/4	0/1	0/1
AM	4/4	4/4	0/4	0/1	0/1
RM	4/4	4/4	0/4	1/1	0/1
SG	4/4	3/4	0/4	0/1	0/1
HL	4/4	4/4	0/4	0/1	0/1
XG	4/4	4/4	3/4	0/1	0/1
JR	3/4	3/4	0/4	0/1	0/1
DY	4/4	4/4	0/4	0/1	0/1
MP	4/4	4/4	2/4	0/1	0/1
JG	4/4	4/4	0/4	0/1	0/1
MB	4/4	4/4	0/4	0/1	0/1
JC	4/4	4/4	1/4	0/1	0/1
BY	4/4	4/4	0/4	0/1	0/1
CC	4/4	4/4	1/4	0/1	0/1
PK	4/4	4/4	0/4	0/1	0/1
RL	4/4	4/4	0/4	0/1	0/1
PX	4/4	4/4	1/4	1/1	1/1
MR	4/4	4/4	0/4	0/1	0/1
DD	4/4	4/4	0/4	0/1	0/1
	A-->B	A--> B	A--> B	A--> B	A--> B
		A--> B	A--> B	A--> B	A--> B
		A--> B	A--> B	A--> B	
					B

Results of 2 group t-tests comparing adult and child acceptance

	adult mean	child mean	t	df	p
item 5/Q2	3.9545	3.2083	-3.37	25.01	**p<.005**
item 19/Q21	3.8182	3.2609	-2.28	43	**p<.05**
item 20/Q20	.4091	2.1739	5.81	43	**p<.001**

Appendix J: Individual Results for Unbound Pronoun Sentences

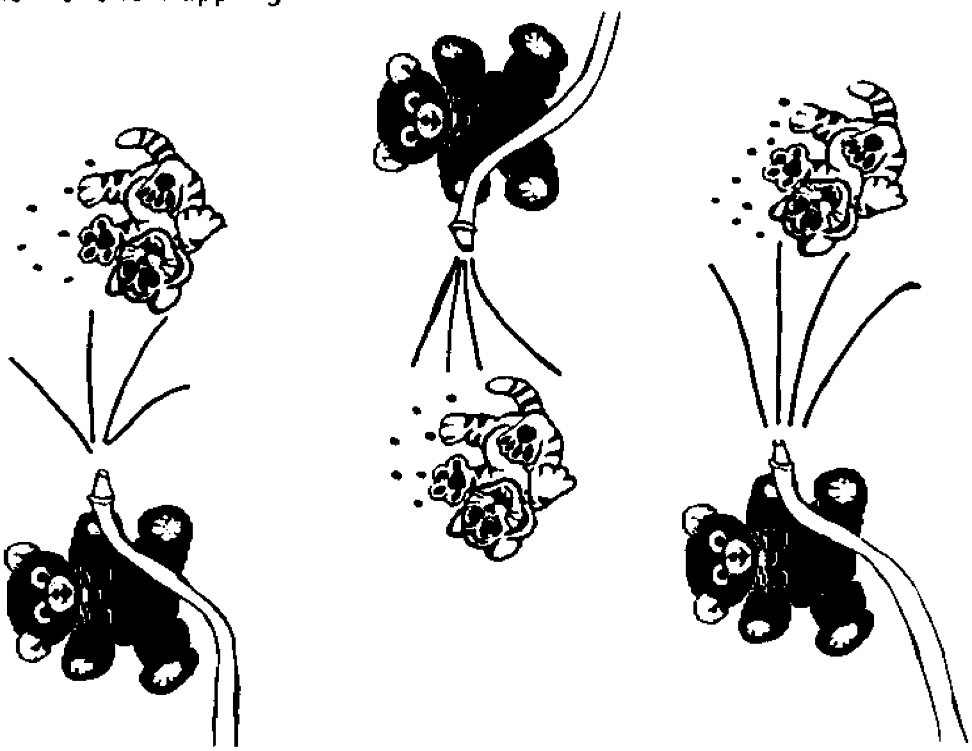
J2: Children

Numbers of Acceptances

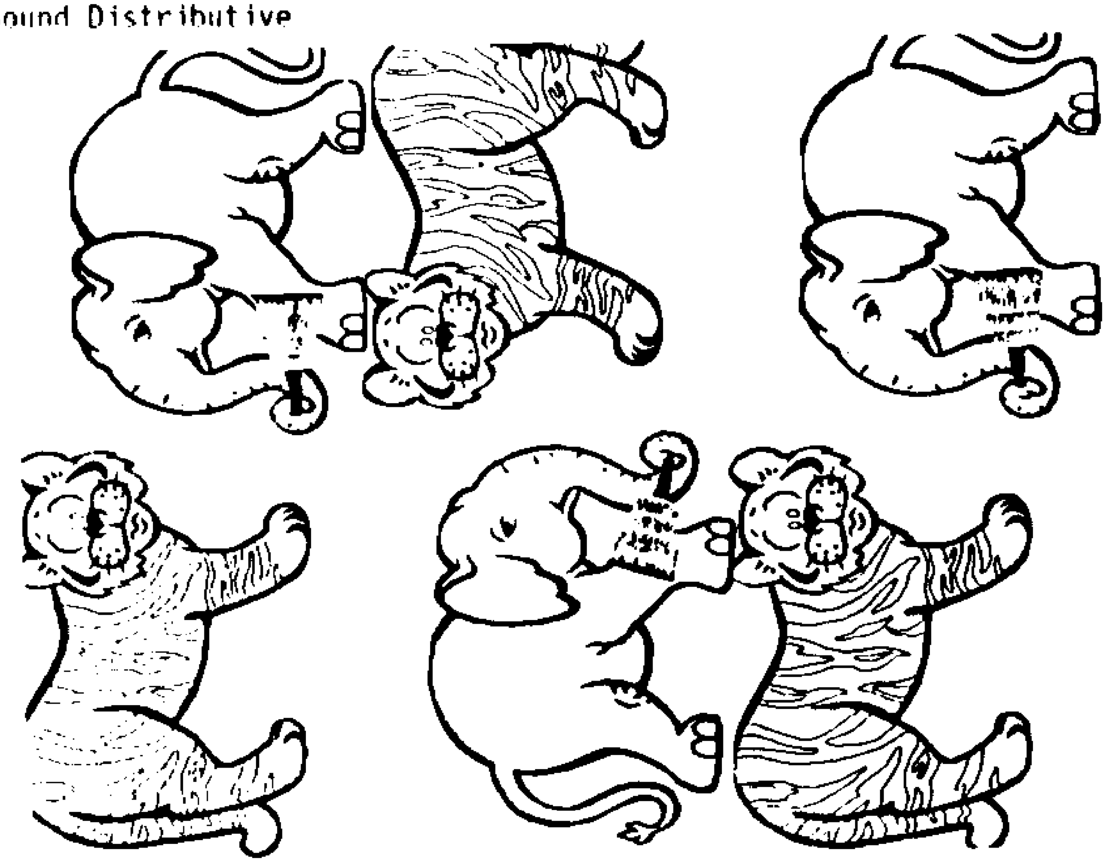
subject (age)	**him** (item5/Q2)	dist. **them** (item19/Q21)	dist. **him** (item20/Q20)	**every** dist. **him** (Q27)	spread-picture **every-him** (Q49)
ET (3;4)	4/4	3/3	3/3	1/1	---
AE (3;9)	4/4	3/4	3/4	1/1	1/1
AM (5;1)	3/4	4/4	4/4	1/1	0/1
AL (5;4)	4/4	4/4	4/4	1/1	0/1
EW (5;4)	3/4	4/4	3/4	1/1	0/1
TM (5;5)	4/4	3/4	2/4	1/1	1/1
AT (5;5)	4/4	4/4	3/4	1/1	1/1
KV (5;7)	4/4	4/4	3/4	0/1	0/1
KY (5;7)	3/4	3/4	1/4	1/1	0/1
CZ (5;10	2/4	3/4	1/4	1/1	0/1
EB (5;11)	4/4	4/4	0/4	0/1	---
AG (5;11)	1/4	0/4	2/4	1/1	1/1
JG (5;11)	4/4	4/4	3/4	0/1	0/1
KL (6;0)	1/4	3/4	2/4	1/1	0/1
CS (6;1)	4/4	3/4	2/4	1/1	0/1
MT (6;1)	4/4	4/4	4/4	1/1	0/1
CA (6;1)	2/4	3/4	1/4	0/1	1/1
JE (6;3)	1/4	1/4	0/4	0/1	0/1
CM (6;5)	4/4	2/4	1/4	0/1	0/1
VN (6;7)	4/4	4/4	2/4	0/1	1/1
KB (6;9)	3/3	3/3	0/3	---	---
EC (6;10)	3/3	3/3	0/3	---	---
RR (6;11)	3/4	4/4	3/4	1/1	1/1
CQ (7;0)	3/3	3/3	1/3	---	---
BH (7;0)	4/4	4/4	3/4	1/1	0/1
MM (7;1)	3/4	3/4	1/4	0/1	1/1
JF (7;3)	3/3	2/3	0/3	---	---
TO (7;7)	3/4	4/4	2/4	1/1	0/1
JS (7;9)	3/3	3/3	0/3	---	---
JR (9;5)	3/3	3/3	0/3	---	---
	A--> B	A--> B	A--> B	A--> B	A--> B
		A--> B	A--> B	A--> B	A--> B
		A--> B	A--> B	A--> B	
					B

Appendix K: Sample Pictures

1. One-to-one Mapping

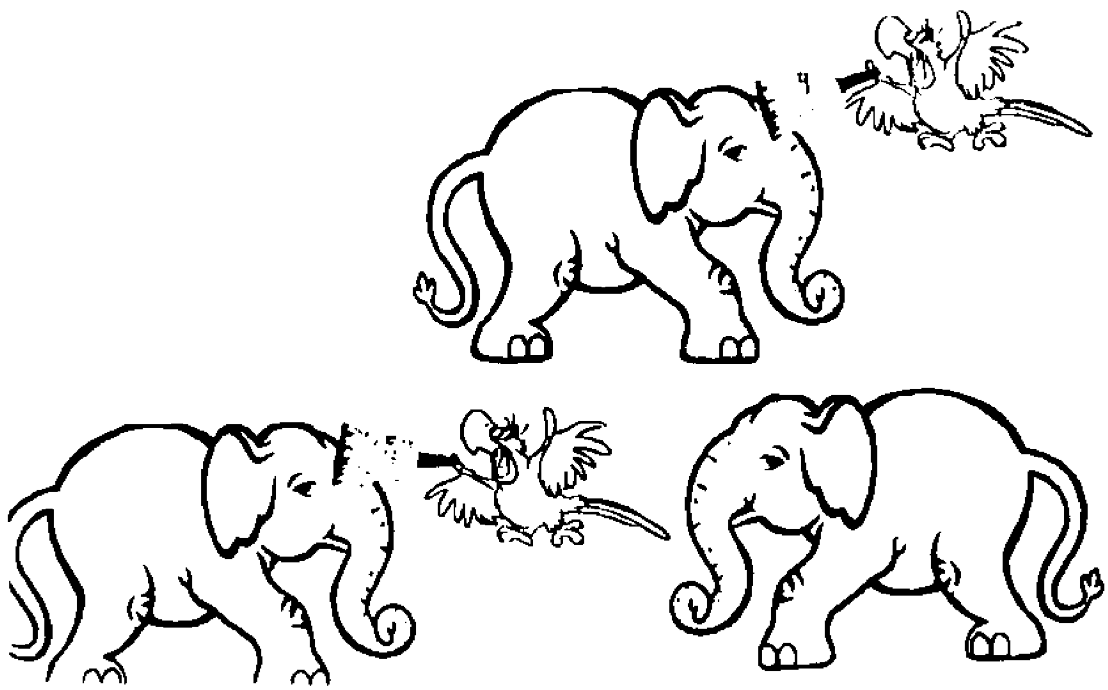


2. Bound Distributive

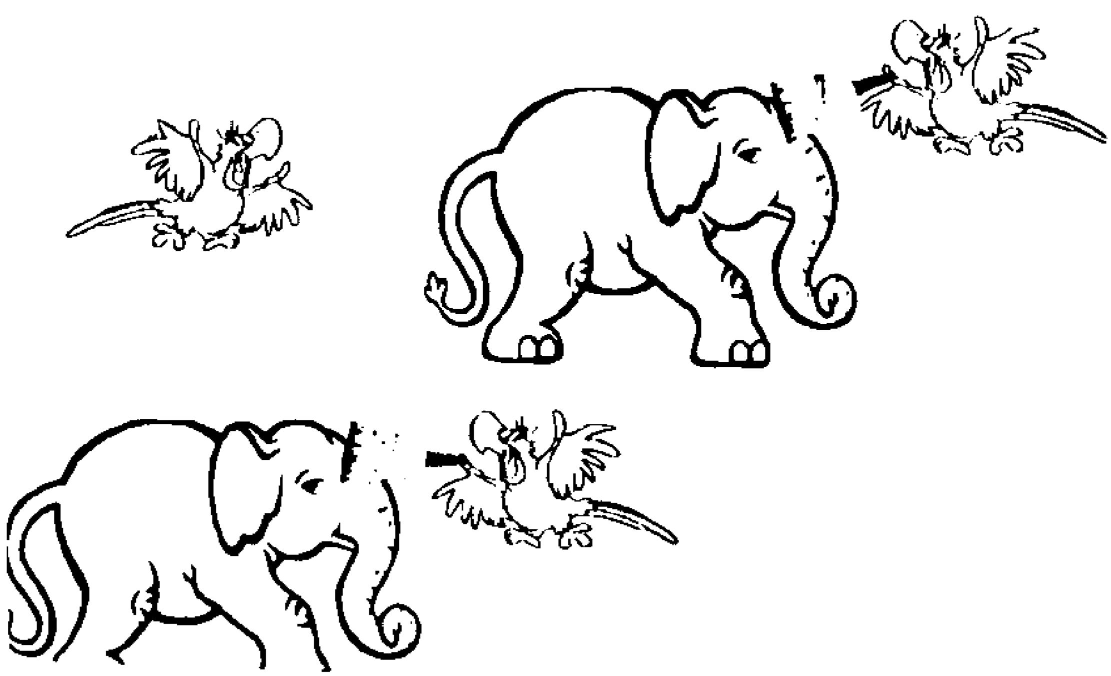


Appendix K: Sample Pictures

3. Every/A



4. A/Every



BIBLIOGRAPHY

Avrutin, S. (1994) Psycholinguistic Investigations in the Theory of Reference. Doctoral dissertation, MIT.

Avrutin, S. & Thornton, R. (1993) Distributive operator: evidence from binding in child grammars. Paper presented at the Linguistic Society of America Annual Meeting, Los Angeles, CA.

Avrutin, S. & Thornton, R. (1994) Distributivity and binding in child grammar. Linguistic Inquiry, 25, 165-171.

Avrutin, S. & Wexler, K. (1992) Development of Principle B in Russian: coindexation at LF and coreference. Language Acquisition, 2, 259-306.

Boster, C.T. (1991) Children's failure to obey Principle B: syntactic problem or lexical error? Ms., University of Connecticut, Storrs.

Brown, R. (1973) A First Language: The Early Stages. The Harvard University Press, Cambridge, MA.

Chien, Y.-C. & Wexler, K. (1987) Children's acquisition of the locality condition for reflexives and pronouns. Papers and Reports on Child Language Development, 26, 30-39.

Chien, Y.-C. & Wexler, K. (1988) Children's acquisition of binding principles. Paper presented at the Boston University Language Development Conference.

Chien, Y.-C. & Wexler, K. (1989) Children's knowledge of relative scope in Chinese. Papers and Reports on Child Language Development, 28, 72-80.

Chien, Y.-C. & Wexler, K. (1990) Children's knowledge of locality conditions in binding as evidence for the modularity of syntax and pragmatics. Language Acquisition, 1, 225-295.

Chien, Y.-C. & Wexler, K. (1991) Children's knowledge of pronouns as bound-variables in a long-distance context. Papers and Reports on Child Language Development, 30, 25-38.

Chierchia, G. & McConnell-Ginet, S. (1990) Meaning and Grammar: An Introduction to Semantics. The MIT Press, Cambridge, MA.

Chipman, H. & de Dardel, C. (1974) Developmental study of the comprehension and production of the pronoun "it". Journal of Psycholinguistic Research, 3, 91-99.

Chomsky, C. (1969) The Acquisition of Syntax in Children from 5 to 10. The MIT Press, Cambridge, MA.

Chomsky, N. (1981) Lectures on Government and Binding. Foris Publications, Dordrecht, The Netherlands.

Cooper, R. (1979) The interpretation of pronouns. In F. Heny & H. Schnelle (eds.) Syntax and Semantics, Volume 10, 61-92.

Crain, S., Thornton, R., Boster, C., Conway, L., Lillo-Martin, D. & Woodams, E. (1994) Quantification without qualification. Ms., University of Connecticut, Storrs & Haskins Laboratories.

Crain, S. & McKee, C. (1985) Acquisition of structural restrictions on anaphora. NELS, 16, 94-110.

Davidson, D. (1967) The logical form of action sentences. In N. Rescher (ed.), The Logic of Decision and Action, The University of Pittsburgh Press, Pittsburgh, PA.

De Mey, S. (1981) The dependent plural and the analysis of tense. NELS, 11, 58-78.

Deutsch, W., Koster, C. & Koster, J. (1986) What can we learn from children's errors in understanding anaphora? Linguistics, 24, 203-225.

Emslie, H. & Stevenson, R. (1981) Pre-school children's use of articles in definite and indefinite referring expressions. Journal of Child Language, 8, 313-328.

Enç, M. (1991) The semantics of specificity. Linguistic Inquiry, 22, 1-25.

Evans, G. (1980) Pronouns. Linguistic Inquiry, 11, 337-362.

Fiengo, R. & Lasnik, H. (1973) The logical structure of reciprocal sentences in English. Reprinted in H. Lasnik, Essays on Anaphora, Kluwer Academic Publishers, Dordrecht, The Netherlands, 37-57.

Fiengo, R. & May, R. (1994) Indices and Identity. The MIT Press, Cambridge, MA.

Fleiss, J. (1973) Statistical Methods for Rates and Proportions. John Wiley & Sons, New York.

Fodor, J.D. (1982) The mental representation of quantifiers. In S. Peters & E. Saarinen (eds.) Processes, Beliefs, and Questions, D. Reidel Publishing Company, Dordrecht, The Netherlands, 129-164.

Fodor, J.D. & Sag, I. (1982) Referential and quantificational indefinites. Linguistics and Philosophy, 5, 355-398.

Foley, C., del Prado, Z.N., Barbier, I. & Lust, B. (1992a) On the strong continuity hypothesis: a study of pronoun coindexing in sloppy identity. Paper presented at the Linguistic Society of America Annual Meeting, January, 1992, Philadelphia, PA.

Foley, C., del Prado, Z.N., Barbier, I. & Lust, B. (1992b) An LF representation of pronouns in VP ellipsis: an argument for UG in the initial state. Paper presented at the Boston University Conference on Language Development, October, 1992, Boston, MA.

Foster-Cohen, S. (1994) Exploring the boundary between syntax and pragmatics: relevance and the binding of pronouns. Journal of Child Language, 21, 237-255.

Gil, D. (1982) Quantifier scope, linguistic variation, and natural language semantics. Linguistics and Philosophy, 5, 421-472.

Grimshaw, J. & Rosen, S. (1990) Knowledge and obedience: the developmental status of the Binding Theory. Linguistic Inquiry, 21, 187-222.

Grodzinsky, Y. & Reinhart, T. (1993) The innateness of binding and the development of coreference: a reply to Grimshaw & Rosen. Linguistic Inquiry, 24, 69-101.

Grodzinsky, Y., Wexler, K., Chien, Y.-C., Marakovitz, S. & Solomon, J. (1993) The breakdown of binding relations. Brain and Language, 45, 396-422.

Heim, I. (1982) The Semantics of Definite and Indefinite Noun Phrases. Doctoral dissertation, University of Massachusetts, Amherst.

Heim, I. (1990) E-type pronouns and donkey anaphora. Linguistics and Philosophy, 13, 137-177.

Heim, I., Lasnik, H., and May, R. (1991) Reciprocity and plurality. Linguistic Inquiry, 22, 63-101.

Hestvik, A. (1992) LF movement of pronouns and antisubject orientation. Linguistic Inquiry, 23, 557-594.

Higginbotham, J. (1983) Logical form, binding, and nominals. Linguistic Inquiry, 14, 395-420.

Higginbotham, J. (1985) On semantics. Linguistic Inquiry, 16, 547-593.

Huang, J. (1982) Logical Relations in Chinese and the Theory of Grammar. Doctoral dissertation, MIT.

Hyams, N. & Sigurjónsdóttir, S. (1990) The development of "long-distance anaphora": a cross-linguistic comparison with special reference to Icelandic. Language Acquisition, 1, 57-93.

Jakubowicz, C. (1984) On markedness and binding principles. NELS, 14, 154-182.

Kadmon, N. (1987) On Unique and Non-Unique Reference and Asymmetric Quantification. Doctoral dissertation, University of Massachusetts, Amherst.

Kaufman, D. (1987) "Who's him?": Evidence for Principle B in children's grammar. Paper presented at the Boston University Language Development Conference.

Kaufman, D. (1988) Grammatical and Cognitive Interactions in the Study of Children's Knowledge of Binding Theory and Reference Relations. Doctoral dissertation, Temple University.

Koster, C. (1992) Problems with pronoun acquisition. Paper presented at the Symposium on Syntactic Theory and First Language Acquisition: Cross-Linguistic Perspectives, Cornell University.

Koster, C. (1993) Errors in Anaphora Acquisition. OTS Dissertation Series, Onderzoeksinstituut voor Taal en Spraak, Utrecht University, The Netherlands.

Kurtzman, H. & MacDonald, M. (1993) Resolution of quantifier scope ambiguities. Cognition, 48, 243-279.

Lasnik, H. & Crain, S. (1985) On the acquisition of pronominal reference. Lingua, 65, 135-154.

Lee, T. H. (1986) Acquisition of quantificational scope in Mandarin Chinese. Papers and Reports on Child Language Development, 25, 57-64.

Lee, T. H. (1991) Linearity as a scope principle for Chinese: the evidence from first language acquisition. In D. Napoli & J. Kegl (eds.) Bridges Between Psychology and Linguistics, Lawrence Erlbaum, Hillsdale, NJ, 183-206.

Lewis, D. (1975) Adverbs of quantification. In E. Keenan (ed.) Formal Semantics of Natural Language, Cambridge University Press, Cambridge, MA.

Link, G. (1983) The logical analysis of plurals and mass terms: a lattice-theoretical approach. In R. Bauerle, C. Schwarze & A. von Stechow (eds.) Meaning, Use, and Interpretation of Language, Walter de Gruyter, NY, 302-323.

Lombardi, L. & Sarma, J. (1989) Against the bound variable hypothesis of the acquisition of Principle B. Paper presented at the Linguistic Society of America Annual Meeting, Washington, DC.

Lust, B. (1981) Constraints on anaphora in child language: a prediction for a universal. In S. Tavakolian (ed.), Language Acquisition and Linguistic Theory, The MIT Press, Cambridge, MA, 74-96.

Maratsos, M. (1974) Preschool children's use of definite and indefinite articles. Child Development, 45, 446-455.

Maratsos, M. (1976) The Use of Definite and Indefinite Reference in Young Children: An experimental study of semantic acquisition. Cambridge University Press, Cambridge.

May, R. (1989) Interpreting logical form. Linguistics and Philosophy, 12, 387-435.

McDaniel, D., Cairns, H.S., & Hsu, J.R. (1990) Binding principles in the grammars of young children. Language Acquisition, 1, 121-139.

McDaniel, D. & Maxfield, T. (1992) Principle B and contrastive stress. Language Acquisition, 2, 337-358.

McKee, C. (1988) Italian Children's Mastery of Binding. Doctoral dissertation, University of Connecticut, Storrs.

McKee, C. (1992) A comparison of pronouns and anaphors in Italian and English acquisition. Language Acquisition, 2, 21-54.

Miyamoto, Y. (1992) The collective and distributive interpretation in child grammar. Ms., March 1992, University of Connecticut, Storrs.

Miyamoto, Y. (1993) A subject/object asymmetry and its implications for the theory of child grammar. Paper presented at the Sixth International Congress for the Study of Child Language.

Miyamoto, Y. & Crain, S. (1991) Children's interpretation of plural pronouns: collective vs. distributive interpretation. Paper presented at the Boston University Language Development Conference.

Montalbetti, M. (1984) After Binding: On the interpretation of pronouns. Doctoral dissertation, MIT.

Montalbetti, M. & Wexler, K. (1985) Binding is linking. WCCFL, 4, 228-245.

Munro, P. (1984) Floating quantifiers in Pima. Syntax and Semantics 16, Academic Press, NY.

Newman, M. (1993) A Theoretical and Descriptive Study of Epicene Pronouns: The Linguistics of a Prescriptive Problem. Doctoral dissertation, Teachers College, Columbia University, NY.

Philip, W. (1991) Spreading in the acquisition of universal quantifiers. In D. Bates, (ed.) WCCFL, 10, 359-373.

Philip, W. (1992) Distributivity and logical form in the emergence of universal quantification. In C. Barker & D. Dowty (eds.) Proceedings of the Second Conference on Semantics and Linguistic Theory, Ohio State University, 327-345.

Philip, W. (1994) Event Quantification in the Acquisition of Universal Quantification. Doctoral dissertation, University of Massachusetts, Amherst.

Philip, W. & Aurelio, S. (1991) Quantifier spreading: pilot study of preschooler's "every". In T. Maxfield & B. Plunkett (eds.), Papers in the Acquisition of WH: Proceedings of the UMASS Roundtable, May 1990, UMOP, 267-282.

Philip, W. & Coopmans, P. (1995a) Symmetrical interpretation and scope ambiguity in the acquisition of universal quantification in Dutch and English. Ms., February 1995, to appear in OTS Yearbook 1994, Onderzoeksinstituut voor Taal en Spraak, Utrecht University.

Philip, W. & Coopmans, P. (1995b) The role of the chain condition in the acquisition of anaphora. Ms., March 1995, Onderzoeksinstituut voor Taal en Spraak, Utrecht University.

Philip, W. & Takahashi, M. (1991) Quantifier spreading in the acquisition of every. In T. Maxfield & B. Plunkett (eds.), Papers in the Acquisition of WH: Proceedings of the UMASS Roundtable, May 1990, UMOP, 283-301.

Reinhart, T. (1983) Anaphora and Semantic Interpretation. The University of Chicago Press, Chicago, IL.

Reinhart, T. & Reuland, E. (1989) Anaphoric territories. Ms., Tel-Aviv University and Groningen University.

Reinhart, T. & Reuland, E. (1991) Anaphors and logophors: an argument structure perspective. In J. Koster & E. Reuland (eds.) Long-Distance Anaphora, Cambridge University Press, Cambridge, 283-321.

Reinhart, T. & Reuland, E. (1993) Reflexivity. Linguistic Inquiry, 24, 657-720.

Reuland, E. & ter Meulen, A. (eds.) (1987) The Representation of (In)definiteness. The MIT Press, Cambridge, MA.

Roberts, C. (1986) Modal Subordination, Anaphora and Distributivity. Doctoral dissertation, University of Massachusetts, Amherst.

Roeper, T. & de Villiers, J. (1991) The emergence of bound variable structures. In T. Maxfield & B. Plunkett (eds.) Papers in the Acquisition of WH: Proceedings of the University of Massachusetts Roundtable, May 1990, UMOP, 225-265.

Russell, B. (1905) On denoting. Mind, 14, 479-493.

Sag, I. (1976) Deletion and Logical Form. Doctoral dissertation, MIT.

Saito, M. (1984) On the definition of c-command and government. NELS, 14, 402-417.

Sano, T. (1992) Explaining the developmental delay with strong continuity: the case of the "Condition B effect". Paper presented at the Boston University Language Development Conference.

Scha, R. (1984) Distributive, collective and cumulative quantification. In J. Groenendijk, T. Janssen, & M. Stokhof (eds.) Truth, Interpretation and Information, Foris, Dordrecht, The Netherlands, 131-158.

Scholes, R.J. (1981) Developmental comprehension of third person personal pronouns in English. Language and Speech, 24, 91-98.

Sigurjónsdóttir, S. & Hyams, N. (1992) Reflexivization and logophoricity: evidence from the acquisition of Icelandic. Language Acquisition, 2, 359-413.

Solan, L. (1983) Pronominal Reference: Child Language and the Theory of Grammar. D. Reidel Publishing Company, Dordrecht, The Netherlands.

Solan, L. & Ortiz, R. (1982) The development of pronouns and reflexives: evidence from Spanish. Paper presented at the Boston University Language Development Conference.

Takahashi, M. (1991) Children's interpretation of sentences containing every. In T. Maxfield & B. Plunkett (eds.), Papers in the Acquisition of WH: Proceedings of the UMASS Roundtable, May 1990, UMOP, 303-327.

Tanz, C. (1977) Learning how "it" works. Journal of Child Language, 4, 224-235.

Thornton, R. (1990) Adventures in Long-Distance Moving: the acquisition of complex wh-questions. Doctoral dissertation, University of Connecticut, Storrs.

Thornton, R. & Wexler, K. (1991) VP ellipsis and the binding principles in young children's grammars. Paper presented at the Boston University Language Development Conference.

Thornton, R. & Wexler, K. (1993) VP Ellipsis and the Binding Theory in Child Grammars. Ms., MIT.

Thráinsson, H. (1991) Long-distance reflexives and the typology of NPs. In J. Koster & E. Reuland (eds.) Long-Distance Anaphora, Cambridge University Press, Cambridge, 49-75.

van der Does, J. (1993) Sums and quantifiers. Linguistics and Philosophy, 16, 509-550.

Warden, D. (1976) The influence of context on children's use of identifying expressions and references. British Journal of Psychology, 67, 101-112.

Wexler, K. & Chien, Y-C. (1985) The development of lexical anaphors and pronouns. Papers and Reports on Child Language Development, 24, 138-149.

Williams, E. (1977) Discourse and Logical Form. Linguistic Inquiry, 8, 101-139.

Williams, E. (1994) Thematic Structure in Syntax. The MIT Press, Cambridge, MA.