Aspects of the Acquisition of Quantification: Experimental Studies of English and Korean Children

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To my family
with love and gratitude
Abstract

This thesis reports on experimental studies of quantifier spreading in young children's interpretation of sentences with universal quantifiers such as *all*, *every* or *each*, and argues that the phenomenon is explicable in terms of the maturation of both the linguistic system and the cognitive system.

On the linguistic side, it is claimed that the phenomenon is influenced by the effect of syntactic detachment, where the subject is typically an island. That is, the experimental results, where young children made significantly higher errors in the interpretation of quantifiers in object position than in subject position, are claimed to be due to the relative ease of detachment of items from the object rather than from the subject. Regarding the categorial status of the quantifier in the children's interpretation, it is argued that children initially treat quantifiers as modifiers, rather than functional heads, focusing on the movement of that quantifier out of its own extended projection to FP.

For the pragmatic (cognitive) analysis, the experimental finding that younger children at the ages of 4 and 5 performed significantly better than the older children at the ages of 6 and 7 gives rise to the classic pattern of a U-shaped developmental curve. On the view that pragmatic considerations are mastered late in acquisition, later than syntactic knowledge, it is assumed that the high rate of spreading errors by older children can be attributed to the interference of pragmatic factors, rather than to lack of grammatical knowledge. More specifically, I argue that such pragmatic
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Factors are a function of the central system, where both the visual input, the picture, and the intrinsic linguistic property of quantifiers as focused elements play important roles in the determination of children's conceptual representations, suggesting the need for the central integration of visual and linguistic inputs.

From these perspectives, I argue that the phenomenon has to be analysed both linguistically and cognitively. Children need to learn at least three different facts to cope with universal quantification. First, they have to learn two kinds of grammatical fact: (i) the status of the quantifier as a functional head of DP so that it has to be positioned inside DP; and (ii) the Left-Branch Condition, which specifies that movement of an element to the left-branch position is possible only by pied-piping the entire phrase. Once they learn requirement (i), right spreading errors should disappear, and then when they master both requirements (i) and (ii), left spreading errors should disappear. The third strand, which underlies the U-shaped developmental curve, involves the deployment of pragmatic knowledge. At this stage children allow pragmatic considerations to "over-rule" their existing grammatical knowledge, resulting in some confusion and pragmatic short-cut performances which cause the appearance of quantifier spreading. When they finally learn that pragmatics cannot override syntactic theory, spreading errors disappear. Children's mastery of quantification is only complete when these three phases of learning are all acquired. From the current experimental results, it seems that this does not happen until after 7 years or so.
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Chapter One

Introduction

This thesis investigates some aspects of the acquisition of children's quantification. It is well known that young children tend to give a different interpretation from adults to sentences with universal quantifiers such as every, each and all in certain contexts. For example, in a situation in which there are three agents and three objects such that each of the agents is holding a different object one by one, satisfying some form of visual symmetry, as depicted in (1):

(1) Agent-Object
    Agent-Object
    Agent-Object

children give the same positive response "yes" as adults do to the following question (2):

(2)
(2) Is every agent holding an object?

However, in the case where another extra object is added to the situation (1), as shown in (3):

(3) Agent-Object
    Agent-Object
    Agent-Object
    Object

they react to the same question (2) differently from adults. That is, they deny the fact that every agent is holding an object. They give a negative response "no" to the question, pointing to the remaining object which is not being held as the reason for their negative response.

In the converse situation where there is an extra agent left without an object as in (4):

(4) Agent-Object
    Agent-Object
    Agent-Object
    Agent

and confronted with the question in (5):

(5) Is an agent holding every object?

children deny that an agent is holding every object because of the presence of the isolated agent.
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Young children spread the scope of the quantifier *every* to the object NP from the subject NP in the sentence (2), construing the sentence as "Is every agent holding every object? (on one interpretation of this string)." Similarly, they apply *every* to both subject and object NPs in the sentence (5), interpreting it as "Is every object being held by every agent?." Due to this property, Philip and his colleagues call this phenomenon "quantifier spreading" and Roeper and de Villiers (1991) describe the notion of "quantifier spreading" as that a quantifier attached to one NP applies to all NP's in a clause (p.243).

When we compare the above three different contexts, (1), (3) and (4), we get the strong impression that "context" (in the form of the different arrays) might affect children's logical thinking about an input sentence containing a quantifier. The context (1) shows a one-to-one correspondence, with which children have no problem of interpretation. On the other hand, the contexts (3) and (4) do not satisfy "visual symmetry" so that children give a non-adult-like response. The presence of the odd entity is somehow salient in their comprehension. Focusing on this fact, Philip (1995) claims that children prefer perfect one-to-one symmetrical interpretations with universal quantification, and further that they quantify over entire events rather than objects, suggesting that children and adults exploit different logical forms. In contrast to this hypothesis, Crain et al. (1996) argue that these children's symmetrical interpretations are errors due to flaws in experimental design, and claim that children have no difficulty with the interpretation of quantifiers if "felicitous" contexts are provided.

The children's behaviour with regard to universal quantification is certainly erroneous from an adult standpoint. However, it is important to notice that these errors are observed consistently in a certain young age group and further are manifest crosslinguistically, perhaps universally. Several studies show that this error occurs in children acquiring French (Inhelder & Piaget (1958; 1964), English (Donaldson & Lloyd (1974), Philip (1995), etc.), Dutch (Philip & Verrips (1994)), Chinese (Chien &
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Wexler (1989) and Lee (1991), Japanese (Takahashi (1991)), Catalan (Philip (1995)) and Korean (the present work). They cannot then be plausibly attributed only to flaws in experimental design. Rather, we have to answer the question:

Why do young children make mistakes in certain contexts which adults do not?

Further we need to determine

What causes this kind of error in children's but not in adults' interpretation?, in other words, what factors give rise to the different interpretations with universal quantification between children and adults?

Something must be different in the development of their logical thinking or linguistic knowledge.

To investigate this, I carried out comparable experiments in English and Korean on the interpretation of universal quantifiers: *every; each; and all* (and their Korean equivalents *modun, kakkak-uy, modun NP-tul*) by four-to-seven year old children. Through the experiments, I tried to find out whether this phenomenon is observed in both English and Korean children of a certain young age group, giving a quantitative characterisation of the differences between the groups. To introduce the study, I first review the previous research and discuss the researchers' theoretical assumptions in Chapter 2. Then in Chapter 3 I claim that quantifier spreading has to be explained by a combination of 'cognitive' and 'linguistic' factors. Assuming that cognitive factors are a function of the central system, I adopt a modified form of Smith & Tsimpli (1995)'s version of Fodor (1983)'s Modularity Hypothesis to explain children's non-adult-like behaviour with regard to universal quantification, and explain it further within the framework of Relevance Theory (Sperber and Wilson (1986;1995). A simplified model of the mind is proposed and it is claimed that the
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locus of the children's difference from adults in the exhaustive interpretation of quantifiers is the interpretation stage, rather than the decoding stage. The structure of this conceptual representation is then specified.

As a transition from the cognitive to the linguistic, Brody's (1990) analysis of focused categories is introduced to explain the movement of the quantifier to FP in children's interpretation. Further the categorial status of the quantifier in the children's interpretation is considered, focusing on the movement of that quantifier out of its own extended projection to FP. It is claimed that children initially treat quantifiers as modifiers, rather than functional heads, and that the phenomenon of quantifier spreading by children can be seen as a reason for the delay of the relevant functional category, i.e. DP, in language acquisition.

The details of English and Korean experiments are reported in Chapters 4 and 5 respectively, and the findings from the two experiments are discussed in Chapter 6, based on the main arguments suggested in Chapter 3, and also in the comparison to the assumptions arising from the previous research.
Chapter Two

Evidence of Children's Quantifier Spreading from Previous Research

There is a long tradition of study about children's behaviour with regard to quantification in the fields of psycholinguistics and developmental psychology. Much previous research\(^1\) has focused on this subject and found the same phenomenon, that is, children, unlike adults, tend to extend the scope of quantifiers to the other noun phrases in the sentence as well as to the noun phrase which contains them. A lot of researchers have provided different hypotheses and explanations for it. Some treat it as a purely cognitive matter and some try to explain it by linguistic principles rather than by general cognitive principles. I will briefly review the different approaches here.

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2.1 Inhelder and Piaget (1958, 1964)'s Class Inclusion Errors

Inhelder and Piaget (1958, 1964) first observed the phenomenon of quantifier spreading in their experiments on the development of children's logical competence through their comprehension of universal quantifiers, especially *all*. In their study, children were shown an array of shapes in which three blue circles, a blue square, a blue circle and a red square are displayed in that order, as in (1):

(1)

[Image of array of shapes: blue, blue, blue, blue, blue, red]

Question : Are all the circles blue?
Response by children : No. There is a blue square as well.

When a child was asked "Are all the circles blue?" the child responded "no," pointing to a square which was also blue as the reason for his negative response. Inhelder & Piaget discussed two main types of error: some of the children at Stage I of the preoperational stage refer the question to the entire set, construing the sentence "Are all the circles blue?" as "Are they all blue circles?"; and somewhat later at Stage II as "Are all the circles all of the blue things?" with *all* applying to both the subject and the predicate set. Inhelder & Piaget (1964) called this kind of error "false

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2 Piaget defined age-related stages: sensori-motor (from birth to 18 months, approximately); preoperational (from 18 months to 7 years); and concrete operational (from 7 to 11 years, approximately). According to him, the preoperational child groups elements into collections rather than classes: children at Stage I (around 3 to 4 years old) group objects by situational belongingness, for example, 'a square under a triangle that serves as a roof', or by thematic relationship, for example, 'a mother, a baby, and a baby carriage' because they go together. Therefore, the items grouped together do not share a common property. At Stage II (around 5 to 7 years of age), collections become more like classes, but the spatial arrangement and theme are still important.
quantification of the predicate," saying that young children at Stage II extend the scope of the quantifier *all* to the logical predicate of the sentence as well as to its logical subject. (1964, p.71) They explained this error as being due to young children's inability to understand the notion of class, that is, that one category (circles) can be part of another larger category (blue things). Children do not understand the relation of class inclusion and cannot group objects into classes which share common features until the age of seven or eight which, they argue, is the stage of emergence of concrete operational reasoning.

2.2 Donaldson and Lloyd (1974)'s Spatial Relations

Donaldson and Lloyd (1974) carried out their own experiment on the phenomenon of quantifier spreading on English speaking children between the ages of three to five years and made observations similar to those of Inhelder and Piaget (1964). For example, children were asked to evaluate the correctness of the following sentences:

(2) Donaldson and Lloyd (1974)
   a. All the cars are in the garages.
   b. The cars are all in the garages.
   c. Each car is in a garage.
   d. All the garages have got cars in them.
   e. The garages have all got cars in them.
   f. Each garage has got a car in it.

when faced with one of either of two situations: a row of four garages, three of which contain cars and one is empty without a car; or a row of four garages, each of which contains a car, plus an additional car (not in a garage) at the end of the row, as in (3a)
and (3b) respectively:

(3) a. G - C
    G - C
    G - C
    G

b. G - C
    G - C
    G - C
    G - C
    G - C
    C

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<td>True</td>
</tr>
<tr>
<td>Child</td>
<td>False^</td>
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11 of the 14 children involved in their experiment gave non-adult responses to the sentences in (2a-c) with the context (3a), pointing to the empty garage as the reason for their judgement. The same children correctly rejected the sentences (2d-f) in the same context and most of the children gave adult-like responses (respectively "no" and "yes") to the sentences (2a-c) and (2d-f) in the context (3b), as we can see in Table 1. Donaldson and Lloyd commented that children gave affirmative responses if all the garages were occupied and they gave negative responses if they were not all occupied, irrespective of variations in syntactic form. That is, "the empty garage was somehow salient for the children, and so they interpreted everything in ways affected by this salience." (Donaldson (1978))

^ Freeman et al. (1982) pointed out that Donaldson and Lloyd could not notice children's non-adult-like responses to the sentences (8a-c) in the context (9b) because of their small sample size. That is, some children gave an affirmative response 'yes' to those questions, ignoring the car not in a garage in the situation, in their experiment, and they called this kind of interpretation "underexhaustive search." See the details in the section 2.8.
2.3 Bucci (1978)'s Structure-Neutral Representation

Bucci (1978), like Inhelder & Piaget (1964), also proposed a maturational kind of explanation for the phenomenon. The subjects were asked to act out block building instructions incorporating universal affirmative propositions. In the task, the same content words (e.g., 'yellow' and 'square') were used, grammatical structures were varied and a number of different instructional forms were generated. The set of examples was as follows:

(4) Bucci (1978, p. 60)

a. Make a building in which all the yellow blocks are square.
b. Make a building in which all the square blocks are yellow.
c. Make a building in which all the blocks are square and yellow.
d. Make a building using all the square yellow blocks.

Bucci tested three different age groups: 37 children aged 6 years and 6 months to 8 years and 4 months: 38 older children aged 11 years and 5 months to 12 years and 5 months; and 28 adults. In the youngest group, on 6 trials, only 5% had all items correct, and 92% of the children made a building in which only blocks that were both yellow and square were used. The older children's group showed some advanced performance: 16% made all items correct, 5% were correct on 5 out of 6, and 74% of the subjects made errors on 6 trials. The adult group showed 50% correct on all items, 25% correct on 5 out of 6 items and only 7% showed the error.

Bucci explained the error made by the majority of children aged 6 to 8 in terms of the notion of "structure-neutral interpretation." That is, children tend to interpret the sentence All F are G as All, F, G, lacking a subject-predicate distinction. She argued that "the sentence is encoded as a single string or unordered set of
substantive words without hierarchical structure, i.e. All, F, G, in certain age groups and under certain circumstances." (p.58) This interpretation gradually disappeared in the development of children's logical reasoning.

### 2.4 Roeper and Matthei's (1974) Quantifier-Adverb Hypothesis

Roeper and Matthei (1974) supported the results of Donaldson and Lloyd (1974) by studying the quantifiers *some* and *all*. In their work, 4 to 6 year old children were asked to interpret the following sentence (5) and choose the one from a set of pictures which matched the sentence:

\[(5)\] Some of the circles are black

\[(6)\] Picture A  Picture B

Picture C  Picture D
They found that the children frequently chose Picture D where some of the circles were partially black. That is, they applied the quantifier *some* to both NPs, *circles* and *black*, interpreting the sentence into "some of the circles are some black," just as *all* does. They suggested that quantifiers initially have an adverbial character, that is, children detach quantifiers from the nouns they belong to and apply them freely to the other NPs in the sentence. The picture D is a correct response to the sentence (5), but Roeper and Matthei's explanation predicts that children should choose Picture A as well because the quantifier *some* can be detached from the NP *some of the circles* and attached to another NP *black*, resulting in the interpretation "the circles are some black." If the children insisted on offering their answer just to Picture D, a more restricted property to the quantifier *some* has to be provided, for example, the quantifier *some* covers both NPs, *circles* and *black*, in scope in the sentence (5).

2.5 Philip and Aurelio's (1991) Adverbial Quantification Hypothesis

Philip and Aurelio (1991) tried to find evidence for linguistic factors underlying children's interpretation of universal quantifiers, by varying the linguistic context in their experiments. They investigated whether there was any effect on the incidence of quantifier spreading by placing the universal quantifier *every* in syntactic
object position as well as in subject position and also placing a sentence boundary between a quantified NP and an indefinite NP (discourse context). Their examples of sentential and discourse contexts are as in (7) and (8):

(7) Philip and Aurelio (1991)

Sentential Context

a. Is every mouse in a cup?  
   b. Is a dog holding every bone?

(8) Philip and Aurelio (1991)

Discourse Context

a. Every window is open.  
   A woman is peeking out.  
   b. A dog got up.  
   Every cat jumped.

Does this picture go with the story?

They found no significant difference between *every/a* and *a/every* type items as in (7): there were 84% quantifier spreading errors in the former and 90% in the latter. However, there was a big difference between the sentential and discourse contexts:
with 87% spreading responses in the former and only 28% in the latter. That is, the rate of spreading errors dropped dramatically in the discourse contexts.

Philip and Aurelio suggested an "Adverbial Quantifier Hypothesis" as one possibility for explaining this example of children's quantification. They adopted both Roeper and Matthei (1974)'s idea, that is, every behaves syntactically like a sentential adverb, and Heim (1982)'s tripartite hypothesis which posits that this adverbial every, like the adverb always, unselectively binds variables in both the subject and object position of the matrix sentence. The general framework of this unselective binding originated with Lewis (1975), who observed that adverbs of quantification such as always, usually, and seldom can have scope over several indefinite NPs at the same time. For example, the adverb always quantifies over both indefinite NPs in the conditional donkey sentence (9). The interpretation of (9) is represented in (10):

\[(9) \text{ If a farmer owns a donkey, he always feeds it.} \]
\[(10) \text{ALWAYS}_{x,y} \text{ If Farmer(x) \& Donkey(y) \& Owns(x,y), then Feeds(x,y)}\]

In (10), the domain of quantification for the adverb always extends to both nominals farmer and donkey.

Then, for the children who showed spreading errors, they suggested that a plausible logical form for the sentence "Every mouse is in a cup," assuming the existence of a Davidsonian event variable for every to bind, would be as in (11):
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(11) Philip and Aurelio (1991, p.281)

Every mouse is in a cup.

\[ Q \quad R \quad S \]

Every e | there's (e) a cup | a mouse is (e) in a cup

i.e. for every event e such that there's a cup, a mouse is in a cup

This version of the Adverbial Quantifier Hypothesis, as noted by Philip and Aurelio, has the limitation of failing to explain why the restrictive clause takes only 'there's (e) a cup', not 'there's (e) a mouse,' as its domain.

2.6 Roeper and de Villiers (1991)

Roeper and de Villiers tried to provide a strictly syntactic proposal to explain children's behaviour with quantification. In their experiment, children were asked to give truth value judgement to the questions such as (12) and (13) with a given context:

(12) Is there a chair that every cat is on?
    Picture: Each cat is on a different chair.

(13) Is every cat on a chair?
    Picture: All the cats are on one chair.
They tested 15 children aged 4 years and 3 months to 5 years and 7 months, and 11 of them accepted the sentence (12) for the picture which depicted each cat on a different chair. Three children rejected the reading of (13) for the picture depicting all the cats on one chair, saying that "no, there's only one chair".

They adapted Roeper and Matthei's quantifier-as-adverb hypothesis, as in (14):

(14) Roeper and de Villiers (1991, p. 248)

a. Quantifiers are analysed as adverbs.

b. Adverbs can be given sentential scope.

c. Therefore all NP's within a clause are modified by the adverb.

and additionally they proposed the optional-Spec hypothesis, as in (15), to explain how the child gradually gets an adult-like interpretation of universal quantifiers:

(15) Quantifiers are adverbs until the Spec of NP is fixed. (p. 253)

According to the hypothesis, the Spec of NP is absent at first and triggered later, around 6 or 7 year old. Only when it is triggered, can quantifiers be appropriately accommodated within the NP. Put simply, their argument was that 'children make an adverbial analysis of quantifiers because their syntax is incomplete.' (p.253) That is, 'functional categories are delayed in emergence in child grammar' and 'require specific triggers.'

Based on these hypotheses, they explained children's non-adult-like bound variable reading for the sentence (12) above with a given picture as follows:
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(16) there is a chair that every cat is on $t$

Picture: Each cat is on a different chair.

Children, unlike adults, normally give wide scope to the quantifier *every* to cover the NP *a chair* as well as *cat* in the sentence (16). Roeper and de Villiers argued that this is not because quantifiers are not subject to subjacency restrictions (that is, they believe that the effect of subjacency at the level of S-structure is present at an early stage, around 3 years old⁴), but because the SPEC is not present yet in the child grammar, and so CP cannot be a Maximal Projection (based on Roeper (1988)'s claim that the Maximal Projections NP, VP, CP and PP are each triggered by the emergence of a SPEC), but just a C, not a barrier. Therefore, the quantifier can have wide scope over the NP which is directly dominating it, as in (17):

(17) there is [a chair [C that every cat is sitting on $t$]]

[\[every cat [ a chair]]

In (17) the quantifier *every* is in a higher position than the NPs *cat* and *a chair* in the structure so that it covers them in its scope.

However, adult grammar does not allow this kind of interpretation because CP functions as a barrier, as in (18):

(18) there is [a chair [CP that every cat is sitting on $t$]]

*[\[every cat [ a chair]]

⁴ de Villiers & Roeper (1991) explored adjunct wh-extraction from relative clauses and found that 3 year olds were strongly obedient to subjacency.
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In (18) an indefinite NP *a chair* is in a higher position than the quantified NP *every cat* so that the former has wider scope than the latter.

2.7 Philip's (1995) Event Quantification Hypothesis

Philip (1995) carried out a more systematic analysis of children's universal quantification. He postulated representations that children assign to sentences with universal quantifiers by introducing the Event Quantification Hypothesis in which children interpret universal quantifiers as quantifying over entire events rather than individual objects, implying that children prefer perfect one-to-one correspondence when interpreting universal quantifiers. That is, to children, unlike adults, the domain of quantification consists of all minimal events which include the agent and the object involved in the event. Let us briefly review Philip (1995)'s test sentences with matching contexts or situations here:

(19) Is every boy riding a pony?
(20) Are the boys all riding a pony?
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<Table 2> Responses in the relevant contexts

<table>
<thead>
<tr>
<th>Context</th>
<th>Response</th>
<th>Child</th>
<th>Adult</th>
</tr>
</thead>
</table>
| a. boy1 rides pony1  
boy2 rides pony2  
boy3 rides pony3  
girl1 | Yes | Yes |
| b. boy1 rides pony1  
boy2 rides pony2  
boy3 rides pony3  
boy4 | No, not that boy | No, not that boy |
| c. boy1  
boy2 together ride  
boy3  
girl1 pony1  
pony2  
pony3 | No, not those ponies | Yes |
| d. boy1 rides pony1  
boy2 rides pony2  
boy3 rides pony3  
girl1  
pony4 | No, not that pony | Yes |

In this format, the extra ponies in the examples (c) and (d) in <Table 2> indicate a potential boy-ride-pony event, and because these ponies are not being ridden by a boy, it cannot be the case that, for all candidate boy-ride-pony-events, a boy is riding a pony. For preschool children the sentence Every boy is riding a pony is true only if every event consists of an individual boy who is riding a pony. In their representation a structure which entails that for every event such that a boy or a pony is involved, the event consists of a boy who is riding a pony. That is, children determine that the domain of quantification consists of all minimal events which involve a boy or a pony (or both). All such events are possible component subevents of an event of 'a boy riding a pony.' On the other hand, the adult logical form for the sentence Every boy is riding a pony does not include these kinds of irrelevant subevents.
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Philip (1995) represents the different logical form for children from that for adults of the sentence *Every boy is riding a pony*, in a form parallel to that in (11) above (of Philip and Aurelio's analysis), adopting the tripartite formalism of Heim (1982):

(21) Child logical form for the sentence *Every boy is riding a pony*.

\[
\begin{align*}
S & \quad \text{restriction} \quad \text{nuclear scope} \\
Q & \quad \forall e_1 \text{ SUBEVENT(boy}^{\text{ride}}{\text{pony},e_1}) \quad \text{a boy is riding (e1) a pony} \\
\end{align*}
\]

'All minimal events which are possible subevents of an event of a boy riding a pony are events in which a boy is riding a pony'

(22) Adult logical form for the sentence *Every boy is riding a pony*.

\[
\begin{align*}
S & \quad \text{restriction} \quad \text{nuclear scope} \\
Q & \quad \forall x \quad \text{boy (x)} \quad \text{a boy (x) is riding a pony} \\
\end{align*}
\]

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

Then, the child logical form (21) is argued to be similar to the adult logical form for
adverbial quantification, as in (23):

(23) Adult logical form for the sentence *A beaver is always building a dam.*

\[
S \\
| Q
| restriction
| nuclear scope
| \forall e
| R(e)
| a beaver is building (e) a dam
\]

'All events in which R are events in which a beaver is building a dam'

(e.g. R=when a dam is built by a beaver)

Philip (1995) claims that a child who gives a symmetrical interpretation does not apply Quantifier Raising, in the sense of May (1977), to a quantified DP, and consequently does not derive an adult-like object quantificational logical form, in which the restriction on the domain of quantification is determined syntactically. He or she rather assigns to a sentence such as *Every boy is riding a pony* the logical form which an adult assigns to a sentence containing a single adverb of quantification, e.g. *A beaver is always building a dam.*

This hypothesis assumes that each individual object is construed as representing an event as well as an individual and that children prefer perfect one-to-one correspondence between each subevent when interpreting universal quantifiers.

---

5 Crain et al. (1996) criticized Philip, saying that "this kind of mapping of syntactic and semantic principles, that is, the assignment of a semantics to the universal quantifier that is appropriate for a different type of quantificational element, an adverb of quantification, is not natural." They rather suggested that "both children and adults use 'skolem functions' in their semantic representations of sentences with both a universal quantifier and an indefinite NP." (p.106-107) According to their analysis, the sentence *Every boy is riding a pony* is assigned a representation like (1):

\[
(1) \quad f(\text{boy} \mapsto \text{pony}) \quad \forall(x) \left[ \text{boy}(x) \mapsto \text{ride}(x, f(x)) \right]
\]

where "\mapsto" indicates that \( f \) is a function from individuals to individuals. They explained that "children assign the representation (1) to the question *Is every boy riding a pony?*, but interpret the question to be asking whether the function, \( f \), is *onto* (i.e., if the range of the function is exhausted). In the adult grammar, however, the function is not required to be *onto.*" (p. 107)
However, this hypothesis fails to explain why children, in particular the symmetrical interpretation children, have different representations for interpreting the quantifiers from the one adults do and how children's logical form is changed ontogenetically into the adults'. Further, this hypothesis incorrectly predicts that children concentrate only on the objects which can be subevents of the event, but this is not always true. The majority of children involved in my experiment show that they can also concentrate on a third element, irrelevant to the event structure of the sentence. That is, when the children were asked to answer the question *Is every bear holding a honeypot?* in a context in which there are three bears holding a honeypot each, an extra honeypot and a third element, a piglet, they normally responded "no," saying "because this honeypot is alone and a piglet has nothing." According to Philip (1995)'s event structure, the event of this sentence will be \[x \text{ holding } y: \text{ here } x=\text{bear}, y=\text{honeypot}\], composing the subevents as 'bear' and 'honeypot'. A *piglet* has nothing to do with the event, but the children are still concerned about it, mentioning, for example, "the piglet will have this honeypot (pointing to the remaining honeypot)," "he is lonely," "he is going to get a honeypot," and so on. That is, the presence of the isolated different agent, here 'a piglet,' can also be a part of the reason why the children deny the question in the input sentence.

2.8 Freeman, Sinha and Stedmon (1982)

Freeman et al. (1982) tried to explain this children's universal quantification from a discourse (pragmatic) point of view. Focusing on the fact that children are dependent on context when they deal with quantifiers in the sentence, that is, contextual factors contribute to explaining the children's behaviour with universal quantification, they proposed that children make "exhaustive" errors because the context does not satisfy the conditions for an appropriate presuppositional analysis of
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the universal quantifier.

They carried out a systematic replication of Donaldson and Lloyd's (1974) study to find whether children's interpretation in the 'car-garage' task is really mediated by 'canonicality' or 'containment,' that is, whether children might think from their background knowledge that "a garage's customary job (canonical function) is to contain cars, and all utterances get referred to that single criterion" (p.60). Testing 32 5-year-olds and another 59 children in the two age groups (above and below 5 years), they found that the frequency of correct answers was not affected by canonicality or by particular spatial relations and that the children's judgement error in the car-garage task was not just restricted to 'the salience of the empty garage' which was discussed by Donaldson (1978). Even though the empty-garage-salience strategy (e.g. G-C, G-C, G-C, G) was found stronger than the spare-car-salience strategy (e.g. G-C, G-C, G-C, G-C, C): among 91 children, 42 compared with 12, respectively, the spare car salience strategy still occurred. They pointed out that Donaldson & Lloyd (1974) could not notice the occurrence of the spare car salience strategy because of their small size sample.

They called the error which children make with the question Are all the cars in the garages? in the situation of four garages in which three contain a car each and one garage is empty (that is, the empty-garage-salience strategy) "overexhaustive search" for one-to-one relations between the sets, and the error to the same question in the situation of four garages in which each garage contains a car, and an extra car not in a garage (the spare-car-salience strategy) "underexhaustive search." In the "overexhaustive search," children insist that there has to be a fourth car in the empty garage, whereas, in the "underexhaustive search," they do not care that the extra car is not in the garage. That is, children assign a wider scope to the quantifier all than they should to the question in the former situation, and on the other hand, they take a narrower scope for the quantifier all in the latter situation.

Further, they tested 20 college students and found that the majority of the
subjects showed errors similar to those made by children. The subjects were shown two pictures:

(24)  <Picture 1>

Four saucepans with saucepan-lids each and an extra lid lying next to the cooker amongst some vegetables and a knife; and

<Picture 2>

Four saucers with three of them having a cup on,

and asked the following questions:

(25) Are all the lids on the saucepans?
(26) Are all the cups on the saucers?

16 among 20 subjects responded 'yes' to the question (25) and 17 responded 'no' to the question (26). The adults also ignored 'the extra lid' in question (25) with the given context (Picture 1 of (24)), just as children did not care about 'the extra car' in the spare-car-salience strategy, and were concerned about the saucer without a cup, as children were concerned about 'the empty garage' in the question *Are all the cars in the garage?* That is, this experiment demonstrated that adults can give the same interpretation as that by children in certain contexts.

Freeman et al. tried to explain these under- and over-exhaustive errors in the framework of discourse analysis. Based on Wason (1965)'s 'context for plausible denial effect,' they propose that "a question about the presence of 'all the Xs' implicitly requests the hearer to carry out an exhaustive search to check that no X is missing." "The conventions underlying asking a question therefore presuppose not only that the size of the intended referent set is potentially larger than the
contemporaneously present set of Xs, but that such knowledge is potentially available to both interlocutors." (p. 64) If the hearer follows this convention, he or she must "check the context for cues which might indicate the absence of one of the items" (p.64). The speaker's apparent concern is that nothing is missing and then the situation effectively provides a context for plausible denial. That is, children seem to understand what the experimenter means, not only what the words mean. Freeman et al. propose that a child first uses salient contextual information to determine the experimenter's intended discourse topic, then uses the cardinality of the set picked out by the topic to specify the numerical boundary for the domain of quantification, and then universally quantifies up to that boundary. They tried to demonstrate that children's nonadult-like responses to universal quantification were quite rational from a discourse point of view.

2.9 Brooks and Braine (1996)

Brooks and Braine (1996) examined children's comprehension of the universal quantifiers all and each through a series of experiments using a picture selection task. Firstly, they examined children's ability to restrict a quantifier to the noun phrase it modifies. Sentences were presented in which the quantifier, all or each, modified either the subject NP or the direct object NP as in (27):

(27)  
a. All of the men are carrying a box
b. There is a man carrying all of the boxes
c. Each man is carrying a box
d. There is a man carrying each of the boxes

Children were shown two pictures and asked to select which of them went best with
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each sentence presented. One of the pictures consisted of a subject-exhaustive interpretation in which all of the actors were involved in an activity with extra objects which were not involved in the activity, and the other an object-exhaustive interpretation in which all of the objects were involved in an activity with extra actors who were not involved. For the sentences with all, the relevant two pictures were as in (28):

(28) Pictures
   a. Three man working together to carry a single box, with two extra boxes left out
   b. One man carrying three boxes, with two extra men

For sentences with each, the pictures showed distributive arrangements as in (29):

(29) Pictures
   a. Three men, each individually carrying a box, with two extra boxes left out
   b. Three men individually carrying a box, with two extra men

They had a wide range of age group from 4 to 10 years old for their subjects: 10 4-year-olds; 10 5-year-olds; 10 6-year-olds; 10 7-year-olds; 10 8-year-olds; 10 9-year-olds; 10 10-year-olds; and 10 adults. They found that children as young as 4 years old were capable of restricting the universal quantifier all to the noun phrase it modified, but failed on each. In contrast to the fact that 4- to 10-year-old children had no difficulty restricting all to the noun, only 9- and 10-year-olds could solve the task with each.

Their second and third experiments examined children's ability to associate collective, distributive, and exhaustive representations with sentences containing
universal quantifiers. The collective representation corresponds to the group meaning, e.g., the sentence *All of the flowers are in a vase* is construed as meaning "all of the flowers are in the same vase." The distributive representation implies a one-to-one pairing, e.g., "each flower pairs with a different vase one by one" for the sentence *Each flower is in a vase.* The exhaustive representation exhausts both sets, e.g., for the sentence *The flowers are in the vases* meaning as "all the flowers are in vases and all the vases have flowers in them." The children involved in their experiments showed a preference for associating collective pictures with sentences containing *all* and distributive pictures with sentences containing *each.* That is, the percentage of collective responses increased with age for sentences with *all,* and decreased for sentences with *each.* Through the experiments, they found that lexical and positional cues were used by children interpreting sentences containing universal quantifiers. That is, children use both lexical and syntactic cues in their interpretation, but correct control of both comes only with age. It is assumed that children's semantic representations do not undergo radical change (p.263).

Brooks and Braine (1996) suggest that the "exhaustive" representation might exist primitively in the syntax of the language of thought, and assume that quantifier spreading by children is the result of mistakenly using this exhaustive interpretation instead of the appropriate collective or distributive reading.

### 2.10 Crain et al.'s (1996) Condition of Plausible Dissent

Crain et al. (1996) claimed that children's symmetrical responses to universal quantification reported in previous research are due to flaws in experimental design, that is, because of the use of infelicitous contexts; and children have no difficulty with the interpretation of quantifiers if "felicitous" contexts are provided. Based on plausible conditions for yes/no questions, they argued that the contexts used in the
previous research did not satisfy 'the condition of plausible dissent' because the negation of the proposition in the question, which can also be a possible outcome, was never presented in the context. They assumed that if the condition of plausible dissent was satisfied, the presence of an extra object, for example, a donkey not being fed by a farmer, should not influence the interpretation children assign to the target test sentence Is every farmer feeding a donkey?.

To prove this, they carried out several experiments, of which one replicated those of previous experiments from Piaget to Philip, and the others used a different methodology, the Truth Value Judgement Task, which, they believe, satisfies 'the condition of plausible dissent.' The condition of plausible dissent asserts that the negation of the proposition in the question can also be a possible outcome so that it has to be presented explicitly in the context. They assume that if the condition is satisfied, the presence of an extra object in the context should not influence the interpretation children assign to the target test question. Experiments 1 and 2, from their seven experiments, are briefly introduced here.

The first part of Experiment 1 replicates previous research, using the same methodology with pictures corresponding to the Extra Object Condition in which, for example, three farmers are each feeding a different donkey and there is an extra donkey not being fed. Among 34 children ranged in age from 3;0 to 5;10 with a mean age of 4;4, there was found a group of 14 children who gave symmetrical responses 82% of the time, (compared to an overall incidence of symmetrical responses of 35%). This group of children answered "No" to questions like Is every farmer feeding a donkey? in the Extra Object Condition, pointing to the extra donkey as the reason for their negative responses.

Crain et al. used these 14 children in their second experiment, which used the Truth Value Judgement task, to find out whether the satisfaction of plausible dissent can reduce or eliminate the symmetrical interpretation. In this task, short stories are acted out with toys and props by one experimenter. The stories are watched by a
child and a puppet, Kermit the Frog, which is played by a second experimenter. After each story, Kermit the Frog says what he thinks happened in the story. The child is asked to indicate whether Kermit's description of the story is true or false. If Kermit is correct, according to the child, the child pretends to feed him something tasty, but if Kermit says something that did not happen in the story, the child pretends to feed something nasty to remind him to pay closer attention. Whenever Kermit says the wrong thing, the child is encouraged to explain to him "what really happened" in the story. Here is the example of the story in Experiment 2 (Crain et al. (1996, p. 126)):

(30) Characters and Crucial Props:
Three skiers (a mom and her two girls)
Five bottles of soda and five cups of apple cider
A Styrofoam mountain, with an arch to ski through

Protocol:

Exp: In this story, this mom and her two girls go skiing. They're going to ski down this mountain here and try to ski through this arch. Over here are the drinks at the ski lodge for when they've finished skiing. First, they all go on the ski lift to the top of the mountain. Then, this girl skis down the mountain.

Girl 1: This looks a bit scary. Here I go! Whee! Oops, here comes the arch. Yeah I made it! <first girl skis down the mountain, and safely through the arch>.


Yeah! <second girl skis down the mountain and safely through the arch>.
Mom: OK girls, watch me. Whee! Oh wow, I didn't realize this arch was so low, I'll have to really bend down to make it through <mom skis down mountain, but barely makes it through the arch>. Oh girls, that gave me a real fright. I almost banged into the arch. Let's go in now and get a drink <mom and girls go over to drinks set out on a table>. I'll have a cup of this nice hot apple cider. This will help calm me down <mom takes a cup of cider>.

Girl 1: Oh, look at these sodas. I want this bottle of orange soda.

Girl 2: I want this bottle of cola.

Mom: Girls, don't take a bottle of soda. You should have a cup of hot apple cider so you get nice and warm. You can have soda another time.

Girl 1: OK. I'll take this cup, it's full to the top.

Girl 2: I want a full cup too. Are any of these other cups of cider full?

Oh, this one looks very full. I'll have this one. Mmm, it's good.

Kermit: That was a hard story, but I think I know something that happened. Every skier drank a cup of hot apple cider.

Child: Yes.

or No, not these cups of apple cider. (symmetrical interpretation)

In the results, twelve of the 14 children who had consistently given symmetrical interpretations in Experiment 1 responded "Yes" on all four trials of this experiment. Even the remaining two children, who rejected the target sentences, are claimed to have done so not because they assigned a symmetrical interpretation to the target sentences. The two children rejected Kermit's statements because of the use of every
to refer to sets with three or fewer members. They are reported as insisting that Kermit should specify the exact number of individuals, for example, *Three skiers drank a cup of hot apple cider*, and in the follow-up session in which there were five characters corresponding to the quantified NP *every skier*, they accepted sentences with the universal quantifier.

From the contrasting results of Experiments 1 and 2, Crain et al. argue that when felicitous contexts are presented, the symmetrical interpretation by children is eliminated. In the story (30) the mother takes a cup of apple cider, but the children are tempted by the sodas. The mother persuades the children to drink apple cider instead, because it will help warm them up. The children each have a cup of apple cider. In this situation, Crain et al. argue that it is felicitous to say "Yes" to Kermit's description *Every skier drank a cup of hot apple cider* because the negation of the sentence was under consideration. Further they mention that the situation also falsifies the symmetrical interpretation of the test sentences because there were extra cups of hot apple cider left over at the end of the story and the extra cups were even highlighted in the story by the children checking that the cups of apple cider were filled to the top. Therefore they conclude that children have full grammatical knowledge of universal quantification and the non-adult-like responses with regard to universal quantification reported by previous research are due to flaws in the experimental design, that is, the non-satisfaction of felicitous contexts.

As argued by Crain et al. (1996), the context plays an important role in the phenomenon of quantifier spreading. However, we cannot explain away the crosslinguistic occurrence of the phenomenon simply on the ground that the context is infelicitous. Rather, we have to concentrate on why young children typically make mistakes in certain contexts which adults do not. Crain et al. failed to answer this basic question.
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2.11 Drozd (1998)'s Weak Quantification Hypothesis

Drozd (1998) also suggests a context dependent explanation called the Weak Quantification Hypothesis, focusing on the fact that children are dependent on context when they deal with quantifiers in a sentence. Before we discuss Drozd's hypothesis in detail, we had better look at the difference between 'weak' and 'strong' quantifiers.

Milsark (1977) defined 'weak' determiners as those which create NPs which sound good in *there is* or *there are* sentences. NPs with strong determiners sound odd in *there* contexts, as we can see in the following sentences:

(31) There is a book . . .
    There are *some* apples . . .
    There are *two* ladybirds . . .
    There are *many* children . . .
    There is *a few* people . . . (in some dialects)
    There are *few* people . . .
    There is *no* space . . .
    *There is *the* book . . .
    *There are *both* . . .
    *There are *all* . . .
    *There is *every* . . .
    *There is *each* . . .
    *There are *most* . . .
    *There are *neither* . . .

Barwise and Cooper (1981, p.182) then made a division between weak and strong quantifiers, as shown in (32):
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(32) Weak quantifiers:  
a, some, one, two, three, many, a few, few, no

Strong quantifiers:  
the, both, all, every, each, most, neither

Given a simple sentence of the form [D N is a N / are Ns], the determiner contained in it is defined as:

(i) positive strong if it is judged automatically valid;

(ii) negative strong if contradictory; or

(iii) weak if contingent on the interpretation.

For example, every train is a train is true in every model, neither train is a train is false in every model in which it is defined and many trains are trains is true just in case there are many trains. Therefore, every, neither and many are classified as positive strong, negative strong and weak, respectively.

Drozd (1998) proposes that weak quantifiers, unlike strong quantifiers, have particular properties of contextual dependence and inference, and argues that young children actually interpret universal quantifiers as weak quantifiers, when they are faced with sentences such as All the boys are riding an elephant. To explain spreading errors by children, he introduces two conditions: Symmetry and Intersectivity, as in (33):

(33) Drozd (1998)

Symmetry Property:  Det(N)(VP) iff Det(VP)(N)

(Two/Many/*All the/*Many of the) boys are riding an elephant iff

(Two/Many/*All the/*Many of the) elephant-riders are boys.
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Intersectivity Property: \( \text{Det}(N)(VP) \text{ iff } \text{Det}(N\&VP)(N) \)

(Two/Many/* All the/* Many of the) boys are riding an elephant iff

(Two/Many/* All the/* Many of the) boys who are riding an elephant are riding an elephant.

Focusing on the fact that sentences with weak quantifiers (e.g., two, many) and sentences with proportional or strong quantifiers (e.g., every, many of the, two of the) in subject position exhibit different inferential properties, he argues that only sentences with weak quantifier subjects observe the above Symmetry and Intersectivity conditions.

According to the Symmetry Property, a determiner quantifier is symmetric if either N or VP can be used to restrict the domain of quantification for the determiner. Drozd (1998) gives the example of the sentence, *Many Americans won an Olympic medal in Atlanta.* He explains that in this sentence the (weak) cardinal quantifier many is symmetric because its value can be fixed by appealing to what we expect 'many' Ns (Americans) should be or what we expect 'many' VPs (Olympic medal winners in Atlanta) to be. In the former case, the sentence is false, because the 200 or so American medal winners in Atlanta do not constitute 'many' of 265 million Americans; for example, it is not true that *Many Americans are Olympic medal winners.* In the latter case, however, since Americans won more Olympic medals than any other nationality in Atlanta, constituting comparably 'many' of the medal winners, for example, it is true that *Many Olympic medal winners were Americans.* On the other hand, strong determiner quantifiers do not show this kind of interpretive flexibility. For example, a sentence like *All the Americans won an Olympic medal in Atlanta.* is false because all the Americans could not be Olympic medal winners. Obviously there is no flexibility in interpretation here.

The hypothesis predicts that children interpret universal determiner quantifiers like every/all the in the question *Are all the boys riding an elephant?* in the context
of three boys riding an elephant each and an extra elephant, as symmetric determiner quantifiers, contrary to normal adult behaviour. Children are expected to assign a value to all the based on the expected number of elephant riders in VP rather than on the expected number of boys in N, as in the case of cardinal many. The expected number of elephant riders in the context is four, but the actual number of elephant riders is only three. Therefore children incorrectly answer no to the question.

On the other hand, given a context in which there are four boys, of whom three are riding an elephant each and one boy is alone, children interpret all the as an intersective determiner quantifier. That is, children ignore the extra boy in the context because it is not an instance of a boy who is riding an elephant and so lies outside the domain of quantification for intersective all the in the sentence Are all the boys riding an elephant? Children incorrectly answer yes to the question because every elephant-riding boy is indeed riding at least one elephant.

However, Drozd (1998) did not make explicit what precisely children are supposed to know about 'weak' and 'strong' quantifiers and how a child eventually learns the strong quantification system of his/her language.

2.12 Concluding Remarks

As reviewed above, the previous researchers, except Crain et al. (1996) which used a different methodology, found evidence for young children's quantifier spreading and tried to explain the phenomenon in terms of their own hypothesis or theoretical assumptions. Some treated it in terms of non-linguistic factors, some tried to explain it from a pragmatic discourse point of view, and some gave a purely linguistic analysis of the same phenomenon. Inhelder and Piaget (1958; 1964) tried to explain it in terms of non-linguistic, that is, cognitive, factors, and suggested that the spreading error disappears in the maturation of their logical thinking at the stage
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of emergence of concrete operational reasoning which, they argue, comes around the age of seven or eight. Bucci (1978) also gave a maturational kind of explanation with regard to children's understanding of quantifiers, suggesting that children's understanding of syntactic structure underspecifies the scope of universal quantifiers. Both theories, however, fail to provide the actual representations that children assign to sentences with universal quantifiers.

On the other hand, Roeper and Matthei (1974), Philip and Aurelio (1991), Roeper and de Villiers (1991), and Philip (1995) tried to explain the same phenomenon from a purely linguistic point of view. Roeper & Matthei's quantifier-as-adverb hypothesis is quite convincing, positing that quantifiers initially have an adverbial character, and so unselectively bind arguments available in the sentence (cf. Lewis (1975)), but they also fail to give systematic and functional explanations to answer why specially young children treat quantifiers differently from adults and what causes their unique interpretation. Philip's (1995) event quantification hypothesis provides a more systematic analysis with regard to the children's universal quantification, but it fails to explain how and when children acquire quantification over individuals after they have acquired quantification over events. Drozd (1998) claims that young children treat strong quantifiers like every and all as weak quantifiers like two and many, but he does not make explicit what children know about 'weak' and 'strong' quantifiers and further how they eventually learn the strong quantification system in their acquisition.

Donaldson and Lloyd (1974) tried to explain the phenomenon in terms of spatial relations, restricting it to the concepts of 'spatiality' or 'canonicity,' and Freeman et al. (1982) tried to account for it in terms of pragmatic (discourse) analysis factors, suggesting that the phenomenon occurs from the influence of different 'topic-setting cues' so that children's behaviour with the quantification is understandable from the discourse point of view. Even more strongly, Crain et al. (1996) deny the existence of children's symmetrical responses to universal quantification which had
been reported in previous research since Inhelder and Piaget, and claim that all the
errors found in children in the previous research are due to the use of infelicitous
contexts in the experimental design. They claim that young children, like adults, have
full grammatical knowledge of universal quantification. On the other hand, Brooks
and Braine (1996) suggest that quantifier spreading errors occur when children
mistakenly assign an exhaustive representation to a sentence with a universal
quantifier instead of the use of an appropriate collective or distributing representation.

What I would like to stress here is that quantifier spreading is a general
phenomenon which is found in a certain young age group of children between
approximately four to seven or eight, until their grammatical knowledge is fully
developed. This spreading occurs crosslinguistically and perhaps universally in a
range of constructions. Here I concentrate on why young children typically give a
different interpretation from adults in certain contexts and try to explain what the
difference between them is with regard to universal quantification.

In addition, this phenomenon is reported to be found in adult aphasics as well
(Avrutin and Philip (1994); Saddy (1995)). This fact makes me think that this
phenomenon might be neither exclusively cognitive nor exclusively linguistic, but
dependent on contributions from the language faculty and from the central system of
the child's mind in the sense of Fodor (1983). That is, a non-linguistic cognitive
factor seems to be clearly operative in this phenomenon. However, this is not simply
'the plausibility conditions' or 'infelicitous contexts' suggested by Freeman et al. or
Crain et al., but rather comes from interaction among the components of the
interpreter's (here children) mind or mind modules. Therefore, in the next chapter, I
will develop a version of the Modularity Hypothesis (borrowing the term from
Fodor's Modularity of Mind) to explain the children's non-adult like interpretation
with regard to universal quantification and attempt to explain it, based on the ideas of
Fodor's (1983) (perceptual) modules, Smith and Tsimpi's (1995) "conceptual"

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6 They observed that some young children and nonfluent aphasics produce the same responses
to quantificational sentences in the same contexts.

At the same time, this spreading phenomenon by children is also argued to be clearly 'linguistic' in origin, due to the fact that spreading errors are only found in a certain young age group and then disappear. Something must be missing in this period of acquisition. Therefore, I assume that the phenomenon of quantifier spreading can be determined by a combination of clearly 'cognitive' and clearly 'linguistic' factors. That is, both non-linguistic cognitive and linguistic factors are operative in children's behaviour with universal quantification. This will be argued in detail in the next chapter.
Chapter Three

Quantifier Spreading:
A Cognitive and Linguistic Approach

In this chapter, I will argue that the phenomenon of quantifier spreading has to be analysed from both cognitive and linguistic points of view. It can be counted as a clearly cognitive phenomenon because the visual input, the picture, plays a key role in the children's conceptual representation. Assuming that cognitive factors are a function of the central system, I will try to draw a map of the central system and show what the conceptual representation looks like. At the same time, it will be argued that the phenomenon must be clearly linguistic, due to the fact that the spreading errors are only found in a certain young age group, putatively up to the age of 7 or 8 and disappear after then. There must be something missing during this period in language acquisition. I will focus on the delay of the functional category, DP (determiner phrase), in the development of grammatical knowledge and argue that children initially treat the universal quantifiers as modifiers, rather than as functional heads of DP.
3.1 Basic Assumption

I start with the assumption that children, like adults, understand the basic property of universal quantifiers: universal quantifiers such as *all*, *every* and *each* function like modifiers which quantify over the noun phrase which contains them. This is proved by children's adult-like affirmative responses to a context which depicts the symmetrical one-to-one correspondence between the agents and the objects, and also by Brooks and Braine (1996)'s experiment in which 4 to 10-year-old children are found to have little difficulty restricting the quantifier *all* to the noun it modifies.

When a picture is presented to a child, prior to exposure to the test sentence, his or her mind focuses on the individual objects available in the picture, and is 'captured' by the scene or situation in it. He or she makes a quick guess and subconsciously predicts what will be in the test question. When he or she listens to the taped question, for example, *Is every bear holding a honeypot?*, the objects such as *bear* and *honeypot* and perhaps the verb *hold* are expected, that is, they can be viewed as constituting old information, which has engaged the child's imagination. On the other hand, the quantifier *every* is unpredictable, and so may be more salient to the child. Moreover, pictures in front of a child may have more effect, they may be more salient, than what is said. When the child finds that the picture is not symmetrical, that is, not every individual in the picture is matched, but that there is one 'odd' entity, he responds to the question in the negative without thinking further.

Children interpret the salient word *every* as covering each individual object available in the picture. They mistakenly generalise the exhaustive and symmetrical interpretations to conditions which depict pictures which are not exhaustively symmetrical, even though they know the function of universal quantifiers is to modify their complements. They give wider scope to the quantifiers than they should,
treating them as focused elements in the sentence bearing a special focus feature \( <+f> \). The focused quantifiers are raised to the highest position in the sentential structure so that they take the whole sentence in their scope. Here I assume that universal quantifiers inherently bear a focus marker so that they tend to quantify over the whole entities available in the situation. Thus in their conceptual representation the domain of quantification might be the set of objects (or arguments) available in both visual and auditory inputs. However, for adults, the salience of the quantifier does not affect their interpretation because they are equipped with full grammatical knowledge of the relevant rules and principles of the language.

Therefore, it is assumed that the spreading error gradually disappears with the maturation of their logical thinking and the acquisition of grammatical knowledge which requires, for example, a strict restriction with regard to the head-complement relationship within the extended projection. This implies that the interpretation with quantification might be effected through close interaction between conceptual representations (of the language of thought) and the language faculty.

3.2 The Cognitive Account

In this section, assuming that the spreading error by children is due to some function of the central system, I will try to depict the inner structure of the central system and show which factor or factors may cause the different interpretation by children from adults in their conceptual representation with regard to the sentences with universal quantifiers. I will first outline Fodor (1983)'s modularity hypothesis, Smith & Tsimpli (1995)'s "central modules" and Sperber & Wilson(1986;1995)'s Relevance Theory on the grounds that each of the theories gives explicit arguments with regard to the information delivered by input systems to the central system(s) and their interaction, the internal structure of the central systems and the role of central
systems in the interpretation of human utterances, respectively. The ideas which they have suggested will provide the basis for my argument about children's behaviour with universal quantification. A simplified model of the mind will be proposed and it will be claimed that the locus of the children's difference from adults in the exhaustive interpretation of quantifiers is at the interpretation stage, which is assumed to be one of the processes carried out in the central system, along with inferencing, memory, etc., rather than at the (linguistic) decoding stage.

3.2.1 Fodor's (1983) (Perceptual) Modules

Fodor (1983) made an explicit distinction between perceptual (input) and other cognitive systems with regard to human cognitive architecture. The former pertains to sensory stimuli such as vision, audition or olfaction and language, while the latter constitutes the 'central system'. According to his theory, the human mind is composed of a number of modular input systems and a non-modular central system(s). The central systems are functionally distinguished from the input systems: the former are responsible for rational thought, the fixation of belief and storing knowledge, and the latter take a sensory stimulus and translate it into a format recognisable by the central system.

Modular input systems are characterized as domain-specific (each module is sensitive to only a subset of the environmental stimuli, for example, vision or audition, but not both), fast, mandatory (or automatic), and informationally encapsulated (referring to their limited access to data, that is, the impossibility of interaction between intra-modular operations and the central system, i.e. "cognitive impenetrability" in the terms of Pylyshyn (1984)).

Central systems, unlike input systems, are not domain-specific: "the representations that input systems deliver have to interface somewhere, and the
computational mechanisms that effect the interface must ipso facto have access to information from more than one cognitive domain" (Fodor (1983, p.102), they are non-modular, and unencapsulated, that is, central processes involve information transduced from sensory stimulus as well as knowledge in the memory store. Fodor assumed that the nature of central systems is mysterious and so difficult to investigate scientifically. His pessimistic position with regard to the central systems has been challenged by Sperber & Wilson's (1986; 1995) Relevance Theory and by Smith & Tsimpli's (1995) careful study of an individual with unique linguistic talent, which will be outlined in the next sections.

3.2.2 Relevance Theory: a theory of the central systems

Sperber and Wilson (1986;1995) have developed a theory of the central systems, Relevance Theory, which concentrates on the relationship of human communication and central cognitive processes. Focusing on the interpretation of utterances which is one of the typical central cognitive processes, they tried to define the nature and functions of the human cognitive system. The core of the theory is that human cognitive processes are designed to pay attention only to that stimulus, among a number of stimuli in the world, which is 'relevant' to them. Here to be 'relevant' means what interacts in certain ways with human representations of the world. Specifically, 'ostensive communication' presupposes that the speaker intends to attract the hearer's attention and guarantees that the information provided in the communication will be worth the effort of processing it. Further, an utterance is defined as 'optimally relevant' when it can achieve maximal cognitive effects with no gratuitous effort.

Communication involves the manipulation of contextual effects (or cognitive effects). Through communication an individual can add new information to the
information which he has previously; strengthen a tentative assumption which he has; or cancel the previous information and create new information. Crucially, note that some information is new but connected with old information. When these interconnected new and old items of information are used together as premises in inferencing, another piece of new information which cannot be inferred without this combination of old and new items can be delivered. This view of the role of new information will be developed with relation to children's non-adult-like interpretation for universal quantifiers in section 3.2.5.

Relevance Theory suggests that concepts, which are constructs of the central system, have three different kinds of property: (i) logical; (ii) encyclopaedic; and (iii) lexical. "The logical entry for a concept consists of a set of deductive rules which applies to logical forms of which that concept is a constituent." (Sperber & Wilson (1995: p. 86)) The encyclopaedic entry refers to previous assumptions or knowledge of the concept which an individual has; for example, a set of assumptions about the concept 'Napoleon' or 'cat'. Finally, the lexical entry contains phonological, morphological and semantic information, and categorial features, in the sense of the standard generative lexicon of Chomsky. The logical entry and the encyclopaedic entry are assumed to belong to the central system because the entries involve memory, (logical) inferencing and truth conditions, even though the lexical entry contains linguistic information and so belongs to the language module. Smith & Tsimpli (1995) whose ideas will be discussed in the next section claim that part of the lexical entries is assumed to belong to the central systems.

3.2.3 Smith and Tsimpli's (1995) "Conceptual" Modules (or "Quasi-Modules"
Tsimpli and Smith, 1998)
Smith and Tsimpli (1995) tried to exploit the nature of the central systems to explain the case of the polyglot savant Christopher. They suggested a map of the mind which was designed to explain Christopher's peculiar language faculty. Their model of the mind will here be introduced to help understand the nature or functions of the central modules:

As we can see in Figure 1, the special-purpose modules form the internal structure of the central system, compared to Fodorian modules such as vision, audition or taste outside of it. That is, in their view, in contrast to Fodor's theory, some parts of the central systems are also modular, but the modules such as (theory of) mind, face

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Christopher can read, write and communicate in any of some 15 to 20 languages, whereas he has difficulty with every-day activities such as shaving, doing up buttons, cutting his finger nails, hanging cups on hooks, and similar fine-judgement tasks. He has poor arithmetic and problem-solving abilities so that he is unable to formulate a strategy for playing noughts and crosses, or identify abstract patterns. (cf. Smith & Tsimpli (1993))
(recognition), language, etc. are not informationally encapsulated, i.e., 'cognitively penetrable', and exploit a non-perceptual, i.e., conceptual, vocabulary. They distinguished between a conceptual lexicon and a linguistic lexicon (UG lexicon), assuming that the former corresponds to the vocabulary used in the language of thought in logical inferencing, that this vocabulary reflects mental properties which are not purely linguistic, and thus that it falls within the central systems. Further, they made a clear distinction between syntax and morphology, and argued that the morphological component constitutes an interface between the language faculty and the central systems. On this view, only part of linguistic knowledge is constituted by the language module in Fodor's sense and part resides within the central system. The mapping between concepts (the language of thought) and words (their linguistic representation) is carried out at the interface, that is, the morphological component, in the mental system.

In Figure 1 the basic processing mechanism (BPM)\textsuperscript{2} functions as a constraint on the operation of the rest of the system, and LOT and LOT\textsuperscript{*} are those varieties of the language of thought downstream from the specific processors\textsuperscript{3} and the knowledge base. For example, for vision, the vision module inputs a signal which is transduced by the visuo-spatial processor (SP1) through the BPM potentially into the language module; and for language, natural language input is transformed at the interface via the verbal propositional specific processor (SP2) into a form suitable for integration into the knowledge base. The language module acts in part as an input system. This central cognitive modularity hypothesis will be shown in the next section to provide a basis which can be developed to account for a different domain, the phenomenon of quantifier spreading.

\textsuperscript{2} See Smith & Tsimpli (1993) for the description of the BPM, or Anderson (1992) on whose work it is based.

\textsuperscript{3} See Smith & Tsimpli (1993) for the properties of the specific processors.
3.2.4 A Model of the Mind

In this section I propose a simplified model of the mind to account for young children's non-adult-like behaviour with regard to universal quantification. Assuming that children and adults have access to the same cognitive mechanisms, it is claimed that the locus of the children's difference from adults in the exhaustive interpretation of quantifiers is at the interpretation stage, rather than at the decoding stage. The simplified model of the mind is in Figure 2:

* LOTv stands for a language of thought for the visual input. LOTa stands for a language of thought for the auditory input.
As shown in Figure 2, I assume an analysis of the central system, comparable to that proposed by Smith and Tsimpli (1995), where LOTv is that variety of the language of thought that arises from transduction from the visuo-spatial system and LOTa is that variety of the language of thought that arises from the language system, that is, assuming that the language of thought in the mind is not unitary. As an example, the vision module inputs the image of the picture into the language of thought to give a LOTv representation, and similarly, the audition (language) module inputs the natural language into the other language of thought to give a LOTa representation. (Note that audition and language are not the same, but language presupposes an auditory input.) That is, the vision and audition modules are input systems in the sense of Fodor (1983).

The two representations, LOTv and LOTa, which might be viewed as intermediate transductions, are integrated into a single unitary interpretation where the two LOTs become neutral and share a common format. In other words, the concepts corresponding to images of a 'bear' and the word 'bear' are both translated into the same conceptual representation at the interpretation stage. Both LOTv and LOTa representations, as the products of subconscious and automatic decoding processes, function as bases for decision-making at the interpretation stage, where presumably the children's non-adult-like behaviour with regard to universal quantification is accounted for.

3.2.5 Universal Quantifiers as New Information

When a child looks at the picture which depicts the situation where there are three bears holding a honeypot each, with one honeypot left out and a piglet alone;
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each individual concept, such as [bear], [bear], [bear], [honeypot], [piglet], and also the relationship of a bear and a honeypot, that is, the event ['x holding y': x=bear; y=honeypot], are decoded to give a representation in the language of thought. That is, in this LOTv representation, each referential concept and the event which the corresponding images are involved in are present.

The second message, that is, the auditory linguistic input, (here Is every bear holding a honeypot?), is decoded into a separate version of the language of thought to give a representation LOTa, where it is probably the case that the vocabularies of the two LOT representations are not identical. This analysis assumes, following Smith and Tsimpli (1995), that the language of thought in the mind is not unitary, though the concepts corresponding to images of a [bear] and the word 'bear' are presumably the same. When the verbal message is decoded, the items such as 'bear,' 'honeypot' and the event ['x holding y': x=bear; y=honeypot] are already present in the child's LOT representation, hence constitute old information. In consequence the word every, which has no obvious visual equivalent, is salient for the child. Here, I take 'salient' to mean "what is more relevant than some other stimulus in the same context," where relevance is in turn defined in terms of contextual effects and processing effort, in the sense of Relevance Theory (Sperber and Wilson (1986; 1995)). Accordingly, the quantifier every plays a predominant role in the child's interpretation. In other words, in the LOTa representation, the items such as 'bear,' 'honeypot' and the event ['x holding y': x=bear; y=honeypot] appear as old information, which overlaps with those in the LOTv representation, whereas the quantifier every appears as new information which is partially correlated with the old information 'bear,' 'honeypot,' and the event ['x holding y': x=bear; y=honeypot].

These two representations are integrated into a single interpretation. In the process of interpretation, the left-hand-side LOTv representation has precedence over

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4 The bracket [ ] indicates that the items inside it represent concepts, distinguishing those from the natural language forms such as 'bear,' 'honeypot' or 'piglet.'

5 N.B. LOTV and LOTA are stages in the transduction process. For integration to take place, the representations are presumably in a neutral form, simply "LOT."
the right-hand-side representation, LOTa, because the visual input is more salient to
the child than the auditory input (the child is still looking at the picture while he/she
listens to the taped question). The LOTv representation interferes with the child's
construction of an LOTa representation. The LOTa representation is structurally
"dissolved" so that the elements are no longer in a deterministic structural
configuration, i.e. *every* is detached from (e.g.) 'bear' and can float free and reattach to
any (or every) constituent. The child tries to connect the salient word *every* to all
individual objects present in his or her LOT representation, including the third
element 'piglet' as well which is not mentioned in the test question, and checks
whether these objects are involved in the target event [x holding y]. If they are not,
he or she responds in the negative.

In other words, the child misconstrues the fact that the experimenter's
intention is precisely to draw his/her attention to the salient word *every* and in the
process of interpretation overgeneralizes its scope to cover all the items represented
in his or her language of thought. However, adults who are equipped with full
grammatical knowledge of the relevant rules and principles of the language are not
affected by this salience. For them, their grammatical knowledge is precise enough to
determine one particular (correct) interpretation. For the proper (adult-like)
interpretation of the quantifier *every* which belongs inside the determiner phrase (DP)
*every bear*, selecting its own complement *bear*, children need to learn through
experience the relevant syntactic information, for example, for the constituent
structure [XP [X YP]], X has to be related to YP under a head-complement relation,
that is, X is a functional head, taking YP as its complement and projecting its own
extended projection XP, X must categorically select YP, X must be restricted to zero-
level expressions, X must be in complementary distribution with other members of its
category, etc. This will be discussed in detail in section 3.3.

This cognitive approach predicts the results of Crain et al. (1996)'s
experiments (for the details, see section 2.10) in which toy figures performing actions
in real time were used to deliver the story. That is, the visual input of real actions which clearly described what happened in the story was definite enough for the children to grasp the correct content of the story. Accordingly the high rates of correct responses by children in their experiments could be accounted for not only because the children who gave the correct answers could recognize the property (or nature) of the quantifiers but because they had a clear visual image which could predominate over the auditory input, that is, the test question. The "real acting" stimulus could provide a more powerful effect than looking-at-pictures to enable children to achieve the correct interpretation for the target test question, because the former provides children with overt clues while the latter depends on the individual's imagination.

3.2.6 Individual Quantification rather than Event Quantification

Children interpret the salient word every as covering each individual object available in the picture. In their conceptual representation the domain of quantification might be the set of objects (or arguments) available in both visual and auditory inputs. Here I try to analyze this phenomenon in terms of "individual (or argument) quantification" rather than Philip (1995)'s "event quantification," partly on grounds of theoretical parsimony (cf. Brooks & Braine (1996)) and partly on empirical grounds. Regarding the sort of representations the children form from the pictures, the entities such as 'a bear', 'a piglet' or 'a honeypot' can be individually shown, but a relationship or an action such as 'holding' cannot be shown without showing the individuals involved in that relationship or action. So the entities have some kind of priority over the action. Each of those entities in the picture seems to be treated by the children as having to be put into some sort of thematic relation with another. One problem with appealing to event quantification is that it fails to explain
how and when children acquire quantification over individuals after they have acquired quantification over events. Further, it cannot predict children's concern with the extra possible agent, for example, *a piglet*, which is not a part of the whole event in the situation 'x (is) holding y'. As an example, let us look again at one of the pictures which was used as a visual input with the corresponding sentence as auditory input:

(1) Picture (extra object & extra different agent condition)

![Picture](image)

Sentence: Is every bear holding a honeypot?

Adult-like response: Yes.

Child response: No, not that honeypot. (and also the piglet has no honeypot)

As discussed above, the quantifier *every* is salient for children and so it plays a dominant role in their interpretation. They treat the quantifier as if it was uttered with heavy stress. Consequently, contrastive stress (note that the test questions do not include any special stress on the quantifier) is given to it so that the focused *every* is automatically raised to the highest position in the structure to be able to quantify over both the first and second arguments.⁶

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⁶ The movement of the focused element to the FP is supported by Brody's (1990) analysis of Hungarian. More interestingly, he argues that universally quantified categories are marked <+f> inherently. See the details in section 3.3.1. Further, crosslinguistic data support the movement of the
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Even though children have the ability to restrict a universal quantifier to the noun phrase it modifies, they tend to overgeneralize its domain of quantification to include all the objects available in the inputs. They know the grammatical function of the quantifier as a lexical category, i.e. a quantifier as a binder or a modifier, but they might be not yet aware of its syntactic function as a determiner, that is, as a functional head of the determiner phrase which influences the interpretation of universal quantifiers. Specifically, in adult grammar, the quantifier is treated as a functional head with its own complement within its own extended projection (at least in English). The quantifier itself cannot be moved out of its extended projection and if it has to be moved, the whole quantifier phrase (Q+NP) has to be moved. However, in child grammar, the functional category DP seems not to be completely developed at this stage and thus the D-element is freely detached from the category which it belongs to and raised to the highest position to range over all arguments available in the sentence. Therefore previous researchers have hypothesized that children tend to treat a universal quantifier as a sentential adverb. That is, as an unselective binder, the adverbial quantifier binds not just one particular variable but an unlimited number of them simultaneously. (See section 2.4 for the details.)

The delay of the emergence of functional categories in language acquisition has been well discussed in the relevant literature though this is generally at a much younger age. According to Radford (1990), the phrasal categories such as NP, VP, AP and PP emerge after around 20 months since birth, and the use of functional words such as a, the, this, that, etc. starts around 24 months of age. Compared to these periods, the proper use (or interpretation) of the phrase with a universal quantifier in child grammar to the Spec of FP. For example, in Greek the quantifier kanena (no) in the sentence (1) is raised to the preverbal position, the Spec of FP, when it has contrastive stress, as in (2):

(1) dhen rotisa kanena anthropo
not asked-I no-ACC man-ACC
(I've asked no man)
(2) kanena dhen rotisa anthropo
no-ACC not asked-I man-ACC
(I've asked no man)

the quantifier kanena (no) in Greek is raised to the preverbal position, the Spec of FP, when it has contrastive stress. I am grateful to Eleni Gregoromichelaki for providing this data.
quantifier apparently seems to be delayed until much later. I assume that the delay is attributable to the intrinsic property of quantifiers, that is, because quantifiers are inherently focus marked, and this property influences children's interpretation with regard to universal quantification.

This individual quantification analysis is supported by the children's reaction to the picture. The children involved in the present experiment generally enumerate the individual entities one by one. For example, to the question What can you see here?, they normally answer "a bear, a honeypot, and a piglet, three bears are holding a honeypot, (and pointing to each item and repeating) this bear is holding a honeypot, this bear is holding a honeypot and this bear is holding a honeypot, but this honeypot is not, nobody is holding this honeypot, this piglet is going to get it because he hasn't got it", etc.. This enumeration of each individual entity by children is also found in their responses to the second input, the test question, for example Is every bear holding a honeypot?. After their answers "yes" or "no" (they were asked to answer "yes" or "no" in the introduction of the experiment), children normally enumerate each item again, for example, "this bear, this bear, and this bear are holding a honeypot, but this honeypot is left out and a piglet too" Some children preferred to answer without the definite response of "yes" or "no", just saying "only three, three bears are holding a honeypot and one honeypot has nobody and a piglet has nothing."7 When they are asked to answer with "yes" or "no," they responded as "yes, but" and enumerated the items again. From their spontaneous reaction to the picture I got a strong impression of the existence of the exhaustive representation which is suggested by Brooks & Braine (1996) in child conceptual representation. They assign the exhaustive representation to the sentence with a universal quantifier so that the quantifier covers all the entities available in their conceptual representation in its scope.

Due to this property, Drozd (1998) argues that children interpret the strong quantifiers such as every, each and all as weak quantifiers such as a, many, a few, etc.
Even though children and adults have access to the same cognitive mechanisms, and further the quantifier might be salient to both of them because of its intrinsic property (i.e. the quantifier as focused element), their conceptual representations could be different because their representations are affected by their different language faculty. That is, the interpretation with quantification might be done through the close interaction between the conceptual representation and the language faculty. Then the difference between children's and adults' conceptual representations might be attributed to the role of the language faculty, i.e. their grammatical knowledge.

Therefore, I assume that the spreading error gradually disappears with the maturation of children's logical thinking and the acquisition of grammatical knowledge which requires, for example, a strict restriction with regard to the head-complement relationship within the extended projection. From the evidence of the present experiments full acquisition of these complexities seems to be delayed until up to seven years or so. This implies that the interpretation with quantification might be done through the close interaction between the conceptual representation (of the variety of the language of thought) and the language faculty. The conceptual representation must be somewhere checked by the interface rules of the language faculty. In the next section I try to draw a map of the mind which shows the process of each conceptual part and then specify the structure of the conceptual representation.

3.2.7 Conceptual Representation

Regarding children's behaviour with universal quantification, specifically, their failure to determine a semantic restriction on the domain of quantification, it can be assumed that children might have different conceptual representations from those
of adults. In children's conceptual representation the domain of quantification might be the set of objects (or arguments) available in both visual and auditory inputs, whereas in adults' conceptual representation it is limited to the object which is quantified by the quantifier. Even though children and adults deploy the same cognitive processes, and even though the quantifier is salient to both of them because of its intrinsic properties, the mode of representation in their minds is different because its representation is affected by the language faculty. That is, the interpretation with quantification might be effected through the close interaction between conceptual representation and the language faculty. The difference between children's and adults' conceptual representations might be triggered by the role of the language faculty, i.e. their grammatical knowledge.

Given this basic assumption, in combination with the assumptions in Figure 1 from Smith & Tsimili (1995) and in Figure 2, I have tried to draw a map of "mental comprehension," as in Figure 3, to specify the structure of the conceptual representation:
As we can see in Figure 3, Fodorian (perceptual) modules such as vision, audition, etc. function as input systems to the central systems. Input to each module is decoded into one of those varieties of the language of thought which link the knowledge base to give a representation, and the representation is in turn referred to the 'relevant' subpart of the knowledge base: for example, conceptual lexicon and conceptual structure. The various mental representations such as LOTv and LOTa are integrated at some point and translated into a single conceptual level of representation.

The "conceptual lexicon" includes encyclopaedic information associated with each item of vocabulary, i.e. it contains a variety of concepts for each lexical item in the UG lexicon. These concepts are integrated into a "conceptual structure," forming
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a thematically (and logically) related configurational structure with specification of predication—a subject-predicate relation, complementation—a head-complement relation, and scope assignment of the operators such as tense, plurals, focus, adverbs, wh-words and quantifiers. Their relation does not need to be syntactically hierarchical but can be linearly ordered, based on the thematic function of each item. This structure maps onto linguistic structure, exploiting the projection of lexical categories such as V, N, P, and A and their corresponding functional categories: VP/IP, NP/DP, PP and AP/DegP. Features such as tense, focus and plurality and all 'functional' information is drawn from the UG lexicon and integrated with the conceptual structure. Conceptual structure may or may not include quantificational information, (indicated by +q and -q in Figure 3) thereby corresponding to the linguistic levels of representation LF and S-structure respectively [note that I am presupposing a 'pre-Minimalist' linguistic theory with at least one level of syntactic representation]. The mapping between items of conceptual representation and those of the language faculty is carried out at the interface. The conceptual and the linguistic representations mirror each other, but the contents of the two representations are not always identical. The contents of the former depend on an individual's knowledge: for example, a person who can deal with several languages which have different properties, e.g. plural systems, parameter settings for word order, the presence or absence of arguments in the structure, etc., may have multi-dimensional entries in his or her conceptual system. Further, the conceptual structure and the linguistic structure are both configurational, but the former includes only thematic and scope relations, as mentioned above, whereas the latter ranges over lexical (V,N,P,A) and phrasal categories (VP,NP,PP,AP). The relation between conceptual structure and linguistic structure needs to be bidirectional so that they are closely inter-connected. The conceptual representation might be affected by the relevant rules of the language faculty. Then we find that the difference between

8 I am not committed to any particular interpretation of S-structure, but I need representations with and without quantificational specification.
children's and adults' conceptual representations with regard to universal
quantification can be caused by their mastery of the relevant grammatical knowledge,
i.e. the language faculty. Focusing on this fact, in the section 3.3 I will specify the
difference between children and adults in their grammatical knowledge with universal
quantification and explain it with relation to children's naturalistic data and also
crosslinguistic data.

Here I would like to concentrate on showing what the structure of the
conceptual representation looks like, based on the idea that thematic roles play an
important role in forming the syntax of thoughts. Let us consider more carefully the
first input to the child: a picture which depicts the situation where there are 3 bears
and 4 honeypots such that each of 3 bears is holding a different honeypot and the
fourth honeypot is not being held, and there is an extra piglet. The conceptual
representation for this visual input by children might be as follow:

(2) Conceptual representation for 1st (visual) input:

[[a bear] [+] [a honeypot]]
[[a bear] [+] [a honeypot]]
[[a bear] [+] [a honeypot]]
[" ? "] [+] [a honeypot]]
[[a piglet] [+] [" ? "]

Here the bracket [ ] means that the items inside it represent images or concepts from
the picture, distinguishing those from the natural language forms such as a bear, a
honeypot or a piglet. Each individual image (or concept), such as [bear], [bear],
bear, [honeypot], [piglet] and [the relationship between the arguments, bear and
honeypot, associated with an action] are represented in the mind, for example, a bear
as a holder (agent) and a honeypot as an object (goal). The relationship between the
entities is marked with the symbol [+] in (2). The extra honeypot and another
possible isolated agent piglet are not involved in the relationship between the
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argument and the predicate. The symbol [?] denotes the missing agent and object. These missing entities make the remaining [honeypot] and the isolated [piglet] salient in the situation. The two entities [honeypot] and [piglet] are still represented in the framework of the argument-predicate structure in children's conceptual representation even though they are not so related in the real situation.

The children's actual reactions to the relevant pictures support the above description of the conceptual representation. That is, the children involved in the present experiments generally enumerate the individual entities one by one. For example, to the question What can you see here?, they normally answer "a bear, a honeypot, and a piglet, three bears are holding a honeypot, (and pointing to each item and repeating) this bear is holding a honeypot, this bear is holding a honeypot and this bear is holding a honeypot, but this honeypot is not, nobody is holding this honeypot, this piglet is going to get it because he hasn't got it," etc. This enumeration of each individual entity by children is also found in their responses to the second input, the test question, for example Is every bear holding a honeypot?. After their answers "yes" or "no" (they were asked to answer "yes" or "no" in the introduction of the experiment), children normally enumerate each item again, for example, "this bear, this bear, and this bear are holding a honeypot, but this honeypot is left out and a piglet too." Some children preferred to answer without the definite response of "yes" or "no," just saying "only three, three bears are holding a honeypot and one honeypot has nobody and a piglet has nothing." When they were asked to answer with "yes" or "no," they responded as "yes, but" and enumerated the items again. They assign the exhaustive representation to the sentence with a universal quantifier so that the quantifier covers all the entities available in their conceptual representation in its scope. In addition, depending on each child's imagination, the colour of the picture, and their encyclopaedic information about bears (e.g. bears love honey and the fact that the picture of the bears is made out of a Winnie-the-Pooh sticker) could be represented.
This conceptual representation might be structured in several alternative ways. One possibility is that each lexical item is incorporated into a linearly ordered structure, based on its thematic role, as in (3):

(3)

```
agent     action     goal (object)
  bear     hold       honeypot
```

The structure (3) represents the relation between the two arguments, that is, an action relation (holding) between a bear and a honeypot. A bear as a holder, that is, an agent of action, comes first, the action verb hold comes next, and the goal of the action a honeypot is the final element of the string. This action relationship between two arguments could also be drawn as the structure in (4):

(4)

```
hold (action)
  bear (argument)  honeypot (argument)
```

In (4), two arguments a bear and a honeypot are dependent on the action verb hold which dominates them. When children concentrate on what is going on in the situation, the actual action (or event) is highly focused in their representation so that it can be highlighted and centralized by the two dependent arguments.

The other possibility is to postulate a hierarchical structure for the argument and predicate relationship. The action verb hold and the goal of the action a honeypot form a cluster to function as the predicate of the whole sentence. The argument a bear is superordinate to the predicate [hold a honeypot], as in (5):
I assume that when children are confronted with a fourth honeypot, which is not being held, and another possible agent (the excrescent piglet) that they construct structures parallel to those above and as diagrammed below in (6) and (7). That is, they regard these isolated items, not as being independent from the main event of the situation, but as parts of the constituent structure which represents the relationship of argument and predicate, even though a corresponding argument or predicate is missing in the linguistic input. For example, the following structures can be drawn for the extra honeypot as in (6) and a piglet as in (7):

(6) (i)

```
  agent
      /\    \
     /   \   \   \ 
 agent action goal (object)
```

cf. (3)

(ii)

```
  action
     /   \ 
    /     \
 argument  argument
```

cf. (4)
The items missing from the structure are salient in the children's mind and they insist that the missing argument and predicate have to be included in the corresponding positions of the structure to give a perfectly satisfied one-to-one interpretation.

The second input to the child is a tape-recorded voice, uttering for example, the sentence *Is every bear holding a honeypot?*. When this auditory input is decoded, a child who is preoccupied with the first input, a picture, presupposes what will be in
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the question. The expected information such as the presence of bear, honeypot and the predicate relationship between the arguments [x is holding y] is identified, but is structurally dissolved so that the sentence is no longer represented with its correct structure. The conceptual representation for this 2nd input can be described as follows:

(8) Schematic conceptual representation for 2nd (auditory) input:

Is EVERY bear holding a honeypot?

where bold type indicates the salience of the concept encoded by the word. The word every is then attached to the whole of the representation given by the first input so that the content of the whole is within its scope. In consequence, the conceptual representation from the integration of the 1st and 2nd inputs will be the partially inconsistent (9):

(9) Conceptual representation from the integration of the 1st and 2nd inputs:

EVERY (x,y,z), x=bear; y=honeypot; and z=piglet; x/z is holding y

For every agent x & z and every object y, the agent holds the object.

This conceptual representation represents universal quantification over individuals. Possible conceptual structures for this representation can be drawn as in (10):

(10) (i)

```
    every
   /   \
bear/piglet hold honeypot
```
Whichever is the "right" structure in (10), children overgeneralize the function of the quantifier, and distribute its scope over all accessible NP's.

On the other hand, for adults, even though their conceptual representation can be affected by the salience of the visual input, and also the intrinsic property of the quantifier, that is, the quantifier as focused element, their representation is checked by the relevant rules of the language faculty at the interface so that the irrelevant representations are abstracted away. As shown in the diagram, Figure 3, the conceptual lexicon and structure are closely inter-connected with the UG lexicon and the linguistic structure of the language faculty. When their representations are integrated to be translated into a common format, the language faculty interferes to make a single neutral level of representation. Then the difference between children's and adults' conceptual representations with regard to universal quantification can be caused by the ability of the language faculty. Therefore in the next section I try to find out the difference between children and adults in their grammatical knowledge with universal quantification and specify it with relation to crosslinguistic data and children's naturalistic language data.
3.3 The Linguistic Account

In the previous section I gave an account of why children give a unique interpretation to sentences with universal quantifiers. The claim was that the individual images from the picture predominate in the children's mind and interfere with their logical thinking about the linguistic input, the test sentence. They pick on just the salient word, the quantifier, for example, *every*, from the second input, the test sentence, treating it as unpredicted new information in the comparison with other items already represented in the LOTv given by the first input. As a result they overgeneralize its scope to include all the items, even objects which are unmentioned, but which have been pictured. An alternative analysis would attribute this behaviour to the intrinsic property of quantifiers which reflects the exhaustivity of the entities mentioned, so that children misapply the property to cover all the entities available in their conceptual representation. Anyhow, children seem to assign a special focus feature <+f> to the quantifier and the focused quantifier is raised to the highest position to cover the whole sentence in its scope. In this section, I will show that this cognitive account with regard to quantifier spreading by children can be accommodated within the framework of standard linguistic theory.

The movement of the focused element to the highest position is supported by crosslinguistic data, for example, consider Brody's (1990) analysis of Hungarian. I will here introduce his assumptions with regard to the existence of an additional extended projection FP (Focus Phrase) and show that the present analysis of quantifier spreading supports those assumptions. Then I will consider the categorial status of the quantifier in the children's interpretation, focusing on the movement of that quantifier out of its own extended projection to FP. I will treat this as an example of a left-branch element being semantically detached and moving out of its own extended projection, sharing the migratory property of other left-branch
elements, which can be subextracted out of their own extended projection, detaching from their complements. It will be shown that degree expressions such as *more, less* and *enough* in the analysis of Doetjes et al. (1998), demonstratives in the analysis of Giusti (1997), a number of aspects of the acquisition of wh-movement, topicalization and scrambling and acquisition of negation and modality in Dutch child grammar, a lot of naturalistic language data and quantifier spreading in child grammar can all be explained in the same way. I will argue that all these elements can be treated as extractable adjuncts which can be adjoined to any suitable host, rather than as the functional heads of extended projection. Finally, I will claim that the phenomenon of quantifier spreading by children can be seen as a reason for the delay of the relevant functional category, i.e. DP, in language acquisition.

### 3.3.1 FP (Focus Phrase) as an Extended Projection

Brody (1990) argues that focus should be treated universally as creating an X'-projection, that is, F, F' and FP as in (11):

\[
\begin{align*}
\text{(11)} & \quad \text{FP} \\
& \quad \text{F'} \\
& \quad \text{F}
\end{align*}
\]

He also argues that F, F' and FP are present only in sentences that contain a focused element. That is, this projection is optional so that it does not have to be present when the sentence does not include any focused category.

As an instance, in a Hungarian sentence like (12), the focused NP JANOST(JOHN) has to be moved to preverbal position:
As we can see in the ungrammatical example (12b), the focused NP JANOST cannot remain in situ, in contrast with JOHN in English, but it must move to preverbal position as in (12a). According to Brody, the focused category does not have the feature <+f> inherently, but the verb assigns <+f> to the category under the same structural conditions as Case assignment: the conditions of government and adjacency. Therefore, JANOST in (12a) has to be moved to the preverbal position to be adjacent to the verb to get the <+f> feature. He suggests that the FP occupies different positions in English and Hungarian, as in (13a & b), respectively:

(13) a. FP  
   |  
   |  
   |  
   |  
JOHN I like t

(13b) represents the LF structure of the English sentence I like JOHN. As shown in the structure, in English FP is additional to IP, while in Hungarian it takes the place of IP as in (13b). It is assumed that the Spec of FP must contain a focused element at S-structure (in the case of Hungarian) or at LF (in the case of English), and at LF all phrases with <+f> must be in an FP.
More interestingly, Brody (1990) argues that universally quantified categories are marked <+f> inherently. He gives the following examples (p. 216):

(14) (a) MINDENKINEK felmondtam a verset
EVERYBODY-TO up-said-I the poem(acc)
I recited the poem to EVERYBODY

(b) MINDENKINEK a verset mondtam fel
EVERYBODY-TO the poem(acc) said-I up
I recited the POEM to EVERYBODY

In the examples (14a) and (14b), the focused universal quantifier phrase MINDENKINEK (EVERYBODY-TO) is not adjacent to the verb. In (14a), it precedes the preverbal verbal modifier fel (up), whereas in (14b) the focused NP a verset (the poem) intervenes between it and the verb. Assuming that the verb assigns the feature <+f> under adjacency, the uq-phrase MINDENKINEK can not receive a <+f> feature from the verb in these sentences. However, the stress pattern and the identificational interpretation show that the uq phrases in both sentences clearly have the <+f> feature. Therefore, Brody argues that uq-phrases are <+f> marked inherently, but this inherent <+f> marking for uq-phrases can only be optional. That is, when the uq-phrase appears in sentences without focus, it is not <+f> marked because <+f> categories can only appear in sentences with FP's where all <+f> categories must be in FP at LF.

3.3.2 Universal Quantifiers as Focused Elements

Bearing in mind this special property of uq-phrases discussed in Brody (1990), let us consider the children's unique interpretation of universal quantification.
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The conceptual representation discussed in the previous section is mapped onto the linguistic representation at the interface. Children may assign a feature <+focus> to the salient word, here the quantifier. The focused quantifier is raised to the preverbal position, the Spec of FP which is adjoined to IP (assuming that the FP is present in children's semantic representation because they interpret the universal quantifier as a focused element). This process satisfies the condition that the FP has to be filled with a focused element at LF. Consequently the quantifier has wide scope over the whole sentence. The semantic representation by children of the sentence *Is every bear holding a honeypot?* will be as in (15) (cf. Chomsky (1995) and Kayne (1994)):

(15) LF by children of the sentence *Every bear is holding a honeypot.*

As we can see from (15), the difference between children and adults is that the quantifier *every* is not part of the DP structure in the children's semantic representation, but it is raised to the Spec position of FP with a focus feature <+f>, so that it takes both the argument and predicate in its scope. On the other hand, in the

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Note that details of this analysis will be modified below, in the discussion of the structure of the DP.

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adult semantic representation, the universal quantifier does not have a <$+f>$ feature so that it stays in situ just to quantify over its own complement bear. The extended projection FP is not present in the adult representation because the sentence does not include a focused category. The semantic representation by adults of the same sentence can be drawn as in (16):

(16) LF by adults of the sentence *Every bear is holding a honeypot.*

\[
\text{CP} \quad \text{Spec} \quad \text{C} \quad \text{I} \quad \text{VP} \\
\text{Spec} \quad \text{I'} \quad \text{V'} \quad \text{DP} \quad \text{NP} \\
\quad \text{every} \quad \text{bear} \quad \text{is holding} \quad \text{a} \quad \text{honeypot}
\]

The reason why children assign a special focus just to the quantifier *every*, not to the quantifier phrase *every bear*, resulting in the detachment of the quantifier out of the quantifier phrase, is again because of the saliency of the quantifier in their conceptual representation, as discussed in the previous section. Interestingly, this kind of semantic interpretation by children is also found in adult English. Roeper & de Villiers (1991) introduce the following sentence as an example of an adverbial quantifier (p.252):

(17) John saw *another* hitchhiker down the street, so he went to a different corner.
Here, the word another implicates (on one reading) that John is also a hitchhiker. That is, the adverbial quantifier another semantically denotes both NPs John and hitchhiker so that it can be formulated as: [an [other [than John]] hitchhiker]. This interpretation can also be explained by focus movement. The adverbial quantifier another might carry a special "stress" because of its identificational interpretation and so it is raised to the preverbal position and adjoined to IP, creating the extended projection FP, to take the subject NP John as well as its own complement hitchhiker in its scope.

### 3.3.3 Universal Quantifiers as Modifiers

In this section, I argue that young children seem to treat a universal quantifier such as every, all or each as a modifier which is dominated by the maximal projection NP as in (18), (note the contrast with (15) above and (21) below), not as a functional head D of DP as in (19), as adults do:

\[
\begin{align*}
&\text{(18)}
\end{align*}
\]

\text{NP} \quad \text{NP}
\quad \text{every}
\quad \text{bear}

\begin{align*}
&\text{(19)}
\end{align*}

\text{DP} \quad \text{NP}
\quad \text{D}
\quad \text{every}
\quad \text{bear}

In (18) the quantifier every occurs in the adjoined position as a modifier, but in (19) it heads a functional projection DP. According to this modifier view, the relationship between every and bear is not one between a head and a complement, that is, every is not treated as a projecting head, but as a natural language binder which modifies the noun bear. Therefore, in the children's interpretation universal quantifiers can be separated from their complement and raised to the highest position of the sentence to get sentential scope.
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This kind of semantic detachment by children occurs everywhere: from the subject position, the object position, the adjunct position, and even from a position in an embedded sentence to take the whole matrix sentence in its scope. An example of each is shown in (20):

(20) a. Every bear is holding a honeypot.
b. A caterpillar is carrying every ladybird.
c. There is a baby behind every mummy elephant.
d. There is a chair that every cat is sitting on.

The semantic representation of each sentence in (20) will be as in (21):
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c. FP
   Spec
   every F' IP
   DP I' VP
      V D NP PP
      D NP I W
       D NP
       ' e mummy elephant
   there is a baby behind

d. FP
   Spec
   every F' IP
   Spec I' VP
      V D NP CP
      Spec C' I' VP
         D NP I V PP
      that e cat is sitting on
   there is a chair that

10 In this analysis I assume non-binary branching.
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As we can see in the semantic representations (21) of the sentences (20), the quantifier *every* is detached from its complement *bear* inside the subject DP *every bear* and raised to the Spec of FP in (21a); from *caterpillar* in the direct object DP *every caterpillar* in (21b); from the DP *every mummy elephant* inside PP *behind every mummy elephant* in (21c); and from the subject DP *every cat* within the embedded sentence, crossing over the CP in (21d).

If the status of quantifiers in child grammar was as a functional head D of DP, this kind of subextraction could not be syntactically accounted for. Ross's Left Branch Condition, which specifies that movement of an element in the left-branch position is possible only by pied-piping the entire phrase, fails to explain this phenomenon. Further Huang (1982)'s CED (the Condition on Extraction Domains), which asserts that adverbial phrases and subject NPs constitute islands for extraction, since they are not L-marked, and Abney (1987)'s generalization about functional heads, that is, the impossibility of functional heads being detached from their complement by movement, cannot account for it. All standard linguistic conditions assert that if the item is to move, the entire phrase in which it belongs has to be moved by pied piping. I am not here interested in proving the universality of these conditions. Rather, concentrating on evidence from natural language data, I am trying to explain our phenomenon within the framework of standard linguistic theory. Therefore, I assume that functional heads cannot be separated from their complements and, I argue that young children treat a universal quantifier as a modifier (a natural language binder), but not as a determiner, i.e. a functional head of the determiner phrase. It follows that the phrase *every bear* in the sentence *Every bear is holding a honeypot* is specified as an NP which includes a modifier *every* and a head noun *bear*, not as a DP.

This view can be supported by crosslinguistic data which allow the subextraction of the left-branch elements out of its own extended projection: for example, Doetjes et al.'s (1998) analysis with regard to the migratory property of
some degree expressions; the categorial status of demonstratives in Rumanian and
Modern Greek (as modifiers of the noun) in the analysis of Giusti (1997); the
subextraction of wh-word in Polish, Russian and Latin, as discussed in Corver (1990)
and quantifier *kanena (no)* in Greek; and children’s naturalistic language data in their
acquisition. They all show that the elements which belong to the left-branch of the
extended projection can be stranded and moved to another position. Even though this
type of syntactic detachment is not sufficient to explain the semantic interpretation
that children provide for universal quantification, we have a strong impression that
the migratory property of the degree expressions such as *more, less* and *enough*, the
subextraction of wh-word and quantifier in adult Polish and Greek, the movement of
wh-elements and topicalized arguments in child grammar, and the misplacement of
expressions with special stress from naturalistic children’s data can be closely related
to the unique interpretation of the sentences with universal quantifiers shown in child
grammar. Therefore, I will here introduce the relevant analyses of the syntactic
detachment.

3.3.4 The Migratory Property of Degree Expressions

Doetjes et al. (1998) classify degree expressions into two sorts: class-1 degree
expressions such as *too, as, very* and *how* are functional heads obligatorily selecting
an AP; on the other hand, class-2 degree expressions such as *more, less* and *enough*
are predicate modifiers which can be adjoined to any suitable host. The relevant
structures are given in (22) and (23) respectively (Doetjes et al. (1998: p.327)).
Examples which show the contrast between the class-1 and class-2 degree expressions are given in Doetjes et al (p.326), as in (24) and (25):

(24)  

a. John is *fond of Mary. *Maybe he is too so.

b. *The weather was hot in Cairo, very so indeed.

c. John is *fond of Mary. *Maybe he is as so as Bill.

d. *John told me he was afraid of spiders, but I wonder how so he really is.

(25)  

a. Of all the careless people, no one is more so than Bill.

b. The police searched the big room carefully, but the small room less so.

c. John is good at mathematics. He seems enough so to enter our graduate program.

As shown in the above sentences, class-2 degree expressions such as *more, less and enough can be stranded when an AP is replaced by a pro-form so as in (25) whereas class-1 expressions such as too, very, as and how cannot, as in (24).

Interestingly, the structures (22) and (23) are similar to (18) and (19): children's putative interpretation of universal quantifiers in (18) is like that in (23), which includes class-2 degree expressions as modifier phrases; and the standard adults' interpretation as in (19) resembles the structure (22) which includes class-1 items as functional heads. I am not directly concerned with the main point of Doetjes et al's paper, but I would like to focus on the "migratory" property which, Doetjes et
al. argue, only the class-2 degree expressions have. The main distinction between the
two degree expressions is that only class-2 degree expressions can be migratory so
that their distribution is not restricted to the extended adjectival projection, but they
can be attached to any predicate. The corresponding examples are given by Doetjes
et al. as follows:

(26) a. He is [AP more [AP famous]] than I thought.
b. His paper is [AP less [AP interesting]] than I thought.
c. He is [AP [AP funny] enough ] to be my buddy.

d. He is [PP more [PP on drugs ]] than any of his friends.
e. He is [PP less [PP into syntax]] than he was before.
f. He is [PP enough [PP over the limit ]] to be arrested.

g. He is [DP more [DP a linguist ]] than a psychologist.
h. He is [DP less [DP a typical Hollywood celebrity ]] than any of his
   neighbours.
i. He is [DP [DP man ] enough ]] for Sue.

j. He [VP [VP likes venison ] more] than his family does.
k. He [VP [VP lives like a celebrity ] less ] than he would like to.
l. He [VP [VP loves Mary ] enough ] to marry her.

As shown in the examples of (26), the class-2 degree expressions, more, less and
enough, can be attached to AP, PP, DP and VP. Due to this kind of property, Doetjes
et al. treat the class-2 degree expressions as adjuncts and also possibly as specifiers,
assuming that specifiers are designated adjuncts. In contrast, the sentences in (27)
show that class-1 degree expressions cannot be attached to other maximal projections than the extended adjectival projection:

(27) a. He is [DegP too [AP famous]] to leave town.
    b. He is [DegP as [AP intelligent]] as Bill.
    c. He is [DegP very [AP dependent on his parents]].
    d. I wonder [DegP how [AP rich]] he really is t.
    
    e. *He is [DegP too [PP under scrutiny]] to be elected at this time.
    f. *He is [DegP as [PP over the limit]] as Bill.
    g. *He is [DegP very [PP on drugs]] indeed.
    h. *I wonder [DegP how [PP into syntax]] he really is t.
    
    i. *He is [DegP too [DP a scientist]] to care about such problems.
    j. *He is [DegP as [DP a typical Hollywood celebrity]] as Robin W.
    k. *It's [DegP very [DP time for coffee]] now.
    l. *I wonder [DegP how [DP man]] he really is t.
    
    m. *He [DegP too [VP likes venison]] for his own good.
    n. *He [DegP as [VP lives like a typical Hollywood celebrity]] as Robin W.
    o. *He [DegP very [VP loves Mary]] indeed.
    p. *I wonder [DegP how [VP expect to be nominated]] he really does t.

As shown in the sentences of (27), the class-1 degree expressions, too, as, very and how, can be attached only to their own maximal projection AP (DegP) but not to any other extended projection such as PP, DP and VP.

Further, with relation to Abney's (1987) generalization that functional heads cannot be separated from their complement by movement, Doetjes et al. (1998)
support their analysis of class-1 elements as functional heads and class-2 elements as modifiers. Topicalization in Dutch, that is, a movement to the specifier position of CP, is allowed only in the case of class-2 items when they are analyzed as modifiers, not as functional heads. The examples are given by Doetjes et al (1998, p. 333):

(28)  
\begin{enumerate} 
  \item a. Hij lijkt me [DegP te [AP afhankelijk van zijn vader ]] om een eigen zaak te beginnen. 
  \begin{itemize} 
    \item he seems to-me \textit{too} dependent on his father for a own business to start 
  \end{itemize} 
  (He seems to me to be too dependent on his father for his own business to start.) 
  
  b. *Te lijkt hij me [DegP t [AP afhankelijk van zijn vader ]] om een eigen zaak te beginnen. 
  \begin{itemize} 
    \item \textit{too} seems he to-me dependent on his father for a own business to start 
  \end{itemize} 
  (He seems to me to be too dependent on his father for his own business to start.) 
\end{enumerate}

(29)  
\begin{enumerate} 
  \item a. Hij lijkt me [AP meer [AP afhankelijk van alcohol ]] dan van andere drugs. 
  \begin{itemize} 
    \item he seems to-me \textit{more} dependent on alcohol than on other drugs 
  \end{itemize} 
  (He seems to me to be more dependent on alcohol than on other drugs.) 
  
  b. ?Meer lijkt hij me [AP t [AP afhankelijk van alcohol]] dan van andere drugs 
  \begin{itemize} 
    \item \textit{more} seems he to-me dependent on alcohol than on other drugs 
  \end{itemize} 
  (He seems to me to be more dependent on alcohol than on other drugs.) 
\end{enumerate}

The ungrammaticality of the sentence (28b) shows that the topicalization of the class-1 element \textit{te} (\textit{too}) is not allowed. On the other hand, (29b) in which the class-2 element \textit{meer} (\textit{more}) is topicalized into the Spec position of CP seems to be more acceptable.
Further, class-2 degree items can be stranded by topicalization of AP whereas class-1 items cannot, as shown in the contrasting examples (30)(p.333):

(30)  
   a. *Intelligent lijkt hij \[\text{DegP te} \ [\text{AP t}]] \text{om enigszins normaal te functioneren.}
       intelligent seems he too for more-or-less normally to function
       (He seems too intelligent to function more-or-less normally)
   b. Intelligent vind ik hem \[\text{AP meer} [\text{AP t}]\] dan de gemiddelde Nederlander.
       intelligent find I him more than the average Dutchman
       (I find him more intelligent than the average Dutchman.)

The ungrammaticality of (30a) shows that the class-1 degree expression te (too) cannot be stranded when the AP intelligent is topicalized into the Spec of CP, whereas the class-2 degree expression meer (more) can, as in (30b).

Doetjes et al. argue that the difference between migratory and nonmigratory degree expressions is due to c-selection (categorial selection, cf. Grimshaw (1979)). The syntactic status of the migratory class is that of a modifier, that is, adjunct or specifier, which attaches to any suitable semantic object. On the other hand, the nonmigratory class is defined as a functional degree head which c-selects a complement of a specific category, AP.

3.3.5 Naturalistic Language Data from Child Grammar

This kind of syntactic detachment often occurs in child grammar. Kampen (1997) reports data involving left-branch subextraction in Dutch child language. She observed that these subextractions occur in wh-questions, topicalizations and scrambling environments, as in the examples of (31a), (31b) and (31c) respectively, (Kampen (1997: p.115)): 
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(31) a. welke wil jij [e liedje] zingen? (3;7)
which want you [e song] sing?
(Which song do you want to sing?)

b. Cynthia is dat niet [e pyjama] (2;5)
Cynthia is that not [e pyjama]
(That is not Cynthia's pyjama.)

c. dat heb ik zo niet meer [e lang] gedaan! (6;6)
that have I so not more [e long] done!
(I have not done that for a long time.)

The wh-word *welke* (*which*) is subextracted out of the wh-phrase *welke liedje* (*which song*), detaching from its complement *liedje* (*song*), to be fronted in a wh-question by a 3 years and 7 months old Dutch child, as in (31a). The proper noun *Cynthia* is also detached from its complement *pyjama* and topicalized (subextracted) to the Spec of CP by a 2 years and 5 months old Dutch child, as in (31b). Another kind of <-wh> subextraction is found in a 6 years and 6 months old Dutch child in sentences where the D-pronoun is in a scrambling position at the left of a negative or positive adverb, as in (31c), in which *dat* is subextracted to the Spec of CP and the adjectival projection [DegP meer [AP e lang] (more [e long])] is stranded.

The subextractions in the sentences of (31) violate Ross's left-branch condition which specifies that movement of an element in the left-branch position is possible only by pied-piping the entire phrase. Based on these examples, Kampen argues that Ross's left-branch condition is not a universal condition but a language-specific one. On the other hand, from her data she finds that these subextractions occur only out of direct object DPs and predicative DegPs, not out of subject DPs or adjuncts. So she supports Huang's (1982) CED (Condition on Extraction Domains)
which asserts that adverbial phrases and subject NPs constitute islands for extraction, since they are not L-marked.

Corver (1990) points out that this kind of subextraction occurs even in adult languages such as Polish, Russian and Latin. For example, the following example of wh-subextraction in Polish is a well-formed sentence in adult grammar:

   jakii wykrenciels [ti numer]?  
   Whichi (you) dialed [ti number]?
   (Which number did you dial?)

He explains this by arguing that nominal arguments in Polish lack the DP-structure, and therefore allow wh-extraction. The subextracted wh-element is assumed to be an extractable adjunct in his analysis, not a head of a functional projection.

In addition, as discussed in footnote 6 above, the subextraction of the quantifier kanena (no) in Greek in the case where contrastive stress is given to it can be another example to support the children's behaviour with regard to universal quantification, that is, the movement of the focused item to the Spec of FP. The examples are repeated here for convenience:

(33) a. dhen rotisa kanena anthropo
    not asked-I no-ACC man-ACC
    (I've asked no man)

b. kanena dhen rotisa anthropo
    no-ACC not asked-I man-ACC
    (I've asked no man)
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As in (33b), the quantifier kanena (no) in Greek is raised to the preverbal position, the Spec of FP, when it has contrastive stress.

In contrast to Corver's analysis, Kampen (1997) tries to explain this subextraction phenomenon by positing a PF-adjacency parameter on a functional head. As an instance of parametric variation, languages such as Polish and Latin have N-projections with a self-sufficient case and so in these languages nouns need no formal D-elements. By contrast, in languages such as English, Dutch and German the N needs a D-element to satisfy the case filter, which requires PF adjacency with the D-element. However, in Dutch child language, the checking rules are not yet present as strict PF conditions and the adjacency of D <+case> and N <-case> is not yet imposed by the case filter. That is, due to their slow acquisition of this parameter setting, Dutch children allow the extraction of a left-branch element from the DP where it belongs.

The interesting findings from Kampen (1997) are that (i) stranding data are still found after the age of six; (ii) in the early period of language development, around the 2 to 3 year old stage, the use of an obligatory D-element is found; and (iii) the subextracted elements seem to bear contrastive stress. These findings are correlated with my points regarding the interpretation of universal quantifiers by children. That is, the children involved in my experiments up to 7 years old continue to show quantifier spreading errors. The apparent lack of development in their comprehension with universal quantification was observed throughout the age range between 4 and 7 without discontinuity. More interestingly, the special stress on the D-element might be a crucial factor for the subextractions in child language. Note that I analyzed children's interpretation of sentences with universal quantifiers from the point of view of focus movement to the Spec of FP, which is adjoined to IP.

This analysis can be supported by further children's naturalistic data (cf. Roeper & de Villiers (1991: p. 250-251):
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(34)  a. Only I want this one. (I want only this one.)
     b. Only hit Adam. (Hit only Adam.)
     c. Only take one. (Take only one.)
     d. Even I want you to drive me to school. (I just want you to drive me to school.)
     e. I just only have a hood. (Only I have a hood.)

As we can see in the sentences of (34), it has been reported in the relevant literature that the expressions only, just and even which characteristically have special stress are often misplaced, mostly raised to the highest position in the sentence, in children's speech. In their LF, an additional extended projection FP must be created to host the category with heavy stress, and be filled by it.

3.3.6 Demonstratives as Modifiers

Giusti (1997) argues on the basis of comparative language data that demonstratives must be treated as modifiers of the noun as well, but not as functional heads of DP. Prenominal elements such as demonstratives, articles and quantifiers are usually treated as determiners which occupy the D position. However, in Rumanian the demonstrative can be in second position following a noun which has incorporated into the definite article, as in (35) (Giusti (1997, p.100)):

(35)  a. un frumos baiat
     (a nice boy)
     b. baiatul acesta frumos
     boy-the this nice
     (this nice boy)
In (35b), the demonstrative *acesta* (this) follows the incorporated noun *baiatul* (boy+the). The structure of (35b) is given in (36) by Giusti (1997):

\[
\text{(36)_DP
}\]

\[
\text{D} \quad \text{AgrP} \quad \text{Spec} \quad \text{Agr} \quad \text{AgrP} \quad \text{Spec} \quad \text{Agr} \quad \text{NP} \quad \text{N'} \quad \text{N}
\]

\[
\text{baiat-ul} \quad \text{acesta} \quad \text{t'i} \quad \text{frumos} \quad \text{t'i} \quad \text{ti}
\]

In (36) the demonstrative is neither in D nor in an intermediate extended nominal head. The demonstrative *acesta* which is in Spec position behaves like a high modifier of the noun, in that it can be preceded by N+Art (*baiat-ul*), but it cannot be preceded by AP (*frumos*).

In Modern Greek the demonstrative *afto* can be found in several different positions, as shown in (37) (Giusti (1997, p.109)):

\[
\text{(37) a. afto to oreo to vivlio}
\]
\[
\text{this the good the book}
\]
\[
\text{(this good book)}
\]

\[
\text{b. to oreo afto to vivlio}
\]
\[
\text{the good this the book}
\]

\[
\text{c. to oreo to vivlio afto}
\]
\[
\text{the good the book this}
\]

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The demonstrative *afto* can be in the extreme left position of the noun phrase where it precedes the article and occupies Spec DP in (37a). It can be in the middle position which is preceded by the article and adjective in (37b), or it can be in the extreme right of the noun phrase in (37c). In all cases the article *to* appears, showing that the article and the demonstrative never compete for the same position.

Assuming that the demonstrative in both Rumanian and Modern Greek starts from a very low Spec and then moves to SpecDP through a high SpecAgrP, Giusti argues that demonstratives have to be lexical elements which always occupy the Spec position, that is, adjectives to modify the noun.

This view can also be supported by the case of Korean demonstratives. Korean demonstratives *i* (this) and *ce* (that) occur more freely within the nominal expressions, but they always appear in the prenominal position followed by the NP (or N) and cannot occur without an N. The examples are shown in (38):

(38)  
\begin{enumerate}
\item[*i/*ce*-nun kuda.]
\begin{itemize}
\item this/that-NOM big-Predicate marker
\item (This/That is big.)
\end{itemize}
\item *ilce*-ket-un kuda.
\begin{itemize}
\item this/that-thing(one)-NOM big
\item (This/that one is big.)
\end{itemize}
\item *ilce* sangja
\begin{itemize}
\item this/that box
\item (this/that box)
\end{itemize}
\item *ilce* kun sangja
\begin{itemize}
\item this/that big box
\item (this/that big box)
\end{itemize}
\end{enumerate}
As shown in the examples of (38), demonstratives in Korean cannot occur by themselves but have always to be accompanied by the NP(or N). They can be in the second position preceded by an adjective as in (38e) or a definite article ku(the) as in the case of ce in (38j), or in the third position preceded by both adjective and definite article as in (38i). However, even though they allow various positionings, they are always found in the prenominal position followed by the NP (or N) which they modify. (Note that Korean is a head-final language.) These properties suggest that demonstratives in Korean cannot be functional heads, rather they can be argued to be lexical elements which serve as adjectival modifiers, always positioned in the Spec position, whether in low Spec or in high Spec, just like those of Rumanian and Modern Greek in the analysis of Giusti(1997). For example, the movement of demonstratives in Korean from Spec to another Spec is shown in the following structures:
In (39), the demonstrative i or ce can occur in the lower Spec to modify the noun sangja (box) or in higher Spec to modify the NP kun sangja (big box). If it starts from the lower Spec to move to the higher Spec, as suggested by Giusti, this movement is optional in Korean. The migratory property of demonstratives from Spec to Spec, detaching from their complement, is attributed to a change in their categorial status, that is as adjectival modifiers rather than functional heads.

3.3.7 Universal Quantifiers from Modifiers to Functional Heads

On the present view universal quantifiers such as every, all and each are treated as modifiers, i.e. adjuncts, in child grammar. They are generally taken to be adjoined to some other projection, rather than projecting their own phrasal structure as heads. This kind of initial interpretation by children has been well established in the literature of language acquisition, especially in the acquisition of functional categories. It can be therefore naturally related to the debate on language development, specifically to the two main hypotheses of 'continuity' and 'maturation' regarding the (controversial) development of functional categories in child grammar.

The syntactic categories available in the framework of current generative theory can be classified into three types: lexical (open class elements), functional (closed class elements) and adjunct categories. The lexical categories are the set N, V, A and P, and the functional categories are D, C and I. Both lexical and functional
categories have phrasal projections NP, VP, AP, PP, DP, CP and IP. The third, adjunct, categories include all sorts of modifying elements, (both lexical and phrasal), for example, adverbs such as *(extremely) often* and a negative adverb *never* (in Hoekstra & Jordens's analysis). In addition, the present analysis of children's interpretation of universal quantifiers as modifiers, a number of aspects of the acquisition of wh-movement (cf. van Kampen (1997)), negation and modality (Hoekstra & Jordens (1994)) in Dutch, and the migratory property of the degree expressions such as *more, less and enough* (Doetjes et al. (1998)) and also demonstratives in Rumanian, Modern Greek and Korean are all considered as belonging to this third category.

It is well known that children's utterances typically lack functional categories in positions where they are obligatory in the adult grammar. This is central to the maturational hypothesis proposed by Lebeaux (1988), Guilfoyle & Noonan (1988), Radford (1990) and Tsimpli (1996): functional categories are not available in the initial stage and they develop in the course of maturation. Further, crosslinguistically there is a parametric variation with regard to the overt realization of functional heads and their maximal projections. Some languages, e.g. English and German, have overt determiners (DET) but other languages, e.g. Polish and Czech (cf. Corver (1990)), do not. In contrast to the universality of lexical categories, the functional categories are language specific so that they have to be individually triggered depending on the language.

I conclude that the child initially prefers an adjunct structure because, as discussed by Hoekstra & Jordens (1994), adjunction requires less information and is also less restricted, compared to the head-complement structure which requires the information (or the strict restriction) that for the constituent structure \([XP \ [X \ YP]]\), for example, X has to be related to YP under a head-complement relation, X must categorically select YP, X must be restricted to zero-level expressions, X must be in

\[\text{Zanuttini (1990) argues that negation may be expressed by an adverb which is adjoined to some other projection than NEGP.}\]
complementary distribution with other members of its category, etc.. It is assumed that the proper (adult-like) use of DP structure (head-complement structure), that is, the ability to use a quantifier as a strong determiner to restrict only its own complement in scope, seems not to be ready yet in child grammar, putatively up to 7 years of age or so from the evidence of current experiments.
Experiment I: Quantifier Spreading in English

The first aim of the present experiment was to replicate the phenomenon of quantifier spreading which young children show in their comprehension of universal quantifiers such as all, every and each. I made a number of variations.

Firstly, the effect of varying the relative order of quantified NPs and indefinite NPs in simple sentences was considered. The phenomenon of right spreading (or forward spreading) which could be predicted from the order of the universal quantifiers every, each and all in subject position and a+noun in object position, and the phenomenon of left spreading (or backward spreading) where there is a+noun in subject position and universal quantifiers in object position were controlled in this experiment. Let us look at the following examples to see what is meant by 'right' and 'left' spreading:

(1) Right spreading  

Every caterpillar is carrying a ladybird.  
Every train is pulling coaches.
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A caterpillar is carrying every ladybird.
A train is pulling every coach.

Children generally spread the scope of the quantifier every in the sentences of (1) to cover the NP a ladybird or coaches in the direct object position, as well as the noun caterpillar or train in the subject position. Similarly, in the sentences of (2), they tend to spread the scope of the quantifier to cover the subject NP a caterpillar or a train as well as the object NPs ladybird or coach. The former is referred to as 'right' spreading, and the latter as 'left' spreading.

Secondly, the lexical distinction between the quantifiers was controlled. English universal quantifiers comprise the words all, every, each, and any. Vendler (1967) considers these words as a single group on the ground that these words can be used interchangeably to stand for the logical operator V in the basic formula Vx (Fx -> Gx): they are contextually determined variants of the same logical structure. The quantifier any is not included in the test sentences of the present research on the ground that any gives rise to interpretive difficulty because of the "free choice" usage. Each quantifier has special lexical characteristics: all can appear within a NP where it modifies a noun, that is, pre-NP position; or it can float over the NP appearing in post-NP position. However, every cannot be floated and it cannot co-occur with a determiner, and unlike all and each, it cannot appear with a prepositional phrase. Finally, every and each take a singular noun, as shown in the following sentences:

(3) a. All the bears are holding a honeypot.
b. All of the bears are holding a honeypot.
c. The bears all are holding a honeypot.
d. Every bear [every the bears] is holding a honeypot.
e. *The bears every are holding a honeypot.
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f. Each bear is holding a honeypot.
g. Each of the bears is holding a honeypot.
h. The bears are each holding a honeypot.

As we can see from the above sentences, quantifiers in NPs in English do not behave syntactically uniformly. The semantic distinctions among the quantifiers are also discussed by Vendler (1967). Based on these differences, my first experiment focuses on children's comprehension of each individual quantifier.

Thirdly, I examined whether the replacement of a singular NP with plural NP in the same position of the sentence caused the children to give different interpretations to universal quantifiers, by comparing the structures [universal quantifier and a singular NP] and [universal quantifier and plural NP].

Fourthly, whether children gave the interpretation which they gave to universal quantifiers to bare plural NPs and the definite article the+NPs in the same structures and contexts, was examined. Bare plural NPs exhibit no quantifier or determiner before the head noun like 'dogs' in the sentence Dogs bark. They were included in the present research because they imply "every kind of" or "all the kinds of" the noun phrase in the sentence. That is, semantically, generic sentences resemble sentences with a universal quantifier. They are normally assumed to contain 'generic quantifiers' or 'zero quantifiers' (cf. Carlson (1977)). For example, sentences such as Children are noisy and Tigers are striped give only a generic interpretation which implies "all children are generally noisy," or rather "generally, all children are noisy" and "generally, all tigers are striped", respectively. The+NPs may also express the same meaning as every or all and so it can be interpreted like a quantifier. For example, the sentence The pears are sweet implies "All the pears are sweet." Most previous research reported that children's exhaustive errors were found far less in these two constructions than in those with universal quantifiers. In contrast to
previous claims, I assumed that children might give interpretations to these two items similar to those with the quantifiers.

Fifthly, the difference in performance by children between the structures with a transitive verb and an intransitive verb with a prepositional phrase was examined.

Finally, I investigated whether there was any discontinuity in the performance of children between the ages of four and seven.

4.1 Design

This experiment was designed so that the subjects had to answer yes/no questions about a set of pictures. Nineteen sets were prepared by randomizing four hundred and eight main sentences and two hundred and fifty-six distracting sentences. Each set included seventy test questions including the distracting sentences, divided into two parts, that is, thirty-five questions for the first session and the other thirty-five for the second session. Each thirty-five question set consisted of ten questions (six main and four distracting) of the set [bear-honeypot], ten (seven main and three distracting) of the set [caterpillar-ladybird], ten (six main and four distracting) of the set [train-coaches] and five (three main and two distracting) of the set [baby-mummy elephants] in order. Each set was administered to each child in two separate sessions, and the same set to three or four children.

The test questions were tape-recorded by an English native speaker to give the same (coherent) input of each test sentence to every individual child involved.
4.2 Subjects

Fifty-nine English primary school children, 22 boys and 37 girls, participated in Experiment I. The ages of the children ranged from 4;5 to 7;5 with a mean age of 5;8. They were all from the same primary school in South-East London. The four-year-olds belonged to Reception Class; and the five to seven year-olds to Lower School (mixed between Year 1 and Year 2). They all spoke only one language (English) and were similar in socio-economic terms, that is, all children were middle class English with a similar cultural background.

4.3 The Visual Input: Control Contexts

There were four sets of pictures with the same six different contexts each:

(i) bear and honeypot
(ii) caterpillar and ladybird
(iii) train and coach
(iv) baby and mummy elephant

By the use of different pictures and words in the same constructions and contexts, I investigated whether children give coherent interpretations for universal quantification.

The six different contexts were controlled:

(i) Extra Object Condition (EO)
(ii) Different Agent Condition (DA)
(iii) Many-to-One Condition (MO)
(iv) Extra Agent Condition (EA)
(v) Different Object Condition (DO)
(vi) Many-to-One and Extra Object Conditions (MO+EO)

As a representative example, I give the six contexts of the set [bear and honeypot):
(See Appendix for the pictures of the other three sets.)

Context 1: There are three bears holding a honeypot each, an extra honeypot not being held, and a piglet alone. (EO+EDA)
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Context 2: Three bears are holding a honeypot each, and a piglet is also holding a honeypot. (DA)

Context 3: There are three bears, among which just one bear is holding all three honeypots and the other two are not, just standing, and a piglet alone. (MO)
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Context 4: There are four bears, among them three bears are holding a honeypot each, and a bear alone without a honeypot. (EA)

Context 5: There are four bears, in which three bears are holding a honeypot each and one bear is holding a bunch of flowers. (DO)
Context 6: There are three bears, among them just one bear is holding three honeypots and the other two are not, just standing, a piglet, and an extra honeypot not being held. (MO+EO)

Context 1 which has a structure similar to that of the previous research (an example of "extra object condition"), that is, an incomplete one-to-one matching, was designed to examine whether children involved in this experiment also show the right spreading error, that is, to identify the interpretation by children in which they generalize the scope of universal quantifiers over the direct object NP as well as the subject NP. This context was also used by the previous research, for example, Freeman et al. (1982) to find whether children show "overexhaustive search" or "underexhaustive search." By including a third element, a piglet, which is not related to the event [bear hold honeypot], in the context, I wanted to test the effect of Philip(1995)'s Event Quantification Hypothesis on the interpretation by children of universal quantifiers. According to his hypothesis, in the case of a sentence such as
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Every bear is holding a honeypot the domain of quantification consists of all minimal events which involve a bear or a honeypot (or both). A piglet in this context has nothing to do with the event [bear hold honeypot] and so it is not a subevent of an event of a bear holding a honeypot. Therefore children do not need to concern themselves with it. I wanted to discover whether this is true or not, in other words, whether children really have no concern for the existence of the third argument, assuming that it has nothing to do with the event of the sentence in the context.

Context 2 is an example of the "different agent condition" of previous research designed to check children's overgeneralization of universal quantifiers. Here a third agent, a piglet, like the three bears, is also holding a honeypot, as an agent of the action [holding honeypot]. I wanted to find out whether there is any difference in the interpretation by children of quantifiers by including one different agent, a piglet, instead of a bear, in the event [bear hold honeypot]. This context satisfies the requirement of visual symmetry, that is, all the agents are exhaustively matched with an object and all the objects with an agent.

Context 3 illustrates many-to-one matching similar to that of previous research. This context seems to be obviously easier to get an adult-like affirmative response from children than the other contexts. If children perform better here, it supports the claim that children's comprehension of universal quantifiers with regard to their grammatical function and scope in the sentence is like the adults'.

Context 4 is an example of the "extra agent condition": one bear is not holding anything, whereas the other three bears are holding a honeypot each. There is no third element, a piglet.

Context 5 is an example of the "different object condition": one bear is holding a different object, a bunch of flowers, instead of a honeypot, representing visual symmetry, with nothing left alone. I wanted to discover whether children show any difference in their interpretation of these two contexts.
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Context 6 depicts the same many-to-one matching as Context 3, but in addition, there is an extra honeypot left alone here.

Based on the above six contexts, twenty-four main pictures were made:

- six bear-honeypot;
- six caterpillar-ladybird;
- six train-coach; and
- six baby-mummy elephant pictures.

4.4 The Auditory (Linguistic) Input: Test Sentences

All the test sentences were composed of simple structures with a transitive (active) verb or an Intransitive verb with a prepositional phrase. The test sentences were divided into main controlled sentences and distracting sentences. The main test sentences included twenty-seven different structures which could be grouped into ten labelled either according to the predicted outcome or in terms of the properties of the various noun phrases:

Group 1: RT: Right Spreading-Transitive

[quantifiers every, each or all in subject position and an indefinite article a+noun in object position, with a transitive verb]

Group 2: RTP: Right Spreading-Transitive-Plural NP

[quantifiers every, each or all in subject position and a plural NP in object position, with a transitive verb]

Group 3: RINT: Right Spreading-Intransitive

[quantifiers every, each or all in subject position and an indefinite article a+noun in object position of PP, with an intransitive verb]
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Group 4: LT: Left Spreading-Transitive
[an indefinite article a+noun in subject position and quantifiers every, each or all in object position, with a transitive verb]

Group 5: LTP: Left Spreading-Transitive-Plural NP
[plural NP in subject position and quantifiers every, each or all in object position, with a transitive verb]

Group 6: LTtheNPs: Left Spreading-Transitive-the+NPs
[the+NPs in subject position and quantifiers every, each or all in object position, with a transitive verb]

Group 7: LINT: Left Spreading-Intransitive
[an indefinite article a+noun in subject position (of there is construction) and quantifiers every, each or all in object position of PP, with an intransitive verb]

Group 8: Bare Plurals
[plural NP in subject position and a singular NP (or plural NP) in object position, with a transitive verb (without a quantifier)]

Group 9: The+NPs-Transitive
[a definite article the+NPs in subject position and a singular NP (or plural NP) in object position, with a transitive verb]

Group 10: The+NPs-Intransitive
[a definite article the+NPs in subject position and a singular NP (or plural NP) in object position of PP, with an intransitive verb]

The position of the quantifiers was varied to see if there was any effect of linear ordering on the spreading phenomenon. The list of the main sentences for each group is as follows:
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Group 1: [every/each/all] - a type with transitive verb

1. Is every bear holding a honeypot?
   Is every caterpillar carrying a ladybird?
   Is every train pulling a coach?

2. Is each bear holding a honeypot?
   Is each caterpillar carrying a ladybird?
   Is each train pulling a coach?

3. Are all the bears holding a honeypot?
   Are all the caterpillars carrying a ladybird?
   Are all the trains pulling a coach?

Group 2: [every/each/all] - plural NP type with transitive verb

7. Is every bear holding honeypots?
   Is every caterpillar carrying ladybirds?
   Is every train pulling coaches?

8. Is each bear holding honeypots?
   Is each caterpillar carrying ladybirds?
   Is each train pulling coaches?

9. Are all the bears holding honeypots?
   Are all the caterpillars carrying ladybirds?
   Are all the trains pulling coaches?

Group 3: [every/each/all] - a type with intransitive verb+PP

20. Is every ladybird on a caterpillar?
    Is every baby behind a mummy elephant?

---

1 This number is the original serial number of the main test sentences
Chapter Four

21. Is each ladybird on a caterpillar?
   Is each baby behind a mummy elephant?

22. Are all the ladybirds on a caterpillar?
   Are all the babies behind a mummy elephant?

Group 4: a - [every/each/all] type with transitive verb

4. Is a bear holding every honeypot?
   Is a caterpillar carrying every ladybird?
   Is a train pulling every coach?

5. Is a bear holding each honeypot?
   Is a caterpillar carrying each ladybird?
   Is a train pulling each coach?

6. Is a bear holding all the honeypots?
   Is a caterpillar carrying all the ladybirds?
   Is a train pulling all the coaches?

Group 5: plural NP - [every/each/all] type with transitive verb

11. Are bears holding every honeypot?
    Are caterpillars carrying every ladybird?
    Are trains pulling every coach?

12. Are bears holding each honeypot?
    Are caterpillars carrying each ladybird?
    Are trains pulling each coach?

13. Are bears holding all the honeypots?
    Are caterpillars carrying all the ladybirds?
    Are trains pulling all the coaches?
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Group 6:  the+NPs - [every/each/all]

16. Are the bears holding every honeypot?
   Are the caterpillars carrying every ladybird?
   Are the trains pulling every coach?

17. Are the bears holding each honeypot?
   Are the caterpillars carrying each ladybird?
   Are the trains pulling each coach?

18. Are the bears holding all the honeypots?
   Are the caterpillars carrying all the ladybirds?
   Are the trains pulling all the coaches?

Group 7:  a - [every/each/all] type with intransitive verb+PP

23. Is there a baby behind every mummy elephant?

24. Is there a baby behind each mummy elephant?

25. Is there a baby behind all the mummy elephants?

Group 8:  bare plurals

10. Are bears holding a honeypot?
    Are caterpillars carrying a ladybird?
    Are trains pulling a coach?

14. Are bears holding honeypots?
    Are caterpillars carrying ladybirds?
    Are trains pulling coaches?

Group 9:  the+NPs, with a transitive verb

15. Are the bears holding a honeypot?
    Are the caterpillars carrying a ladybird?
    Are the trains pulling a coach?
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19. Are the bears holding honeypots?
   Are the caterpillars carrying ladybirds?
   Are the trains pulling coaches?

Group 10: the+NPs, with intransitive verb+PP

26. Are the babies behind a mummy elephant?
27. Are the babies behind mummy elephants?

The nineteen sentences with a transitive verb phrase were made for three different pictures: [bear-honeypot]; [caterpillar-ladybird]; and [train-coach]. They were copied six times for the six different contexts of each picture set, just by substituting the relevant words according to the picture. Further, eight sentences with an intransitive verb and PP were added for the pictures of [caterpillar-ladybird] and [baby-mummy elephant]: the sentences from 20 to 22 included the prepositions on for the set [caterpillar-ladybird] and behind for the set [baby-mummy elephant], and those from 23 to 27 were added for the set [baby-mummy elephant] with the preposition behind instead of on. These eight sentences were also copied six times to produce the sentences for the six control contexts. That is, sixty-eight main sentences were made for four different pictures and these sixty-eight sentences were copied six times for each six different contexts of four pictures, resulting in the total for the main test sentences of four hundred and eight sentences.

As we can see above, sentences from 1 to 19 (serial numbers of the main type of test sentences) are simple sentences with transitive (active) verbs such as hold (or carry in the caterpillar-ladybird set or pull in the train-coach set). Sentences 1, 2 and 3 investigate the situation where the quantifiers every, each and all modify the noun in the subject position and there is an indefinite article a + noun in the object position. These are designed to investigate whether the children involved in this experiment, like the children who participated in previous research, also show the error of
quantifier spreading to the direct object NP as well as the subject NP in the scope of
the quantifier, and whether there is any lexical distinction between the quantifiers
every, each and all in children's interpretation and acquisition. Sentences 7, 8 and 9
are grouped with the sentences 1, 2 and 3 because these are likely to give rise to
examples of the right spreading phenomenon. The difference between them is that
the object positions are filled with plural NPs in the sentences 7 to 9 instead of a
singular NP. The aim here is to find out whether the replacement of a singular noun
with plural NPs in the same position gives rise to any difference in the interpretation
of the sentences with a universal quantifier.

Sentences 4, 5 and 6 are opposite cases to sentences 1, 2 and 3 in the
placement of quantifiers and an indefinite article a+noun in the sentence: indefinite
article a+noun in the subject position and quantifiers in the object position. These are
putative examples of the left spreading phenomenon. Previous research showed that
children found more difficulty with the interpretation of quantifiers in the object
position than in the subject position. This is what I wanted to replicate in this
experiment. Similar to the subgroups in Group 1 (the sentences 1, 2 and 3 vs. 7, 8
and 9), sentences 11, 12 and 13 have a plural NP in the subject position instead of a
singular NP, compared to the ones in the sentences 4, 5 and 6. These sentences were
also prepared to find out whether there is any difference between a singular NP and a
plural NP in the interpretation by children. The sentences 16 to 18 were also
prepared to look for examples of left spreading errors so that those can be grouped
with the sentences 4 to 6 and 11 to 13. The difference is that the subject positions are
filled with the+NPs instead of a singular noun or plural NPs in the former. We will
see whether there is any difference in the interpretation by children between these
three subgroups.

Sentences 10 and 14 are bare plural sentences without quantifiers: sentence
10 has a bare plural NP in the subject position and a singular noun in the object
position; and in sentence 14 both the subject and the object positions are filled with
bare plural NPs. Plurals imply the meaning "every" or "all", and so might be interpreted like quantifiers, that is, generic quantifiers (e.g. Beavers build dams.). These sentences were prepared in order to examine whether children show the same errors as those they make on the interpretation of the sentences with quantifiers. In Philip (1995)'s experiment, children produced significantly fewer errors on transitive sentences with two bare plural NPs than they did in response to transitive sentences with a universal quantifier. This is what the event quantification hypothesis predicts. That is, the children will give an adult-like affirmative response to sentences such as 10 and 14 because those sentences contain no universal quantification. Through this experiment, I wanted to test whether the prediction of previous research including the Event Quantification Hypothesis is right or not. Most previous research reported that children gave adult-like interpretations to the sentence Farmers are feeding a donkey (or donkeys) in a context in which there are three farmers who are feeding a donkey each and an extra donkey not being fed. That is, they did not show symmetrical and exhaustive interpretations of bare plural NPs. However, I assume that children might show similar errors on these sentences to those which they show on the interpretation of universal quantifiers, due to their quantifying property. If similar non-adult-like errors are found in the constructions with bare plurals, we can argue that the phenomenon of quantifier spreading is not just limited to the sentences with overt universal quantifiers.

Sentences 15 and 19 include the definite article the+NPs: the+NPs in the subject position and a singular noun or plural NPs in the object position. Generally the+NPs, like a quantifier, are interpreted exhaustively by adults. For example, the sentence The bears are holding the honeypots suggests that all of the bears are holding at least one honeypot and all of the honeypots are being held. This characteristic interpretation was examined by means of this experiment, comparing such sentences with the other sentences with universal quantifiers.
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Sentences 20 to 27 are comparable to the previous sentences 1 to 19 in that they have the intransitive verb *be* and a prepositional phrase with *on* or *behind*. These sentences were designed to find whether there is any difference in the interpretation by children between sentences with transitive verb (active verb) phrases and ones with intransitive verb phrases. The sentences 20 to 22 were prepared to look for the existence of right spreading errors, and children's interpretation of those sentences was compared to that of the sentences 1 to 3 with transitive verb phrases. The sentences 23 to 25 are formed with the existential *there is* construction and the quantifiers are placed in the adjunct position of the PP. These sentences are compared to the sentences 4 to 6 in the interpretation by children. The sentences 26 and 27 include *the*+NPs in the subject position with the construction of an intransitive verb *be* and PP, contrasting with the sentences 15 and 19.

4.5 Distracting Sentences

In addition to these main sentences, two hundred and fifty-six distracting sentences were prepared to be inserted into roughly every two main sentences of the test set. A relevant picture was made as well for each of the two hundred and fifty-six distracting sentences. These are to prevent children from giving stereotyped responses to the test questions, and also by giving simple sentences which require general knowledge, to have an idea whether they are rational in their responses to the sentences, for example, *How many red stars are there?*, *What sign is this?*, *Are mice dancing?*, *Which fruit do you like best among these?*, *Which circle is the biggest?*, etc. (See Appendix for the relevant pictures.)
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4.6 Materials

The materials consisted of twenty four pictures for the main target sentences and two hundred fifty six pictures for the distracting sentences depicting agents and objects familiar to children, for example, bear(winnie-the-pooh)-honey pot, caterpillar-ladybird, train-coaches, cat-mouse, fish, frog, star, circle, etc. The pictures were made of a variety of stickers, available in the children's section of shops, to be put on self-replacing papers to attract children's attention (on the assumption that most children like stickers). They were colourful and shiny or furry on the surface, so children could touch and feel them. Each paper was five and half by eight and half inches in size.

Nineteen test sets were prepared. Each test set included two separate parts: one for the first session and the other for the second session. Each part included 35 questions in the order of 10 questions (6 main and 4 distracting) from the set of bear-honey pot, 10 (7 main and 3 distracting) from caterpillar-ladybird, 10 (6 main and 4 distracting) from train-coach, and 5 (3 main and 2 distracting) from baby-mummy elephant. There were typed test questions in the order of 1 to 35, the 'yes' and 'no' blocks for ticking according to the response of the child, and spaces for the experimenter to jot down children's comment and behaviour.

Ten recording tapes which recorded one set of the test sentences on each side were prepared to be used promptly in the experiment.

4.7 Apparatus

Two tape-recorders and a tie-clip microphone were used in this experiment. One tape-recorder was for recording the whole sessions of the experiment including the children's responses, and another one was for subjects to listen to the test
questions. The latter one had the function of making the sounds of animals and musical instruments, so children could enjoy playing with it at the beginning of the experiment for warming up or at the end of the session.

4.8 Procedure

Letters in which the details of the experiment were described were sent to head teacher, teachers and parents for their approval. Just those children whose parents agreed participated, and all of them were English speaking monolingual children.

Children were individually interviewed in a quiet room which was located in the corner of the corridor, next to the classrooms, at school. Each child appeared on two separate occasions with an interval of around one week between each session. Each session lasted around 15 to 20 minutes. Young children generally took more time than the older children.

When a child sat by the table, we normally started with general conversation, for example, "What happened today?", "What did you learn today?", etc., to warm up the atmosphere and get children involved in talking as well. More time for this kind of chatting was given to some shy children so that they became positively involved in the experiment. While chatting, a microphone was introduced and put on the middle part of the school tie which the child wore, in order to record his or her responses in the whole session on the tape. Most children were very excited with the microphone and some of them wanted to listen to their recorded voice after the session.

When the child seemed to be ready, the experimenter explained what would be done: (i) a picture would be presented to a child by an experimenter; (ii) he/she should look at the picture carefully; (iii) he/she should listen to the test question from the tape-recorder (the child is still looking at the picture while he or she is listening to
the question); and (iv) he/she should answer 'yes' or 'no' to the question. When the experimenter showed a picture, she encouraged the child to describe the picture by asking questions, for example, _What can you see here?_, _What are they doing?_, _How many bears are there?_, _How many honeypots are there?_, _What is he doing?_ (e.g. pointing to a piglet in the picture), etc. Children normally enumerated each item in the picture, for example, "this bear (pointing to each item with their finger) is holding a honeypot, this bear is holding a honeypot, this bear is holding a honeypot as well, but this honeypot has no bear, there is no bear on this honeypot or nobody is holding this honeypot and this piglet is alone, he is not holding a honeypot, he is lonely," etc. Therefore the children were conscious of the details of the picture before listening to the test question. It is important to note that, given a particular input sentence such as "Is every bear holding a honeypot?", the negation of the corresponding proposition, i.e. "Every bear is [not] holding a honeypot", was salient to the child. This is clear from the fact that children mentioned, for example, "this honeypot is not being held", "this piglet is not holding a honeypot", "these bears are not holding this honeypot", etc.. In this respect, the negation of the proposition in the question, that is, "the condition of plausible dissent," which is suggested by Crain et al. (1996) was under consideration. At this stage the other experimenter played the question on the tape. When a child was not sure of the answer, the question was repeated. When a child answered 'no', the follow-up question "Why not?" or "Why did you say "no"?" were asked. The responses were ticked in the 'yes' or 'no' section and notes were jotted down on the blank side of the test paper. All the responses and comments by a child were also tape-recorded.

Thirty-five simple questions with different pictures each were put to a child in one session in the order of the sets [bear-honeypot], [caterpillar-ladybird], [train-coach] and [baby-mummy elephant]. Children usually found them enjoyable and liked touching and feeling the surface of the stickers used to make the pictures.
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4.9 Results

In this section I report on the results of all the test sentences with the six control contexts, grouping them according to the variances. The ten groups are repeated here for convenience:

Group 1 (RT):
1. Is every bear holding a honeypot?
2. Is each bear holding a honeypot?
3. Are all the bears holding a honeypot?

Group 2 (RTP):
7. Is every bear holding honeypots?
8. Is each bear holding honeypots?
9. Are all the bears holding honeypots?

Group 3 (RINT):
20. Is every ladybird on a caterpillar?
21. Is each ladybird on a caterpillar?
22. Are all the ladybirds on a caterpillar?

Group 4 (LT):
4. Is a bear holding every honeypot?
5. Is a bear holding each honeypot?
6. Is a bear holding all the honeypots?

Group 5 (LTP):
11. Are bears holding every honeypot?
12. Are bears holding each honeypot?
13. Are bears holding all the honeypots?

Group 6 (LTtheNPs):
16. Are the bears holding every honeypot?
17. Are the bears holding each honeypot?
18. Are the bears holding all the honeypots?

Group 7 (LINT):
23. Is there a baby behind every mummy elephant?
24. Is there a baby behind each mummy elephant?
25. Is there a baby behind all the mummy elephants?

Group 8 (Bare Pls):
10. Are bears holding a honeypot?
14. Are bears holding honeypots?

Group 9 (the NPs):
15. Are the bears holding a honeypot?
19. Are the bears holding honeypots?

Group 10 (theNPsINT):
26. Are the babies behind a mummy elephant?
27. Are the babies behind mummy elephants?

RT: Right Spreading-Transitive

RTP: Right Spreading-Transitive-Plurals
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RINT: Right Spreading-Intransitive
LT: Left Spreading-Transitive
LTP: Left Spreading-Transitive-Plurals
LTthe: Left Spreading-Transitive-theNPs
LINT: Left Spreading-Intransitive

The six control contexts are repeated here as well:

Context 1: extra object & extra different agent
Context 2: different agent (visual symmetry)
Context 3: many to one, extra different agent
Context 4: extra agent
Context 5: different object (visual symmetry)
Context 6: many to one, extra object & extra different agent

All the data are presented here in the form of percentage between adult-like (correct) and non-adult-like (incorrect) responses. The percentage figures represent summed figures of the individual children's responses. To illustrate, 50% adult-like responses represent summed figures across the children involved in the task, for example, indicating that 10 out of 20 children made adult-like (correct) responses. Because of the randomization process different children receive different numbers of stimulus sentences, so that individual children's responses are random and produce inconsistent responses.

4.9.1 Right Spreading (or Forward Spreading)

The aim here was to find whether young children spread the scope of universal quantifiers such as every, each and all to the direct object NP as well as to
the subject NP which they belong to. I also examined whether there was any lexical
distinction between the quantifiers in the children's comprehension, and whether there
was any difference in the interpretation by children of constructions with a singular
NP and those with plural NPs in the same positions. Further, the difference between
transitive and intransitive constructions in their comprehension are investigated. The
sentences from Groups 1, 2 and 3 are considered individually first and then the results
from each group are compared.

4.9.1.1 Universal Quantifier - \([a\, N]\) with Transitive Verb

Group 1: 1. Is every bear holding a honeypot?
2. Is each bear holding a honeypot?
3. Are all the bears holding a honeypot?

<Table 1> Summed results across children in percentages for every/each/all - a in
the six different contexts (Unit: %)

<table>
<thead>
<tr>
<th>Context</th>
<th>every - a</th>
<th>each - a</th>
<th>all - a</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adult-like responses</td>
<td>Non-adult responses</td>
<td>Adult-like responses</td>
</tr>
<tr>
<td>1 (yes)</td>
<td>50 (10/20)</td>
<td>50 (10/20)</td>
<td>50 (10/20)</td>
</tr>
<tr>
<td>2 (yes)</td>
<td>44 (8/18)</td>
<td>56</td>
<td>56</td>
</tr>
<tr>
<td>3 (no)</td>
<td>89 (16/18)</td>
<td>11</td>
<td>90</td>
</tr>
<tr>
<td>4 (no)</td>
<td>94 (16/17)</td>
<td>6</td>
<td>79</td>
</tr>
<tr>
<td>5 (no)</td>
<td>85 (17/20)</td>
<td>15</td>
<td>78</td>
</tr>
<tr>
<td>6 (no)</td>
<td>95 (18/19)</td>
<td>5</td>
<td>95</td>
</tr>
</tbody>
</table>

The figures in brackets indicate the total number of individual responses out
of the total number of trials. For example, 10 responses out of 20 trials were incorrect
in the case of [every - a noun] type with Context 1 so that it results in 50%.

Contexts 1 and 2 yield the positive response 'yes' as the right answer, whereas
Contexts 3 to 6 yield the negative response 'no' as the right answer. The interesting
finding is that there is a big difference in children's interpretation between those two:
high errors, more than half (more than 50% in average), were found in the former; but
only 10% in average made errors in the latter. More than 50% errors in the former, as
shown in the shaded columns in Table 1, are evidence of right spreading of
quantifiers by children. From the figures in the brackets we can see that 59 responses out of 106 trials represent the right spreading errors, spreading the scope of the quantifiers to the object NP *a honeypot* as well as the subject NP *bear*.

### 4.9.1.2 Universal Quantifier - Plural NP with Transitive Verb

Group 2:  
7. Is *every* bear holding honeypots?  
8. Is *each* bear holding honeypots?  
9. Are *all* the bears holding honeypots?

<Table 2> Rates in percentages for *every/each/all* in the construction [Qs-pls] in the six different contexts.  
(Unit: %)

<table>
<thead>
<tr>
<th>Context</th>
<th>Right answers</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><em>every/NPs</em></td>
<td><em>each/NPs</em></td>
<td><em>all/NPs</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adult-like responses</td>
<td>Non-adult responses</td>
<td>Adult-like responses</td>
<td>Non-adult responses</td>
<td>Adult-like responses</td>
<td>Non-adult responses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>63 (yes)</td>
<td>37</td>
<td>79</td>
<td>21</td>
<td>58</td>
<td>42</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>42 (yes)</td>
<td>58</td>
<td>23</td>
<td>77</td>
<td>33</td>
<td>67</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>100 (no)</td>
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<td>100</td>
<td>0</td>
<td>100</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>89 (no)</td>
<td>11</td>
<td>83</td>
<td>17</td>
<td>89</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>94 (no)</td>
<td>6</td>
<td>94</td>
<td>6</td>
<td>90</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>94 (no)</td>
<td>6</td>
<td>94</td>
<td>6</td>
<td>95</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The negative responses "no" to the above sentences in Contexts 1 and 2 (in which each bear is holding just one honeypot, not two) might be the right answers in the adult grammar by reason of the existence of the plural NPs, *honeypots*, instead of *a honeypot* in the object position. However, the adults, around 10 normal people, whom I questioned individually (and also informally) actually responded with the affirmative answer "yes." They simply ignored the presence of the plural markers. Therefore the expected adult-like answers here are designated as "yes." Children, on the other hand, seem to give a negative response to the same sentences in the same contexts by reason of *a honeypot* being left alone without a bear in Context 1, and *a honeypot* being held by *a piglet* in Context 2. That is, children still spread the scope of the quantifiers, *every, each and all*, to the object plural NPs, *honeypots*, saying "no bear on this honeypot," pointing to the honeypot left out in Context 1, and "these four
(are) holding (a) honeypot, but this is not a bear, that's a piglet" in Context 2. The rates of spreading, as we can see in Table 2, are higher in Context 2 (which shows visual symmetry) than in Context 1; that is, in Context 2 all individual agents including a piglet are involved in holding a honeypot. Children seem to require a one-to-one relationship between the agent and the object referred to in the test question.

Similar to the case of Group 1, in the case of Contexts 3, 4, 5 and 6, which expect the right answer to be "no," high rates of adult-like responses were given by the children.

### 4.9.1.3 Universal Quantifier - [a N] with Intransitive Verb and PP

Group 3: Is every ladybird on a caterpillar?
Is each ladybird on a caterpillar?
Are all the ladybirds on a caterpillar?

<Table 3> Rates in percentages for every/each/all with an intransitive verb in the six different contexts (Unit: %)

<table>
<thead>
<tr>
<th>Context</th>
<th>every/a</th>
<th>each/a</th>
<th>all/a</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adult-like responses</td>
<td>Non-adult responses</td>
<td>Adult-like responses</td>
</tr>
<tr>
<td>1</td>
<td>93 (no)</td>
<td>7</td>
<td>69</td>
</tr>
<tr>
<td>2</td>
<td>85 (no)</td>
<td>15</td>
<td>92</td>
</tr>
<tr>
<td>3</td>
<td>8 (yes)</td>
<td>92</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>33 (yes)</td>
<td>67</td>
<td>32</td>
</tr>
<tr>
<td>5</td>
<td>45 (yes)</td>
<td>55</td>
<td>17</td>
</tr>
<tr>
<td>6</td>
<td>75 (no)</td>
<td>25</td>
<td>92</td>
</tr>
</tbody>
</table>

In contrast to the case of the test sentences belonging to Groups 1 and 2, in this case Contexts 3, 4 and 5 yield "yes" as the right answer. Very high percentages of quantifier spreading are observed for context 3: 92% in every-a type; 100% in each-a; and 62% in all-a. Children are concerned about two caterpillars being alone, saying "he's got three," pointing to a caterpillar which carries three ladybirds, "but
they've none." For Context 4 and 5, they still show high rates of spreading, as shown in the table. They comment on one caterpillar being alone in the former and a caterpillar carrying a butterfly in the latter.

Lexical variation between the quantifiers is found in the interpretation in Context 3: the rate of non-adult responses, 62%, to the all-a type in Context 3 is much less than the other two, 92% in every-a and 100% in each-a. Children tend to give a more collective interpretation to the quantifier all than to every or each. "All" usually modifies a plural NP, giving a "collective" reading, whereas "every" and "each" typically modify a singular NP, where "each" implies "distributivity." Labov (1972) places "every" as functionally intermediate between the collective "all" and the distributive "each." Freeman and Stedmon (1986) mention that "the word "every" may be regarded as a distributive which has collective ambitions" (p.36). In Context 3, all of the three ladybirds are together on a caterpillar, and perhaps this togetherness of three ladybirds affects children's interpretation of all, so they give more affirmative responses in the case of all than of every or each. However, that figure, 62%, is still high, more than half, and hence shows the existence of the spreading error.

Here, high percentages of adult-like responses are also observed in the case of the expected right answer "no," as in Contexts 1, 2 and 6. The figure 93% of children's adult-like responses in Context 1 demonstrates that children understand the property of the universal quantifier every which modifies the adjacent NP, here ladybird, in the sentence. The rates of adult-like responses become less in the each-a and all-a types than in every-a type, but the rates of right answers, 69% and 62% respectively, are still more than half. The figures for non-adult-like responses in each-a type and all-a type in Context 1, 31% and 38% respectively, are still too high to be ignored. These provide evidence of "underexhaustive search" in Freeman & Stedmon (1986)'s sense. That is, these children ignore the existence of a ladybird left alone in Context 1.
4.9.1.4 Summary

It was found that for the transitive sentences of Groups 1 and 2, Context 1 (which includes one extra object and an extra different agent) and Context 2 (which depicts a different agent involved in the same action, giving a visual one-to-one symmetry) produce spreading errors by children. On the other hand, in the case of the intransitive sentences of Group 3, Contexts 3, 4 and 5 were found to induce high rates of spreading errors.

In summary of this subsection, in the case of right spreading, an average 58% of children show erroneous spreading of the quantifiers: 58% for every; 59% for each; and 56% for all.

<table>
<thead>
<tr>
<th>Type of quantifiers</th>
<th>every</th>
<th>each</th>
<th>all</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error rate (%)</td>
<td>58</td>
<td>59</td>
<td>56</td>
</tr>
</tbody>
</table>

With respect to the two different structures, transitive and intransitive, the error rates of Group 1 (sentences 1, 2 and 3) for Contexts 1 and 2 and Group 3 (sentences 20, 21 and 22) for Contexts 3, 4 and 5 are compared. 51% spreading errors were found in the transitive sentences and 72% in the intransitive sentences. The details are summarized in Table 5:

<table>
<thead>
<tr>
<th></th>
<th>every</th>
<th>each</th>
<th>all</th>
<th>total</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>transitive</td>
<td>53</td>
<td>47</td>
<td>54</td>
<td>51</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>intransitive</td>
<td>74</td>
<td>80</td>
<td>62</td>
<td>72</td>
<td></td>
</tr>
</tbody>
</table>
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Right spreading errors were significantly higher in the case of the intransitive sentences than the transitive, with p<0.001.

The change from a singular NP to plural NPs here did not make a difference to the children’s interpretation. Table 6 shows the rates of spreading errors between quantifiers followed by a singular NP and quantifiers followed by plural NPs:

<table>
<thead>
<tr>
<th>Error rate (%)</th>
<th>uq - a singular NP</th>
<th>uq - plural NPs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>51</td>
<td>50</td>
</tr>
<tr>
<td>p-value</td>
<td>0.14</td>
<td></td>
</tr>
</tbody>
</table>

4.9.2 Left Spreading (or Backward Spreading)

In this section, I focus on sentences in which universal quantifiers are in object position to see if they spread to the left to modify the subject NP as well as their own object NP. The sentences of Groups 4, 5, 6 and 7 are considered individually, and the results from each group are then compared to find out if there is any variation between the quantifiers, or between constructions with a singular NP, plural NPs or the+NPs, and between transitive and intransitive sentences.

4.9.2.1 [a N] - Universal Quantifier with Transitive Verb

Group 4: 4. Is a bear holding every honeypot? 5. Is a bear holding each honeypot? 6. Is a bear holding all the honeypots?
Table 7: Rates of adult/non-adult-like responses in the 'a N - every/each/all' type (Unit: %)

<table>
<thead>
<tr>
<th>Context</th>
<th>a/every</th>
<th></th>
<th>a/each</th>
<th></th>
<th>a/all</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adult-like responses</td>
<td>Non-adult responses</td>
<td>Adult-like responses</td>
<td>Non-adult responses</td>
<td>Adult-like responses</td>
<td>Non-adult responses</td>
</tr>
<tr>
<td>1</td>
<td>83 (no)</td>
<td>17</td>
<td>64</td>
<td>36</td>
<td>85</td>
<td>14</td>
</tr>
<tr>
<td>2</td>
<td>72 (no)</td>
<td>28</td>
<td>55</td>
<td>45</td>
<td>74</td>
<td>26</td>
</tr>
<tr>
<td>3</td>
<td>47 (yes)</td>
<td>53</td>
<td>39</td>
<td>61</td>
<td>68</td>
<td>32</td>
</tr>
<tr>
<td>4</td>
<td>16 (yes)</td>
<td>84</td>
<td>17</td>
<td>83</td>
<td>11</td>
<td>89</td>
</tr>
<tr>
<td>5</td>
<td>16 (yes)</td>
<td>84</td>
<td>16</td>
<td>84</td>
<td>15</td>
<td>85</td>
</tr>
<tr>
<td>6</td>
<td>85 (no)</td>
<td>15</td>
<td>94</td>
<td>6</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>

Contexts 1, 2, and 6 give the negative response "no" as the right answer, but Contexts 3, 4, and 5 yield "yes" as the right answer to the test questions. Children show even higher rates of quantifier spreading here, especially in Contexts 4 and 5. The majority of children spread the scope of the quantifiers to the subject NP, a bear, as well as the NP they belong to. In other words, most of the children involved in this experiment drew attention to the bear who is not holding a honeypot in Context 4, and the bear who is holding a bunch of flowers instead of a honeypot in Context 5, without regard to the change of the quantifiers in object position.

In those cases where the right answer is "no," high percentages of adult-like responses are achieved here as well, but some exceptions are observed. That is, in the case of a-each, non-adult responses (36% for Context 1, and 45% for Context 2) are quite high. The children who gave incorrect positive responses to these trials ignored the existence of the remaining honeypot not being held in Context 1, and also the honeypot being held by the different agent, a piglet, in Context 2. These figures represent further evidence of underexhaustive search. Interestingly, half of the children involved in the task with a-all gave incorrect positive responses in Context 6. That is, half of the children ignored the presence of the remaining honeypot in this situation.
4.9.2.2 Plural NP - Universal Quantifier with Transitive Verb

Group 5 (LTP):

11. Are bears holding every honeypot?
12. Are bears holding each honeypot?
13. Are bears holding all the honeypots?

<Table 8> Rates of adult/non-adult-like responses in 'plural NPs - every/each/all' type.

<table>
<thead>
<tr>
<th>Context</th>
<th>NPs / every</th>
<th>NPs / each</th>
<th>NPs / all</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adult-like responses</td>
<td>Non-adult responses</td>
<td>Adult-like responses</td>
</tr>
<tr>
<td>1</td>
<td>61 (no)</td>
<td>39</td>
<td>61</td>
</tr>
<tr>
<td>2</td>
<td>76 (no)</td>
<td>24</td>
<td>78</td>
</tr>
<tr>
<td>3</td>
<td>100 (no)</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>4</td>
<td>21 (yes)</td>
<td>79</td>
<td>11</td>
</tr>
<tr>
<td>5</td>
<td>32 (yes)</td>
<td>68</td>
<td>17</td>
</tr>
<tr>
<td>6</td>
<td>89 (no)</td>
<td>11</td>
<td>85</td>
</tr>
</tbody>
</table>

In this case Contexts 1, 2, 3 and 6 have the negative response "no" as the right answer to the questions, but Contexts 4 and 5 have the positive response "yes." The high figures of non-adult responses in Contexts 4 and 5, shaded in the table, again represent high rates of left quantifier spreading by children. They spread the scope of the quantifiers every, each and all, without any distinction, to the subject plural NPs bears, responding in the negative. They insist that both one bear who is not holding a honeypot in Context 4, and the bear who is holding a bunch of flower in Context 5 have to be engaged in the action of 'holding a honeypot.' The incorrect affirmative responses in Context 1 and 2 could be counted as further evidence of underexhaustive search.
4.9.2.3 The+NPs - Universal Quantifier with Transitive Verb

Group 6 (LTheNPs): 16. Are the bears holding every honeypot?  
17. Are the bears holding each honeypot?  
18. Are the bears holding all the honeypots?

<table>
<thead>
<tr>
<th>Context</th>
<th>theNPs/Adult-like responses</th>
<th>every Adult-like responses</th>
<th>each Adult-like responses</th>
<th>all Adult-like responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>75 (no)</td>
<td>25</td>
<td>56</td>
<td>56</td>
</tr>
<tr>
<td>2</td>
<td>58 (no)</td>
<td>42</td>
<td>42</td>
<td>70</td>
</tr>
<tr>
<td>3</td>
<td>89 (no)</td>
<td>11</td>
<td>89</td>
<td>83</td>
</tr>
<tr>
<td>4</td>
<td>17 (yes)</td>
<td>83</td>
<td>30</td>
<td>22</td>
</tr>
<tr>
<td>5</td>
<td>17 (yes)</td>
<td>83</td>
<td>37</td>
<td>18</td>
</tr>
<tr>
<td>6</td>
<td>94 (no)</td>
<td>6</td>
<td>94</td>
<td>89</td>
</tr>
</tbody>
</table>

For the sentences of this group, Contexts 4 and 5 have the positive response "yes" as the right answer, but Contexts 1, 2, 3 and 6 have the negative response "no" as the right answer. The high figures of non-adult-like responses in Contexts 4 and 5 further support the existence of left quantifier spreading errors. Even for Contexts 1 and 2, high figures of non-adult-like responses were observed, representing examples of underexhaustive search.

4.9.2.4 [a N] - Universal Quantifier with Is there + PP

Group 7(LINT): 23. Is there a baby behind every mummy elephant?  
24. Is there a baby behind each mummy elephant?  
25. Is there a baby behind all the mummy elephants?
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Table 10: Rates of adult/non-adult-like responses in the type "a N - every/each/all" with intransitive verb+PP

(\begin{tabular}{|c|c|c|c|c|c|c|}
\hline
Context & \textit{a / every} & & \textit{a / each} & & \textit{a / all} & \\
 & Adult-like & Non-adult & Adult-like & Non-adult & Adult-like & Non-adult \\
responses & responses & responses & responses & responses & responses & responses \\
\hline 1 & 0 \ (yes) & 100 & 17 & 83 & 33 & 67 \\
2 & 33 \ (yes) & 67 & 0 & 100 & 0 & 100 \\
3 & 100 \ (no) & 0 & 100 & 0 & 83 & 17 \\
4 & 83 \ (no) & 17 & 83 & 17 & 83 & 17 \\
5 & 100 \ (no) & 0 & 83 & 17 & 100 & 0 \\
6 & 86 \ (no) & 14 & 100 & 0 & 83 & 17 \\
\hline
\end{tabular})

For the sentences of this group Contexts 1 and 2 have "yes" as the right answer, but Contexts 3, 4, 5 and 6 have "no" as the right answer. High rates of non-adult-like responses are also shown in Contexts 1 and 2. The majority of the children involved in this task did spread the scope of quantifiers to the subject NP, \textit{a baby}, crossing over the node PP which contains them. Table 10 shows that in the case of \textit{a-every} in Context 1 and also in the case of \textit{a-each} and \textit{a-all} in Context 2 all the children involved in these tasks incorrectly gave negative responses. They were all concerned about 'the baby elephant left alone' in Context 1 and 'the baby elephant behind a black cat' in Context 2. Here as well, when negative answers were expected as correct answers, as in Contexts 3, 4, 5 and 6, high rates of adult-like responses were given.

4.9.2.5 Summary

An average 79% of instances of the left spreading phenomenon, even higher than in the case of right spreading, was observed in the present experiment. The rates of left spreading for the individual quantifiers are as follows: 79% for \textit{every} (sentences 4, 11, 16 and 23); 80% for \textit{each} (sentences 5, 12, 17 and 24); and 79% for \textit{all} (sentences 6, 13, 18 and 25).
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<Table 11> Error rates of left-spreading between every, each and all

<table>
<thead>
<tr>
<th>Type of quantifiers</th>
<th>every</th>
<th>each</th>
<th>all</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error rate (%)</td>
<td>79</td>
<td>80</td>
<td>79</td>
</tr>
</tbody>
</table>

Higher spreading errors were found in the case of intransitive verb phrases than in the case of transitive verb phrases here as well. The error rates of Group 4 (sentences 4, 5 and 6) for Contexts 3, 4 and 5, and those of Group 7 (sentences 23, 24 and 25) for Contexts 1 and 2 are compared. The results for each quantifier in transitive and intransitive sentences are shown in Table 12:

<Table 12> Error rates in percentage and p-value of left spreading: transitive vs. intransitive

<table>
<thead>
<tr>
<th>Type</th>
<th>every</th>
<th>each</th>
<th>all</th>
<th>total</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>transitive</td>
<td>74</td>
<td>76</td>
<td>68</td>
<td>73</td>
<td>0.23</td>
</tr>
<tr>
<td>intransitive</td>
<td>83</td>
<td>92</td>
<td>86</td>
<td>86</td>
<td></td>
</tr>
</tbody>
</table>

No significant difference was found in the variation of the noun phrases (a singular noun/plural NPs/the+NPs) in subject position.

<Table 13> Error rates in percentage of left-spreading between a N-uq, pls-uq and the+NPs-uq

<table>
<thead>
<tr>
<th></th>
<th>a N-uq</th>
<th>pls-uq</th>
<th>the+NPs-uq</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error rates (%)</td>
<td>73</td>
<td>81</td>
<td>76</td>
</tr>
<tr>
<td>p-value</td>
<td></td>
<td>0.25</td>
<td></td>
</tr>
</tbody>
</table>
4.9.3 Bare Plurals

In this subsection, children's interpretation of transitive sentences with bare plurals in subject position is considered and compared with their interpretation of universal quantifiers.

Group 8: 10. Are bears holding a honeypot? 14. Are bears holding honeypots?

<Table 14> Rates of adult/non-adult-like responses in sentences with bare plurals. (Unit: %)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50 (yes)</td>
<td>50</td>
<td>62 (yes)</td>
<td>38</td>
</tr>
<tr>
<td>2</td>
<td>61 (yes)</td>
<td>39</td>
<td>50 (yes)</td>
<td>50</td>
</tr>
<tr>
<td>3</td>
<td>63 (no)</td>
<td>37</td>
<td>82 (no)</td>
<td>18</td>
</tr>
<tr>
<td>4</td>
<td>32 (yes)</td>
<td>68</td>
<td>30 (yes)</td>
<td>70</td>
</tr>
<tr>
<td>5</td>
<td>56 (yes)</td>
<td>44</td>
<td>31 (yes)</td>
<td>69</td>
</tr>
<tr>
<td>6</td>
<td>74 (no)</td>
<td>26</td>
<td>74 (no)</td>
<td>26</td>
</tr>
</tbody>
</table>

For the sentences with bare plurals, Contexts 1, 2, 4 and 5 have the positive response "yes" as the right answer, but Contexts 3 and 6 have the negative response "no" as the right answer. The children involved in this experiment still show non-adult-like responses to the above bare plural structures. As we can see in Table 14, they are still preoccupied with 'a honeypot' being left out in Context 1 and 'a honeypot' being held by 'a piglet' in Context 2. The figures of non-adult-like responses in Contexts 4 and 5, 68%/70% and 44%/69% respectively, show that the children interpret the bare plural NP, bears, as quantified and give an exhaustive interpretation to it. They seem to interpret the sentence "Are bears holding a honeypot?" in Contexts 4 and 5 as "Are all the bears holding a honeypot?".

This result is discrepant with reports from previous research. For example, Philip (1995) reported that children produced significantly fewer non-adult responses
to transitive questions with two bare plural NPs (e.g. "Are farmers feeding donkeys?") than they did in response to transitive questions with a universal quantifier, and concluded that children applied the symmetrical interpretation to the questions with a universal quantifier and a transitive verb phrase. However, from the present experiment, in the case of the sentence Are bears holding honeypots? which has two bare plural NPs, 38% non-adult-like responses for Context 1, 50% for Context 2, 70% for Context 4 and 69% for Context 5 are observed. The average rate of these four figures is 57% which is similar to that found in sentences with universal quantifiers.

4.9.4 The+NPs

Even adults generally give an exhaustive interpretation to the+NPs, treating them as quantified. This section focuses on sentences with the+NPs in subject position to find out how children deal with them, and compares the results with their interpretation of NPs with universal quantifiers in the same position.

4.9.4.1 The+NPs - a / plural NP with Transitive Verb

Group 9: 15. Are the bears holding a honeypot?
19. Are the bears holding honeypots?

<Table 15> Rates of adult/non-adult-like responses in the transitive sentences with the+NPs

<table>
<thead>
<tr>
<th>Context</th>
<th>theNPs/a Adult-like res.</th>
<th>Non-adult res.</th>
<th>theNPs/plurals Adult-like res.</th>
<th>Non-adult res.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>53 (yes)</td>
<td>47</td>
<td>58 (yes)</td>
<td>42</td>
</tr>
<tr>
<td>2</td>
<td>61 (yes)</td>
<td>39</td>
<td>47 (yes)</td>
<td>53</td>
</tr>
<tr>
<td>3</td>
<td>87 (no)</td>
<td>13</td>
<td>89 (no)</td>
<td>11</td>
</tr>
<tr>
<td>4</td>
<td>61 (no)</td>
<td>39</td>
<td>70 (no)</td>
<td>30</td>
</tr>
<tr>
<td>5</td>
<td>76 (no)</td>
<td>24</td>
<td>84 (no)</td>
<td>16</td>
</tr>
<tr>
<td>6</td>
<td>95 (no)</td>
<td>5</td>
<td>83 (no)</td>
<td>17</td>
</tr>
</tbody>
</table>
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These sentences do not lend themselves happily to a yes/no response, especially in Contexts 4 and 5. That is, adults prefer the response "yes, but not all of them," rather than answering "no," in these contexts. However, on the assumption that adults generally give an exhaustive interpretation to the+NPs, as mentioned above, adult-like answers in Contexts 3, 4, 5 and 6 were deemed to be the negative response, "no," for the purposes of comparison.

The high rates of negative responses for Contexts 3, 4, 5 and 6 show that children also give an exhaustive interpretation to the+NPs, insisting that every bear in the context has to be involved in the action 'holding a honeypot.' They do not even allow 'one bear holding a bunch of flowers' in Context 5.

Here the spreading of the scope of the+NPs is also found. The children who gave negative responses in Contexts 1 and 2, 47%/42% and 39%/53% respectively, were concerned about the honeypot being left out in the former and the honeypot being held by a piglet in the latter.

4.9.4.2 The+NPs - a / plural NP with Intransitive Verb and PP

Group 10: 26. Are the babies behind a mummy elephant?
27. Are the babies behind mummy elephants?

<Table 16> Rates of adult/non-adult-like responses in the intransitive sentences with the+NPs

<table>
<thead>
<tr>
<th>Context</th>
<th>theNPs / a</th>
<th>theNPs/ plurals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adult-like</td>
<td>Non-adult</td>
</tr>
<tr>
<td>1</td>
<td>67 (no)</td>
<td>33</td>
</tr>
<tr>
<td>2</td>
<td>83 (no)</td>
<td>17</td>
</tr>
<tr>
<td>3</td>
<td>33 (yes)</td>
<td>67</td>
</tr>
<tr>
<td>4</td>
<td>33 (yes)</td>
<td>67</td>
</tr>
<tr>
<td>5</td>
<td>50 (yes)</td>
<td>50</td>
</tr>
<tr>
<td>6</td>
<td>43 (no)</td>
<td>57</td>
</tr>
</tbody>
</table>
For the sentences of Group 10, Contexts 1, 2 and 6 have the negative answer "no" as the right answer, but Contexts 3, 4 and 5 have "yes" as the right answer, assigning an exhaustive reading to the+NPs. Table 16 shows that the majority of children involved in this task gave the same exhaustive interpretation that they gave to sentences with universal quantifiers. 67% of them in Context 1 and 83% of them in Context 2 seemed to take the sentence "Are the babies behind a mummy elephant?" to mean "Are all the babies behind a mummy elephant?" They spread the scope of the definite article the to the object NP a mummy elephant of PP, interpreting the same sentence in Contexts 3, 4 and 5 as "Are the babies behind all the mummy elephants?" As we can see from the high rates of negative responses in Contexts 4 and 5, 83% and 67% respectively, to the sentence "Are the babies behind mummy elephants?," the substitution of a singular NP for the plural NPs does not make any difference to the children's interpretation.

4.10 Discussion

4.10.1 Statistical Background

Before starting to discuss the main concerns, the statistics for the p-values needs to be briefly described here. 'Binary Logistic Regression' model is used for the p-values test here because the response variable in the present experiments is dichotomous, i.e., binary or 0-1, for example, "yes"-"no". To test significance in the contingency tables of correct/incorrect answer versus type of question it is not appropriate to use the usual chi-square statistic, because each child in the study has been asked many questions and children typically contribute several responses to any one table. This invalidates the independence assumptions underlying the chi-square analysis. Instead, the p-values quoted come from a binary logistic regression analysis.
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of each table, with child and type of question as the explanatory factors. This allows
the probability of a correct response to vary between children as well as between
types of question. Sometimes the p-value seems rather at odds with the percentages
in the table--apparently small differences being quite highly significant, or large ones
being less so. This is because the evidence for differences between the success rates
for different types of question comes from only some of the children: those who have
responded to both types of question and who get some correct and some incorrect
answers. To remind, p-value does not measure the size of the difference, but the
strength of the evidence for difference. It depends on two things: (i) how big
difference is found between two comparing groups; and (ii) how much (informative)
data is given. For example, the combination of a big difference between groups and
lots of data give very small p-value meaning as highly significant difference; lots of
data with small difference could give small p-value as well; on the other hand, with
small data, even though there is a big difference, just moderate p-value is given.
That is, the figure of p-values is a logically different figure. In standard, p=.05
represents 'moderate strong evidence'; p=.01 'strong evidence'; p=.001 'very strong
evidence'; and p<.001 'very highly strong evidence', etc.. The value p<.001 means
that p is smaller than .001 and no exact value under .001 is given.

4.10.2 Effects between English Universal Quantifiers: every, each and all

In this section, focusing on the results from the sentences with three different
types of English universal quantifiers, every, each and all, we discuss whether young
children give different interpretation to the quantifiers. For comparison, the relevant
sentences are categorized into three sets:
The test sentences are repeated here for convenience:

Category A: 1. Is every bear holding a honeypot?  
4. Is a bear holding every honeypot?  
7. Is every bear holding honeypots?  
11. Are bears holding every honeypot?  
16. Are the bears holding every honeypot?  
20. Is every ladybird on a caterpillar?  
23. Is there a baby behind every mummy elephant?  

Category B: 2. Is each bear holding a honeypot?  
5. Is a bear holding each honeypot?  
8. Is each bear holding honeypots?  
12. Are bears holding each honeypot?  
17. Are the bears holding each honeypot?  
21. Is each ladybird on a caterpillar?  
24. Is there a baby behind each mummy elephant?  

Category C: 3. Are all the bears holding a honeypot?  
6. Is a bear holding all the honeypots?  
9. Are all the bears holding honeypots?  
13. Are bears holding all the honeypots?  
18. Are the bears holding all the honeypots?  
22. Are all the ladybirds on a caterpillar?  
25. Is there a baby behind all the mummy elephants?  

The Category A includes the sentences with a universal quantifier *every* in subject, object or adjunct position, and the Categories B and C include the sentences with *each* and *all* the NPs respectively in the same position. The results from the sentences belonging to Category A are compared to those from the sentences belonging to Categories B and C respectively. As summarized in Table 20, Contexts 1 and 2 are considered for the sentences 1, 2, 3, 7, 8, 9, 23, 24 and 25; Contexts 3, 4 and 5 for the sentences 4, 5, 6, 20, 21 and 22; and Contexts 4 and 5 for the sentences 11, 12, 13, 16, 17 and 18. Overall spreading error rates and p-value between the quantifiers, *every*, *each* and *all*, are shown in Table 24:
Chapter Four

Table 24 Overall error rates and p-value for the whole contexts between every, each and all

<table>
<thead>
<tr>
<th>Category (quantifier type)</th>
<th>Error Rate (%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (every)</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>B (each)</td>
<td>71</td>
<td>0.94</td>
</tr>
<tr>
<td>C (all)</td>
<td>70</td>
<td></td>
</tr>
</tbody>
</table>

The replacement of a universal quantifier in the same position of the sentence did not have any effect on English children's universal quantification. They made high spreading error rates on all the three quantifiers: 68% for every; 70% for each; and 67% for all, in which no significant difference was found between them, with p=0.94.

4.10.3 A Singular NP vs. Plural NP

The substitution of a singular NP by plural NPs in the test sentences shows a slight but not significant difference: 62% of spreading in a singular noun; 66% in plural NPs; and 77% in the+NPs. For comparison, the relevant sentences are categorized into four sets:

Category A: vs. Category B:

1. Is every bear holding a honeypot?
2. Is each bear holding a honeypot?
3. Are all the bears holding a honeypot?
7. Is every bear holding honeypots?
8. Is each bear holding honeypots?
9. Are all the bears holding honeypots?

Category C: vs. Category D:

4. Is a bear holding every honeypot?
5. Is a bear holding each honeypot?
6. Is a bear holding all the honeypots?
11. Are bears holding every honeypot?
12. Are bears holding each honeypot?
13. Are bears holding all the honeypots?

Table 25 shows the spreading error rates and p-values between each category:
Chapter Four

<Table 25> Error rates in percentage and p-values between the sentences with a singular NP and plural NP

<table>
<thead>
<tr>
<th>Category (Sentence No.)</th>
<th>Error rate (%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A(1,2,3)/B(7,8,9)</td>
<td>51/50</td>
<td>0.14</td>
</tr>
<tr>
<td>C(4,5,6)/D(11,12,13)</td>
<td>73/81</td>
<td>0.07</td>
</tr>
</tbody>
</table>

As we can see in Table 25, a difference was found in the comparison of Categories C and D, but not significantly, with p=.07.

4.10.4 Right Spreading vs. Left Spreading

To find out whether there is any difference in children's interpretation between right and left spreadings, six categories were made:

Category A: the sentences 1, 2, 3 vs. Category B: 4, 5, 6
Category C: 7, 8, 9 vs. Category D: 11, 12, 13
Category E: 20, 21, 22 vs. Category F: 23, 24, 25

The result for Category A is compared to that for Category B; C to D; and E to F, respectively. The details are shown in Table 26:

<Table 26> Error rates in percentage and p-values between right and left spreading

<table>
<thead>
<tr>
<th>Category (Sentence No.)</th>
<th>Error rate (%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A(1,2,3)/B(4,5,6)</td>
<td>51/73</td>
<td>0.001</td>
</tr>
<tr>
<td>C(7,8,9)/D(11,12,13)</td>
<td>50/81</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>E(20,21,22)/F(23,24,25)</td>
<td>72/86</td>
<td>0.13</td>
</tr>
</tbody>
</table>

The majority of children involved in this study showed a high rate of quantifier spreading both ways, right and left, in all types of structure considered. For the transitive sentences, error rates were much higher in the case of left spreading than
the case of right spreading, with \( p = .001 \) for the categories A vs. B and \( p < .001 \) for C vs. D. Here the p-values .001 for A vs. B difference and <.001 for C vs. D difference mean that stronger evidence is found in the case of C vs. D difference than in the case of A vs. B difference, but does not necessarily mean that C vs. D difference is bigger than A vs. B difference. The children involved in this experiment made more spreading errors in the case of left spreading. This finding does not support Philip & Aurelio (1991)'s result for the comparison of every/a and a/every types. They found no significant difference between the two types: 84% spreading errors for the former and 90% for the latter. They found very high error rates in both cases. On the other hand, in the case of intransitive sentences, no significant difference was found between right and left spreading in the present experiment. The children made high errors in both cases. The overall average rate of spreading is 69%: 58% for right spreading and 80% for left spreading.

4.10.5 Transitive Constructions vs. Intransitive Constructions

Through the discussion in the previous sections, we found that the children involved in the present experiment made more errors in the case of intransitive constructions than transitive constructions. In this section, details of the results of the two different constructions are shown. For the comparison, the sentences belonging to Group 1 are compared to those in Group 3, and the sentences in Group 4 to those in Group 7.

Category A: the sentences 1, 2, 3 vs. Category B: 20, 21, 22
Category C: 4, 5, 6 vs. Category D: 23, 24, 25
As shown in Table 27, a very high significant difference was found in the comparison of Categories A and B, with \( p < 0.001 \). In the case of right spreading, the children made higher errors with intransitive sentences than with transitive sentences. However, in the case of left spreading, they made high errors in both cases, 73% and 86% respectively.

### 4.10.6 Bare Plurals

The children involved in this task showed an average 53% of non-adult-like responses (spreading errors) in sentences with bare plurals without an overt quantifier. These children were as concerned about the honeypot left out or being held by the other agent as they were with the sentences with universal quantifiers. They still gave symmetrical and exhaustive interpretations to the sentences with bare plurals. To compare the results from the sentences with bare plurals and those with universal quantifiers, four categories were made:

**Category A:**

10. Are bears holding a honeypot?

**Category B:**

1. Is every bear holding a honeypot?
2. Is each bear holding a honeypot?
3. Are all the bears holding a honeypot?

**Category C:**

14. Are bears holding honeypots?

**Category D:**

7. Is every bear holding honeypots?
8. Is each bear holding honeypots?
9. Are all the bears holding honeypots?
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Error rates and p-values between bare plurals and universal quantifiers

<table>
<thead>
<tr>
<th>Category (Sentence No.)</th>
<th>Error rate (%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A(10)/B(1,2,3)</td>
<td>51/51</td>
<td>0.75</td>
</tr>
<tr>
<td>C(14)/D(7,8,9)</td>
<td>55/50</td>
<td>0.05</td>
</tr>
</tbody>
</table>

As we can see in Table 28, the children involved here did not show any difference in their interpretation between the sentences with bare plurals and those with universal quantifiers. The substitution of universal quantifiers into bare plurals in subject position of the simple transitive sentences did not have any effect on their interpretation. The big difference between the p-values 0.75 and 0.05 in the table, even though the difference of percentage rates are quite small between the categories A vs. B (51%/51%) and the categories C vs. D (55%/50%), looks odd. This is due to, as discussed in the previous section (see 3.10.1 for cross-reference), the evidence for differences between the success rates for different types of question comes from only some of the children: those who have responded to both types of question and who get some correct and some incorrect answers. If we combine the categories A & C and B & D together, the error rates and p-value between them are as in Table 29:

Error rates and p-values between bare plurals and universal quantifiers

<table>
<thead>
<tr>
<th>Category (Sentence No.)</th>
<th>Error rate (%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A(10,14)/B(1,2,3,7,8,9)</td>
<td>53/51</td>
<td>0.73</td>
</tr>
</tbody>
</table>

The children treated bare plurals as belonging to the same category as universal quantifiers.
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4.10.7 The+NPs

As has already been discussed, the+NPs has a quantifying effect just like universal quantifiers, and even adults give an exhaustive interpretation to it. In this section, the detailed figures about how much young children give the exhaustive interpretation to the+NPs are given and they are compared to those for universal quantifiers. Four categories are again made for the comparison: sentence 15 is compared to sentences 1, 2 and 3; and 19 to 7, 8 and 9.

Category A: vs. Category B:

15. Are the bears holding a honeypot? 
   1. Is every bear holding a honeypot? 
   2. Is each bear holding a honeypot? 
   3. Are all the bears holding a honeypot?

Category C: vs. Category D:

19. Are the bears holding honeypots? 
   7. Is every bear holding honeypots? 
   8. Is each bear holding honeypots? 
   9. Are all the bears holding honeypots?

<Table 30> Error rates and p-values between the+NPs and universal quantifiers

<table>
<thead>
<tr>
<th>Category (Sentence No.)</th>
<th>Error rate (%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A(15)/B(1,2,3)</td>
<td>43/51</td>
<td>0.39</td>
</tr>
<tr>
<td>C(19)/D(7,8,9)</td>
<td>47/50</td>
<td>0.006</td>
</tr>
</tbody>
</table>

No significant difference was found between the categories A and B, with p=.39, but it was found between C and D, with .006. If we combine the categories A & C and B & D together, error rates and p-value between them are as in Table 31:

<Table 31> Error rates and p-value between the+NPs and universal quantifiers

<table>
<thead>
<tr>
<th>Category (Sentence No.)</th>
<th>Error rate (%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A(15,19)/B(1,2,3,7,8,9)</td>
<td>45/51</td>
<td>0.04</td>
</tr>
</tbody>
</table>

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As shown in Table 31, 45% errors were found in the case of the+NPs and 51% errors in the case of universal quantifiers on average. Moderate strong evidence, p=0.04, is found in p-value test between A and B.

The comparison between transitive and intransitive constructions with the+NPs, without universal quantifiers, was made as follows:

Category A: vs. Category B:

15. Are the bears holding a honeypot? 26. Are the babies behind a mummy elephant?
19. Are the bears holding honeypots? 27. Are the babies behind mummy elephants?

<table>
<thead>
<tr>
<th>Category (Sentence No.)</th>
<th>Error rate (%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A(15,19)/B(26,27)</td>
<td>45/67</td>
<td>0.02</td>
</tr>
</tbody>
</table>

As shown in Table 32, 45% spreading errors were found in the case of transitive sentences and 67% in the case of intransitive sentences. More errors were found in the latter, but not significantly. The children involved in this task interpreted the babies as all the babies in the sentence "Are the babies behind a mummy elephant?", hence, as meaning "Are all the babies behind a mummy elephant?" and insisted that the sentence is true only when every baby is behind a mummy elephant. They gave an exhaustive interpretation to the+NPs, the babies. Further, they interpreted the same sentence, as meaning "Are the babies behind all the mummy elephants?", giving the exhaustive interpretation to the argument in adjunct position, a mummy elephant. This is similar to categorial syllogisms: for example, "All of the A are B" is interpreted as meaning "All of the A are B and all of the B are A".

Further, to find out the difference between the sentences with the+NPs and those with universal quantifiers in the case of intransitive constructions, the result
from the sentences 20, 21 and 22 can be compared to that from the sentences 26 and 27.

Category A: vs. Category B:

20. Is every ladybird on a caterpillar?
21. Is each ladybird on a caterpillar?
22. Are all the ladybirds on a caterpillar?
26. Are the babies behind a mummy elephant?
27. Are the babies behind mummy elephants?

<table>
<thead>
<tr>
<th>Category (Sentence No.)</th>
<th>Error rate (%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A(20,21,22)/B(26,27)</td>
<td>72/67</td>
<td>0.23</td>
</tr>
</tbody>
</table>

As shown in Table 31, no significant difference was found between the sentences with universal quantifiers and the+NPs, with p=0.23. The children involved in this task made high errors in both cases, treating them as belonging to the same category, that is, quantifying elements.

In conclusion, the majority of English children involved in this experiment showed the phenomenon of quantifier spreading in all types of construction. They spread the scope of universal quantifiers such as every, each and all to the other argument in the sentence from the argument which contains them. It was found that when the other NP was placed in the adjunct position, that is, inside PP, the children made more spreading errors than in the case of its placement in the argument position. It was also found that they made higher errors in the case where the universal quantifiers occupied the object position, rather than the subject position.

The overall average spreading error rate was 68%: 58% of right spreading (sentences involved 1, 2, 3, 7, 8, 9, 20, 21 and 22); 80% of left spreading (4, 5, 6, 11, 12, 13, 23, 24 and 25). A very highly significant difference was found between right
and left spreading: the children made much higher errors in the case of left spreading than in the case of right spreading.

No significant difference was found between the three types of universal quantifiers, *every*, *each* and *all*: 68% errors in the sentences with *every*; 70% with *each*; and 67% with *all*, with p=0.94. The children did not make any difference in their interpretation, treating them as belonging to the same category, universal quantifiers. The syntactic and semantic distinctions between the quantifiers do not seem to affect children's behaviour with universal quantification.

Further, no difference was found between sentences with a singular NP and those substituted with plural NPs: on average 62% errors in the former; and 66% in the latter. More specifically, to find out whether there is any difference between the lexical variations in subject position, the sentences 4, 5 and 6; 11, 12 and 13; and 16, 17 and 18 were compared. 73% errors were found in the first; 81% in the second; and 76% in the last. No significant difference was found between them, with p=0.25. The change of lexical item did not have any effect on children's universal quantification.

More than half of the children involved, 53%, made similar spreading errors in the sentences with bare plurals: this is higher than the case of universal quantifiers, 51% (sentences involved: 1, 2, 3, 7, 8 and 9). Further, on average 51% spreading errors were found in the sentences with *the+NPs* (15, 19, 26 and 27). Again, the change of universal quantifiers into bare plurals or *the+NPs* in the same position did not have any effect on children's comprehension with regard to universal quantification.

The results can be summarized in the following Tables:

<Table 32> Spreading error rates: right/left

<table>
<thead>
<tr>
<th></th>
<th>Right (1,2,3,7,8,9,20,21,22)</th>
<th>Left (4,5,6,11,12,13,23,24,25)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right</td>
<td>58%</td>
<td>Left</td>
</tr>
<tr>
<td></td>
<td></td>
<td>80%</td>
</tr>
</tbody>
</table>
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<Table 33> Spreading error rates between lexical variations (sentences involved in brackets)

<table>
<thead>
<tr>
<th></th>
<th>every (1,4,7,11,16,20,23)</th>
<th>each (2,5,8,12,17,21,24)</th>
<th>all (3,6,9,13,18,22,25)</th>
<th>bare plurals (10,14)</th>
<th>the+NPs (15,19,26,27)</th>
</tr>
</thead>
<tbody>
<tr>
<td>70%</td>
<td>71%</td>
<td>70%</td>
<td>53%</td>
<td>51%</td>
<td></td>
</tr>
</tbody>
</table>

<Table 34> Spreading error rates: transitive/intransitive+PP

<table>
<thead>
<tr>
<th></th>
<th>Transitive (1,2,3,4,5,6)</th>
<th>Intransitive+PP (20,21,22,23,24,25)</th>
</tr>
</thead>
<tbody>
<tr>
<td>62%</td>
<td></td>
<td>79%</td>
</tr>
</tbody>
</table>

<Table 35> Spreading error rates with universal quantifiers and a singular NP/plurals/the+NPs

<table>
<thead>
<tr>
<th></th>
<th>uq - a singular NP (1,2,3,4,5,6)</th>
<th>uq - plural NPs (7,8,9,11,12,13)</th>
<th>uq - the+NPs (16,17,18)</th>
</tr>
</thead>
<tbody>
<tr>
<td>62%</td>
<td>66%</td>
<td>76%</td>
<td></td>
</tr>
</tbody>
</table>
The aim of the second experiment was to discover whether Korean children, like English children, spread the scope of universal quantifiers to the other NPs in a clause as well as the NP which contains them. The same test sentences (Korean version) and contexts as those in Experiment I were used and six more sentence types involving a floated quantifier were added. Just as in Experiment I, I investigated:

1. the effect of varying the relative order of quantified NPs and indefinite NPs in simple sentences, that is, right and left spreading;
2. the difference in Korean children's performance between structures with a transitive verb, and an intransitive verb with a postpositional phrase;
3. the lexical distinction between the quantifiers;
4. Korean children's interpretation of bare plurals and the definite article *ku (the)+NPpl* in the same structures and in the same contexts.
In addition, in Experiment II

5. children's interpretation of sentences with floated quantifiers was compared to their interpretation of those with quantified noun phrases (Q+NP).

Based on the fact that in Korean most quantifiers can be floated in a sentence, I wanted to find out whether children give the same kind of interpretation to the two different types: [NP floated-Q] and [Q+NP]. I will briefly introduce the Korean quantifiers here.

5.1 Korean Quantifiers

Korean has universal quantifiers with functions similar to those of the English quantifiers. It contains strong and weak quantifiers with semantic properties as in English, and most quantifiers in Korean can be floated in a sentence like adverbials, just as all or each can in English. The Korean equivalent of the English quantifier shown is:

'modun' (every);
'kakkak' or 'kakca' (each); and
'modun NP-tul' (as a modifying adjective) or 'modwu' (as an adverbial) (all).

Here the Korean equivalent of English every is spelt out as modun and that of all as modun (NP)-tul, though the contrast in Korean is one of preference rather than strict grammaticality. -tul is the plural marker in Korean, but both expressions with and
without the plural marker are acceptable. Examples of Korean quantifiers are as follows:

**Strong quantifiers**

*modun* (the adjectival form) / *modwu* (the adverbial form)

(every / all)

   every bear-NOM honeypot-ACC is holding
   (Every bear is holding a honeypot.)

b. *modun* komsu-i kkultong-ul tulgo isseyo.
   all bear-PL-NOM honeypot-ACC is holding
   (All the bears are holding a honeypot.)

c. komsu-i *modwu* kkultong-ul tulgo isseyo.
   bears-NOM all honeypot-ACC is holding
   (Bears are all holding a honeypot.)

d. kom-i *modun* kkultong(tul)-ul tulgo isseyo.
   bear-NOM every/all honeypot(s)-ACC is holding
   (A bear is holding every honeypot/all the honeypots.)

e. kom-i kkultong-ul *modwu* tulgo isseyo.
   bear-NOM honeypot-ACC all is holding
   (A bear is holding every honeypot/all the honeypots.)

*kakkak-uy* (the adjectival form) / *kakkak or kakca* (the adverbial form)

(each)

a. aitul-i *kakkak/kakca* gongboo-lil hago isseyo.
   children-NOM each study-ACC is doing
   (Each child is studying.)
   each-POS children-NOM study-ACC is doing
   (Each child/Each of the children is studying.)

c. aitul-i gongboo-lil *kakkak* hago isseyo.
   (Each child is studying.)

*amwudo* (anyone or anybody)

   anyone school-LOC come-NEG-past-DEC
   (Nobody came to school.)

b. hakkyo-e *amwudo o-gi-an-ass-da.*
   (Nobody came to school.)

daebwubwun* (most)

a. *daebwubwun-uy haksayntul-i sookge haki-lil* silehanda.
   most-POS students-NOM homework do-ACC hate.
   (Most students hate doing homework.)

b. haksayntul-i *daebwubwun sookge haki-lil* silehanda.
   (Most students hate doing homework.)

c. haksayntul-i sookge haki-lil *daebwubwun* silehanda.
   (Most students hate doing homework.)
Chapter Five

Weak quantifiers

*manhi* (adv.)/ *manun* (adj.) (many/much)

a. haksayngtul-i *manhi* chamseukha-yess-da.
   students-NOM many attend-PAST-DEC
   (Many students attended.)

b. *manun* haksayngtul-i chamseukha-yess-da.
   (Many students attended.)

numeral classifier: *dwu-myung* (two people), *say-kwun* (three books), etc.

   two-CLASS-POSS policeman-NOM come-PAST-DEC
   (Two policemen came.)

b. kyungchalkwan *dwu-myung-i* chajawassda.
   policeman two-CLASS-NOM come-PAST-DEC
   (Two policemen came.)

c. na-nun *say-kwun-uy* check-il sassda.
   I-NOM three-CLASS-POSS book-ACC buy-PAST-DEC
   (I bought three books.)

d. na-nun check *say-kwun-il* sassda.
   I-NOM book three-CLASS-ACC buy-PAST-DEC
   (I bought three books.)

As we can see from the above examples, Korean quantifiers can be floated, regardless of whether they are semantically strong or weak. In this experiment, the quantifiers *modun/modun* NP-†, *kakkak-uy* and the floated quantifiers *modwu* and *kakkak* were considered for comparison with the equivalent quantifiers in English.
5.2 Design

As in Experiment I, this experiment was designed for the subjects to answer yes/no questions about a set of pictures. Nineteen sets were prepared by randomizing four hundred and forty-four main sentences (thirty-six more sentences which included floated quantifiers were added to the sentences in Experiment I) and two hundred and twenty distracting sentences (thirty-six sentences fewer than in Experiment I). Each set included seventy test questions including the distracting sentences, divided into two parts, that is, thirty-five questions for the first session and the other thirty-five for the second session. Each thirty-five question set consisted of ten questions (seven main and three distracting) from the set [bear-honeypot], ten (seven main and three distracting) from the set [caterpillar-ladybird], ten (six main and four distracting) from the set [train-coaches], and five (three main and two distracting) from the set [baby-mummy elephants] in order. One set (of 70 sentences) was administered to each child in two separate sessions (of 35 sentences), and this same set was used for three or four children.

The test questions were tape-recorded by a Korean native speaker to give the same input to every child involved.

5.3 Subjects

Sixty-two Korean kindergarten and primary school children in Korea, 27 boys and 35 girls, participated in Experiment II. The ages of the children ranged from 4;5 to 7;5 with a mean age of 5;8. There were 15 children in the 4 year old group; 27 in the 5 year old group; 16 in the 6 year old group; and 4 in the 7 year old group. The four- and five-year-olds were all from the same kindergarten in Pusan, Korea, and the
six to seven year-olds were all from the same primary school in Seoul, Korea. They were all monolingual Korean children.

5.4 Test Sentences and Control Contexts

All the test sentences in this experiment were Korean versions of the English test sentences in Experiment I. Just six more sentences to include floating quantifiers were added to the main test sentences. The list of the main sentences is as follows:

Group 1: 

1. modun kom-i kkultong-ul tulgo isseoyo?
   (Is every bear holding a honeypot?)
   modun ebulle-ka moodangbulle-lul upgo isseoyo?
   (Is every caterpillar carrying a ladybird?)
   modun kicha-ka kaekcha-lul kkulgo gago isseoyo?
   (Is every train pulling a coach?)

2. kakkak-uy kom-i kkultong-ul tulgo isseoyo?
   (Is each bear holding a honeypot?)
   kakkak-uy ebulle-ka moodangbulle-lul upgo isseoyo?
   (Is each caterpillar carrying a ladybird?)
   kakkak-uy kicha-ka kaekcha-lul kkulgo gago isseoyo?
   (Is each train pulling a coach?)

3. modun komtul-i kkultong-ul tulgo isseoyo?
   (Are all the bears holding a honeypot?)
   modun ebulletul-i moodangbulle-lul upgo isseoyo?
   (Are all the caterpillars carrying a ladybird?)
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modun kichatul-i kaekcha-lul kkulgo gago isseoyo?
(Are all the trains pulling a coach?)

Group 2:  
[modun (every) / kakkak (each) / modun NP-tul (all) - NPpl]
type with transitive verb

7. modun kom-i kkultongtul-ul tulgo isseoyo?
(Is every bear holding honeypots?)
modun ebulle-ka moodangbulle-tul-ul upgo isseoyo?
(Is every caterpillar carrying ladybirds?)
modun kicha-ka kaekchatul-ul kkulgo gago isseoyo?
(Is every train pulling coaches?)

8. kakkak-uy kom-i kkultongtul-ul tulgo isseoyo?
(Is each bear holding honeypots?)
kakkak-uy ebulle-ka moodangbulle-tul-ul upgo isseoyo?
(Is each caterpillar carrying ladybirds?)
kakkak-uy kicha-ka kaekchatul-ul kkulgo gago isseoyo?
(Is each train pulling coaches?)

9. modun komtul-i kkultongtul-ul tulgo isseoyo?
(Are all the bears holding honeypots?)
modun ebulletul-i moodangbulle-tul-ul upgo isseoyo?
(Are all the caterpillars carrying ladybirds?)
modun kichatul-i kaekchatul-ul kkulgo gago isseoyo?
(Are all the trains pulling coaches?)

Group 3:  
[ modun (every) / kakkak (each) / modun NP-tul (all) - NPsg ]
type with intransitive verb+PP

20. modun moodangbulle-ka ebulle-uye isseoyo?
(Is every ladybird on a caterpillar?)
modun aki khokkiri-ka umma khokkiri tuye isseoyo?
(Is every baby behind a mummy elephant?)

21. kakkak-uy moodangbulle-ka ebulle-uye isseoyo?
(Is each ladybird on a caterpillar?)
kakkak-uy aki khokkiri-ka umma khokkiri tuye isseoyo?
(Is each baby behind a mummy elephant?)

22. modun moodangbulletul-i ebulle-uye isseoyo?
(Are all the ladybirds on a caterpillar?)
modun aki khokkiritul-i umma khokkiri tuye isseoyo?
(Are all the babies behind a mummy elephant?)

Group 4: [NPsg - modun (every) / kakkak (each) / modun NP-tul (all)]
type with transitive verb

4. kom-i modun kkultong-ul tulgo isseoyo?
(Is a bear holding every honeypot?)
ebulle-ka modun moodangbulle-lul upgo isseoyo?
(Is a caterpillar carrying every ladybird?)
kicha-ka modun kaekcha-lul kkulgo gago isseoyo?
(Is a train pulling every coach?)

5. kom-i kakkak-uy kkultong-ul tulgo isseoyo?
(Is a bear holding each honeypot?)
ebulle-ka kakkak-uy moodangbulle-lul upgo isseoyo?
(Is a caterpillar carrying each ladybird?)
kicha-ka kakkak-uy kaekcha-lul kkulgo gago isseoyo?
(Is a train pulling each coach?)

6. kom-i modun kkultongtul-ul tulgo isseoyo?
(Is a bear holding all the honeypots?)
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ebulle-ka *modun* moodangbulleul-ul upgo isseoyo?
(Is a caterpillar carrying *all* the ladybirds?)

kicha-ka *modun* kaekchatul-ul kkulgo gago isseoyo?
(Is a train pulling *all* the coaches?)

Group 5: [ NPpl - *modun* (every) / *kakkak* (each) / *modun* NP-tul (all)]

type with transitive verb

11. komtul-i *modun* kkultong-ul tulgo isseoyo?
(Are bears holding *every* honeypot?)

ebulletul-i *modun* moodangbulle-lul upgo isseoyo?
(Are caterpillars carrying *every* ladybird?)

kichatul-i *modun* kaekcha-lul kkulgo gago isseoyo?
(Are trains pulling *every* coach?)

12. komtul-i *kakkak-uy* kkultong-ul tulgo isseoyo?
(Are bears holding *each* honeypot?)

ebulletul-i *kakkak-uy* moodangbulle-lul upgo isseoyo?
(Are caterpillars carrying *each* ladybird?)

kichatul-i *kakkak-uy* kaekcha-lul kkulgo gago isseoyo?
(Are trains pulling *each* coach?)

13. komtul-i *modun* kkultongul-ul tulgo isseoyo?
(Are bears holding *all* the honeypots?)

ebulletul-i *modun* moodangbulletul-ul upgo isseoyo?
(Are caterpillars carrying *all* the ladybirds?)

kichatul-i *modun* kaekchatul-ul kkulgo gago isseoyo?
(Are trains pulling *all* the coaches?)
Group 6:  

16. *ku kom tul-i modun kkultong-ul tulgo isseoyo?*

   (Are the bears holding *every* honeypot?)

   *ku ebulletul-i modun moodangbulle-lul upgo isseoyo?*

   (Are the caterpillars carrying *every* ladybird?)

   *ku kichatul-i modun kaekcha-lul kkulgo gago isseoyo?*

   (Are the trains pulling *every* coach?)

17. *ku kom tul-i kakkak-uy kkultong-ul tulgo isseoyo?*

   (Are the bears holding *each* honeypot?)

   *ku ebulletul-i kakkak-uy moodangbulle-lul upgo isseoyo?*

   (Are the caterpillars carrying *each* ladybird?)

   *ku kichatul-i kakkak-uy kaekcha-lul kkulgo gago isseoyo?*

   (Are the trains pulling *each* coach?)

18. *ku kom tul-i modun kkultongtul-ul tulgo isseoyo?*

   (Are the bears holding *all* the honeypots?)

   *ku ebulletul-i modun moodangbulletul-ul upgo isseoyo?*

   (Are the caterpillars carrying *all* the ladybirds?)

   *ku kichatul-i modun kaekchatul-ul kkulgo gago isseoyo?*

   (Are the trains pulling *all* the coaches?)

Group 7:  

23. aki khokkiri-ka *modun umma khokkiri tuye isseoyo?*

   (Is there *a* baby behind *every* mummy elephant?)

24. aki khokkiri-ka *kakkak-uy umma khokkiri tuye isseoyo?*

   (Is there *a* baby behind *each* mummy elephant?)
25. aki khokkiri-ka *modun* umma khokkiritul tuye isseoyo?
   (Is there a baby behind all the mummy elephants?)

Group 8: Bare plurals

10. kom†-i kkultong-ul tulgo isseoyo?
    (Are bears holding a honeypot?)
    ebulletul-†i moodangbulle-lul upgo isseoyo?
    (Are caterpillars carrying a ladybird?)
    kicharatul-†i kaekcha-lul kkulgo gago isseoyo?
    (Are trains pulling a coach?)

14. kom†-i kkultong†ul-ul tulgo isseoyo?
    (Are bears holding honeypots?)
    ebulletul-†i moodangbulletul-ul upgo isseoyo?
    (Are caterpillars carrying ladybirds?)
    kicharatul-†i kaekchatul-ul kkulgo gago isseoyo?
    (Are trains pulling coaches?)

Group 9: *ku* (*the*)+NP*pl* with transitive verb

15. *ku* kom†-i kkultong-ul tulgo isseoyo?
    (Are the bears holding a honeypot?)
    *ku* ebulletul-†i moodangbulle-lul upgo isseoyo?
    (Are the caterpillars carrying a ladybird?)
    *ku* kicharatul-†i kaekcha-lul kkulgo gago isseoyo?
    (Are the trains pulling a coach?)

19. *ku* kom†-i kkultong†ul-ul tulgo isseoyo?
    (Are the bears holding honeypots?)
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ku ebule{discretionary}tu{discretionary}l{-}i moodangbule{discretionary}tu{discretionary}l{-}ul upgo isseoyo?
(Are the caterpillars carrying ladybirds?)

ku kichatul{-}i kaekchatul{-}ul kkulgo gago isseoyo?
(Are the trains pulling coaches?)

Group 10:  \textit{Ku (the)+NPpl} with intransitive verb+PP

26. ku aki khokkiritul{-}i umma khokkiri tuye isseoyo?
(Are the babies behind a mummy elephant?)

27. ku aki khokkiritul{-}i umma khokkiritul tuye isseoyo?
(Are the babies behind mummy elephants?)

Group 11: Floated quantifier quantifying subject NP (that is, the sentence is unambiguous and has that interpretation)

28. kom-i \textit{modwu} kkultong{-}ul tulgo isseoyo?
(Is every bear holding a honeypot?)
ebulle{-}ka \textit{modwu} moodangbulle{-}lul upgo isseoyo?
(Is every caterpillar carrying a ladybird?)
kicha{-}ka \textit{modwu} kaekcha{-}lul kkulgo gago isseoyo?
(Is every train pulling a coach?)

29. kom-i \textit{kakkak} kkultong{-}ul tulgo isseoyo?
(Is each bear holding a honeypot?)
ebulle{-}ka \textit{kakkak} moodangbulle{-}lul upgo isseoyo?
(Is each caterpillar carrying a ladybird?)
kicha{-}ka \textit{kakkak} kaekcha{-}lul kkulgo gago isseoyo?
(Is each train pulling a coach?)

30. kom\textit{tu}l{-}i \textit{modwu} kkultong{-}ul tulgo isseoyo?
(Are the bears all holding a honeypot?)
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ebulletul-i *modwu* moodangbulle-lul upgo isseoyo?

(Are the caterpillars all carrying a ladybird?)

kichatul-i *modwu* kaekcha-lul kkulgo gago isseoyo?

(Are the trains all pulling a coach?)

Group 12: Floated quantifier quantifying object NP (but it can marginally quantify remote subject NP, so the sentence is ambiguous.)

31. kom-i kkultong-ul *modwu* tulgo isseoyo?

(Is a bear holding every honeypot?)

ebulle-ka moodangbulle-lul *modwu* upgo isseoyo?

(Is a caterpillar carrying every ladybird?)

kicha-ka kaekcha-lul *modwu* kkulgo gago isseoyo?

(Is a train pulling every coach?)

32. kom-i kkultong-ul *kakkak* tulgo isseoyo?

(Is a bear holding each honeypot?)

ebulle-ka moodangbulle-lul *kakkak* upgo isseoyo?

(Is a caterpillar carrying each ladybird?)

kicha-ka kaekcha-lul *kakkak* kkulgo gago isseoyo?

(Is a train pulling each coach?)

33. kom-i kkultong*ttul*-ul *modwu* tulgo isseoyo?

(Is a bear holding all the honeypots?)

ebulle-ka moodangbulletul-ul *modwu* upgo isseoyo?

(Is a caterpillar carrying all the ladybirds?)

kicha-ka kaekchatul-ul *modwu* kkulgo gago isseoyo?

(Is a train pulling all the coaches?)
Sentences 1, 2 and 3 in Group 1 have the quantifiers *modun* (every), *kakkak* (each) and *modun NP-tul* (all) which modify the noun in the subject position and a singular noun in the object position. From these examples I wanted to find out whether the Korean children involved in this experiment, like the English children who participated in Experiment I, also show quantifier spreading, that is, the extension to the direct object NP as well as the subject NP of the scope of the quantifier, and also whether there are any lexical distinctions between the quantifiers *modun* (every), *kakkak* (each) and *modun NP-tul* (all) in their interpretation and acquisition.

Sentences 4, 5 and 6 in Group 4 have a singular noun in the subject position and quantifiers in the object position. These are for detecting left spreading errors. In comparison with children's interpretation of the sentences in Group 1, I wanted to find out whether Korean children have more difficulty with quantifiers in object position than with quantifiers in subject position.

Sentences 7, 8 and 9 in Group 2 test for right spreading, like those in Group 1, but they have plural NPs in object position. If a significant difference is found in children's responses between Groups 1 and 2, there must be some role of the plural marker in those sentences. Similarly, sentences 11, 12 and 13 in Group 5 replace a singular NP in the subject position of the sentences in Group 4 with plural NPs. I wanted to find out whether the replacement of a singular noun with plural NPs in the same position gives rise to any difference in the interpretation of the sentences with a universal quantifier.

Sentences 10 and 14 in Group 8 are bare plural constructions without quantifiers: the former has a bare plural NP in subject position and a singular noun in object position; and the latter is filled with bare plural NPs in both the subject and the object positions. Korean does not have a strict grammatical rule for the presence of the plural marker *-tul* in the sentence. The plural marker *-tul* is optional, and sounds
awkward, especially in the expression of plural nouns referring to things (rather than persons). For example, the Korean equivalent of the English sentence *I bought ten apples* is:

\[
\text{na-nun yul-key-uy sakwa-lul ssa-ss-ta.} \\
\text{I-NOM ten-CLAS apple-ACC buy-PAST-PRED} \\
\text{(I bought ten apples.)}
\]

As shown in the above example, the plural marker *-tul* is not present on the noun *sakwa* (apple). That is why I am here interested in finding Korean children's interpretation of bare plurals in the same contexts as are used in the interpretation of universal quantifiers. This experiment was designed to test whether the Korean plural marker *-tul* has the property of a quantifier.

Sentences 15 and 19 in Group 9 include the definite article *ku (the)+NPpl*: the former has *ku (the)+NPpl* in subject position and a singular noun in object position; and the latter is just different from the former in the object position which is replaced by a plural NP. Here I wanted to find out whether the Korean definite article *ku*, like English *the*, has quantificational properties and gives an exhaustive interpretation.

Sentences 16, 17 and 18 in Group 6 have the definite article *ku (the)+NPpl* in subject position and universal quantifiers *modun, kakkak* and *modun NP-tul* in object position. Children's responses to the sentences of Group 9 (without universal quantifiers) and to those of Group 6 (with universal quantifiers) were compared and examined to see whether there is any difference between them. Further, the results from Groups 4, 5 and 6 were compared to find out whether there is any difference in children's interpretation between a singular NP, plural NPs and the+NPs in subject position.
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Sentences 20, 21 and 22 in Group 3 are intransitive constructions with postpositions -uye (on) or -tuye (behind). They are designed to test for right spreading so that the quantifiers are in subject position. Children's responses to these sentences were compared with those to the sentences in Group 1 so that we can find out the difference in children's interpretation between transitive and intransitive sentences, if there is any. Sentences 23, 24 and 25 in Group 7 are also intransitive constructions with a postposition -tuye (behind). They are designed to test for left spreading in the intransitive construction, so they are compared to the sentences in Group 4 to find out the difference between transitive and intransitive sentences.

Sentences 26 and 27 in Group 10 have the definite article ku (the)+NPpl in the intransitive construction with a postposition -tuye. These sentences are to be compared to sentences 15 and 19 in Group 9. Further, the results from Group 10 and Group 3 (sentences 20, 21 and 22) were compared to find out whether there is any difference between the construction with universal quantifiers and the one with ku+NPpl in subject position.

Sentences 28 to 33 are constructions with a floated quantifier, modwu or kakkak. In sentences 28, 29 and 30 of Group 11 the floated quantifier is adjacent to the subject NP and it is interpreted as modifying the subject NP in adult grammar with the same interpretation as the sentences of Group 1. On the other hand, in sentences 31, 32 and 33 the floated quantifier is adjacent to the object NP, but in this case it can modify either the object NP or the subject NP, though modification of the object NP is preferable. I wanted to find out how children interpret floated quantifiers in the test sentences and whether there is any difference in their interpretation between the case of quantifier floated and the one of quantifier modifying a noun phrase which is adjacent to it in the same six contexts.

The four sets of different pictures and the six contexts which were used in Experiment I were used here again. I will repeat them here for convenience. The four sets of pictures are as follows:
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(i) bear and honeypot
(ii) caterpillar and ladybird
(iii) train and coach
(iv) baby and mummy elephant

The six different contexts are as follows:

Context 1: Extra Object and Extra Different Agent Condition
e.g. There are three caterpillars carrying a ladybird each, an extra ladybird not being carried, and a dragonfly alone.

Context 2: Different Agent Condition
e.g. Three caterpillars are carrying a ladybird each, and a dragonfly is also carrying a ladybird.

Context 3: Many-to-One Condition
e.g. There are three caterpillars, among which just one caterpillar is carrying all three ladybirds and the other two are not, just standing, and a dragonfly alone.

Context 4: Extra Agent Condition
e.g. There are four caterpillars, among them three caterpillars are carrying a ladybird each, and one caterpillar alone without carrying a ladybird.

Context 5: Different Object Condition
e.g. There are four caterpillars, in which three caterpillars are carrying a ladybird each and one caterpillar is carrying a bunch of flowers.
Context 6: Many-to-One and Extra Object Conditions

e.g. There are three caterpillars, among them just one caterpillar is carrying three ladybirds and the other two are not, just standing, a dragonfly and an extra ladybird alone.

5.5 Distracting Sentences

The Korean version of English distracting sentences were used with the same matching pictures which were used in Experiment I (See Appendix).

5.6 Materials

The same materials as those used in Experiment I were used in this experiment. See the details in section 4.5.

5.7 Procedure

The procedure was the same as in Experiment I. Children were individually interviewed in a quiet room on two separate occasions with an interval of around one week between each session. Each session lasted around 15 to 20 minutes.

Before the start of the main questions, general conversation was made to warm up the atmosphere and involve the children in talking. More time for this kind of chatting was given to some shy children so they became positively involved in the experiment. While chatting, a microphone was introduced and put on the middle part
of their jumper, in order to record their responses during the whole session on the tape.

When the child seemed to be ready, the experimenter explained what would be done: (i) a picture would be presented to the child by an experimenter; (ii) he/she should look at the picture carefully; (iii) he/she should listen to the test question on the tape-recorder (the child is still looking at the picture while he or she is listening to the question); and (iv) he/she should answer 'ne (yes)' or 'anio (no)' to the question. When the experimenter showed a picture, she encouraged the child to describe the picture by asking questions, for example, *i kurim-e mooess-i issnayo?* (What can you see here?), *mooess-ul hago issnayo?* (What are they doing?), *muet mari-uy kom-i issnayo?* (How many bears are there?), *muet kae-uy kkultong-i issnayo?* (How many honeypots are there?), *i kom/toechi-un mooess-ul hago issnayo?* (What is the bear/piglet doing?) (e.g. pointing to a bear or a piglet in the picture), etc. Children enjoyed mentioning all the items in the picture one by one, for example,

"i kom-un kkultong-ul han-kae tulgo isskuyo (this bear, (pointing to each item with their finger), is holding a honeypot), i kom-do kkultong-ul tulgo isskuyo (this bear is also holding a honeypot), i kom-do kkultong-ul tulgo isseyo (this bear is holding a honeypot as well). kurunte, i kkultong-un kom-i upseyo (but this honeypot has no bear or there is no bear on this honeypot), kuriko i teochi-nun kkultong-ul an tulgo isseyo/honcha isseyo (and this piglet is alone/he is lonely)" etc.

The children were conscious of the details of the picture before listening to the test question. It is important to note that, given a particular input sentence such as "Is every bear holding a honeypot?", the negation of the corresponding proposition, i.e. "Every bear is [not] holding a honeypot", was salient to the child. This is clear from the fact that children mentioned, for example, "this honeypot is not being held", "this
piglet is not holding a honeypot", "these bears are not holding this honeypot", etc. At this stage the other experimenter played the question on the tape. When a child was not sure of the answer, the question was repeated. When a child answered in the negative, that is, 'anio (no)', the follow-up question "Why not?" or "Why did you say "no"?" were asked, of course in Korean. The responses were ticked in the 'yes' or 'no' sections and notes were jotted down on the blank side of the test paper. All the responses and comments by the child were also tape-recorded.

Thirty-five simple questions with different pictures each were asked to a child in one session in the order of the sets [bear-honeypot], [caterpillar-ladybird], [train-coach] and [baby-mummy elephant]. Children enjoyed answering the taped questions and liked touching and feeling the surface of the stickers used to make the pictures.

5.8 Results

5.8.1 Right Spreading (or Forward Spreading)

The aim here was to discover whether Korean children also spread the scope of the quantifiers *modun* {every), *kakkak* {each) and *modun NP-tul* {all} to the direct object NP as well as to the subject NP which they belong to. Further I examined whether there was any lexical distinction between the quantifiers in the children's comprehension, and whether there was any difference between the constructions with a singular NP and the ones with plural NPs in the same positions.
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5.8.1.1 Universal Quantifier - [N] with Transitive Verb

<Table 1> e.g.
1. modun kom-i kkultong-ul tulgo isseoyo?
   Is every bear holding a honeypot?
2. kakkak-uy kom-i kkultong-ul tulgo isseoyo?
   Is each bear holding a honeypot?
3. modun komtul-i kkultong-ul tulgo isseoyo?
   Are all the bears holding a honeypot?

<table>
<thead>
<tr>
<th>Context</th>
<th>modun /NP</th>
<th>modun NPpl /NP</th>
<th>kakkak-uy /NP</th>
<th>kakkak-uy NPpl /NP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adult-like responses</td>
<td>Non-adult responses</td>
<td>Adult-like responses</td>
<td>Non-adult responses</td>
</tr>
<tr>
<td>1</td>
<td>65 (yes)</td>
<td>35</td>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>2</td>
<td>61 (yes)</td>
<td>39</td>
<td>65</td>
<td>35</td>
</tr>
<tr>
<td>3</td>
<td>79 (no)</td>
<td>21</td>
<td>85</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>79 (no)</td>
<td>21</td>
<td>79</td>
<td>21</td>
</tr>
<tr>
<td>5</td>
<td>75 (no)</td>
<td>25</td>
<td>63</td>
<td>37</td>
</tr>
<tr>
<td>6</td>
<td>90 (no)</td>
<td>10</td>
<td>63</td>
<td>37</td>
</tr>
</tbody>
</table>

The shaded columns of Contexts 1 and 2 in Table 1 represent evidence of right spreading of quantifiers by children. The error rates found are a bit lower than those from Experiment I, but are still high: 37% right spreading errors in the case of modun; 38% in the case of kakkak-uy; and 49% in the case of modun NP-tul. On average, 38% (44 out of 117 trials) right spreading errors are found in the sentences of Group 1. The interesting point is that the errors are found consistently in those contexts which have negative responses as their right answers. In the case of modun NP-tul, high rates of errors are found in Contexts 4 and 5: 35% and 40%, and in the case of kakkak-uy, 37% errors are found in both Contexts 5 and 6. On average, 24% (54 out of 227 trials) of the answers were "yes" to sentences 1, 2 and 3 with the contexts 3, 4, 5 and 6, which yield the negative responses "no" as their right answers. These figures can be regarded as evidence of underexhaustive search in the sense of Freeman and Stedmon (1986). Korean children showed higher underexhaustive search than English children, who showed only 10% (22 out of 220 trials) on average.
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5.8.1.2 Universal Quantifier - Plural NP with Transitive Verb

<Table 2> e.g. 7. *modun* kom-i kkultong-tul-ul tulgo isseoyo?
   Is every bear holding honeypots?
8. *kakkak-uy* kom-i kkultong-tul-ul tulgo isseoyo?
   Is each bear holding honeypots?
9. *modun* komtul-i kkultong-tul-ul tulgo isseoyo?
   Are all the bears holding honeypots?

<table>
<thead>
<tr>
<th>Context</th>
<th>Answers</th>
<th>(Unit: %)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><em>modun</em></td>
<td>/ pl</td>
</tr>
<tr>
<td></td>
<td>Adult-like responses</td>
<td>Non-adult responses</td>
</tr>
<tr>
<td>1</td>
<td>47 (yes)</td>
<td>53</td>
</tr>
<tr>
<td>2</td>
<td>50 (yes)</td>
<td>50</td>
</tr>
<tr>
<td>3</td>
<td>75 (no)</td>
<td>25</td>
</tr>
<tr>
<td>4</td>
<td>75 (no)</td>
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<tr>
<td>5</td>
<td>63 (no)</td>
<td>37</td>
</tr>
<tr>
<td>6</td>
<td>83 (no)</td>
<td>17</td>
</tr>
</tbody>
</table>

The shaded columns of Contexts 1 and 2 in Table 2 again show evidence of right spreading errors. On average 41% (48 out of 118 trials) right spreading errors were found in sentences 7, 8 and 9 which have plural NPs instead of a singular NP in object position. This figure is a bit lower than the one from Experiment I (50%-57/113), but still high. Here the errors in Contexts 3, 4, 5 and 6, which yield the negative response as their right answer, are still found consistently: 28% (65/231) on average, which is higher than the rate from Experiment I, only 6% (14/223).
5.8.1.3 Universal Quantifier - \([ \text{N} ]\) with Intransitive Verb and PP

<table>
<thead>
<tr>
<th>Context</th>
<th>modun / N</th>
<th>kakkak-uy / N</th>
<th>modun-pl / pl</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adult-like responses</td>
<td>Non-adult responses</td>
<td>Adult-like responses</td>
</tr>
<tr>
<td>1</td>
<td>50 (no)</td>
<td>50</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>69 (no)</td>
<td>31</td>
<td>64</td>
</tr>
<tr>
<td>3</td>
<td>31 (yes)</td>
<td>69</td>
<td>29</td>
</tr>
<tr>
<td>4</td>
<td>33 (yes)</td>
<td>67</td>
<td>50</td>
</tr>
<tr>
<td>5</td>
<td>29 (yes)</td>
<td>71</td>
<td>36</td>
</tr>
<tr>
<td>6</td>
<td>73 (no)</td>
<td>27</td>
<td>75</td>
</tr>
</tbody>
</table>

Sentences 20, 21 and 22 are intransitive constructions with postpositional phrases. Contexts 3, 4 and 5 yield "yes" as the right answer, and high rates of spreading errors are also found for those contexts: 66% (75/114) on average (69% in case of modun; 62% in kakkak-uy; and 69% in modun NPpl). Compared with the error rates 72% (79/110) from Experiment I, this rate is a bit lower, but not significantly different. Lexical variation between the quantifiers was not found here.

Here, high percentages of adult-like responses are also observed in the case of the expected right answer "no," as in Contexts 1, 2 and 6: 70% (82/117) on average. But the error rate 30% (35/117) from the contexts is again higher than the one from Experiment I (17%-19/114). Especially, in modun - NP type with Context 1 half of the children involved in this task, 50%, made errors.
5.8.1.4 Summary

In the case of right spreading, the Korean children show an average 48% (167/349) errors: 51% (55/107) for modun (every); 46% (56/121) for kakkak-uy (each); and 48% (56/116) for modun NP-tul (all). No significant difference between the quantifiers was found.

To find out the difference between the transitive and the intransitive sentences, the results from sentences 1, 2 and 3 in Group 1, and 20, 21 and 22 in Group 8 are compared. 38% spreading errors were found in the transitive sentences and 66% in the intransitive sentences, which indicates a significantly higher error rate in the latter. The details are shown in Table 4:

<table>
<thead>
<tr>
<th></th>
<th>modun</th>
<th>kakkak-uy</th>
<th>modun-tul</th>
<th>total</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>transitive (1, 2, 3)</td>
<td>37</td>
<td>38</td>
<td>38</td>
<td>38</td>
<td>p&lt;.001</td>
</tr>
<tr>
<td>intransitive (20, 21, 22)</td>
<td>70</td>
<td>60</td>
<td>69</td>
<td>66</td>
<td></td>
</tr>
</tbody>
</table>

The substitution from a singular NP to plural NPs did not make a big difference here as well, as shown in Table 5:

<table>
<thead>
<tr>
<th></th>
<th>modun</th>
<th>kakkak-uy</th>
<th>modun-tul</th>
<th>total</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q - a singular NP (1,2,3)</td>
<td>37</td>
<td>38</td>
<td>38</td>
<td>38</td>
<td>p=.70</td>
</tr>
<tr>
<td>Q - plural NPs (7,8,9)</td>
<td>51</td>
<td>33</td>
<td>38</td>
<td>41</td>
<td></td>
</tr>
</tbody>
</table>

However, if we split the result between the quantifiers, in the case of modun the error rate is found to be significantly higher than in the case of kakkak-uy or modun-NP tul.
5.8.2 Left Spreading (or Backward Spreading)

5.8.2.1 [ N] - Quantifier with Transitive Verb

Table 6

<table>
<thead>
<tr>
<th>Context</th>
<th>Adult-like responses</th>
<th>Non-adult responses</th>
<th>Adult-like responses</th>
<th>Non-adult responses</th>
<th>Adult-like responses</th>
<th>Non-adult responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>58 (no)</td>
<td>42</td>
<td>44</td>
<td>56</td>
<td>63</td>
<td>37</td>
</tr>
<tr>
<td>2</td>
<td>47 (no)</td>
<td>53</td>
<td>43</td>
<td>57</td>
<td>37</td>
<td>63</td>
</tr>
<tr>
<td>3</td>
<td>53 (yes)</td>
<td>47</td>
<td>30</td>
<td>70</td>
<td>30</td>
<td>70</td>
</tr>
<tr>
<td>4</td>
<td>20 (yes)</td>
<td>80</td>
<td>37</td>
<td>63</td>
<td>21</td>
<td>79</td>
</tr>
<tr>
<td>5</td>
<td>16 (yes)</td>
<td>84</td>
<td>30</td>
<td>70</td>
<td>30</td>
<td>70</td>
</tr>
<tr>
<td>6</td>
<td>84 (no)</td>
<td>16</td>
<td>81</td>
<td>19</td>
<td>65</td>
<td>35</td>
</tr>
</tbody>
</table>

(Unit: %)

Very high rates of left spreading errors are also found here, as shown by the shaded columns in Table 6. On average 70% (124/176) spreading errors are found: 71% for modun; 68% for kakkak-uy; and 73% for modun -tul. That is, the majority of Korean children involved in this task spread the scope of quantifiers to the subject NP as well as the object NP. Moreover, even in the case of Contexts 1, 2 and 6, which have the negative response "no" as the right answer, high rates of erroneous spreading of the quantifiers are observed. An average of 44% (88/201) errors is found: 37% for modun; 49% for kakkak-uy; and 44% for modun -tul. This figure is much higher than in the case of Experiment I (29% errors). Korean children tend to spread the scope of quantifiers to both arguments in the sentence without much relation to context.
Chapter Five

5.8.2.2 Plural NP - Quantifier with Transitive Verb

<table>
<thead>
<tr>
<th>Context</th>
<th>NPpl / modun</th>
<th>NPpl / kakkak-uy</th>
<th>NPpl / modun-pl</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adult-like responses</td>
<td>Non-adult responses</td>
<td>Adult-like responses</td>
</tr>
<tr>
<td>1</td>
<td>70 (no)</td>
<td>30</td>
<td>58</td>
</tr>
<tr>
<td>2</td>
<td>44 (no)</td>
<td>56</td>
<td>47</td>
</tr>
<tr>
<td>3</td>
<td>63 (no)</td>
<td>37</td>
<td>84</td>
</tr>
<tr>
<td>4</td>
<td>30 (yes)</td>
<td>70</td>
<td>47</td>
</tr>
<tr>
<td>5</td>
<td>42 (yes)</td>
<td>58</td>
<td>40</td>
</tr>
<tr>
<td>6</td>
<td>68 (no)</td>
<td>32</td>
<td>80</td>
</tr>
</tbody>
</table>

The figures of non-adult-like responses in Contexts 4 and 5, shaded in the table, again represent high rates of left spreading by children. The average error rate is 64% (74/116): 64% for modun; 56% for kakkak-uy; and 71% for modun-tul. Here a higher rate of incorrect affirmative responses in Contexts 1, 2, 3 and 6 is also found: 35% (80/231) on average which is higher than the rate of Experiment I (19% - 42/221). These could be counted as further evidence of underexhaustive search.

5.8.2.3 Ku (the)+ NPpl - Quantifier with Transitive Verb

<table>
<thead>
<tr>
<th>Context</th>
<th>NPpl / modun</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adult-like responses</td>
</tr>
<tr>
<td>1</td>
<td>70 (no)</td>
</tr>
<tr>
<td>2</td>
<td>44 (no)</td>
</tr>
<tr>
<td>3</td>
<td>63 (no)</td>
</tr>
<tr>
<td>4</td>
<td>30 (yes)</td>
</tr>
<tr>
<td>5</td>
<td>42 (yes)</td>
</tr>
<tr>
<td>6</td>
<td>68 (no)</td>
</tr>
</tbody>
</table>
5.8.2.4 [N] - Quantifier with Intransitive Verb+ PP

23. aki khokkiri-ka modun umma khokkiri tuye isseoyo?
   Is there a baby behind every mummy elephant?

24. aki khokkiri-ka kakkak-uy umma khokkiri tuye isseoyo?
   Is there a baby behind each mummy elephant?

25. aki khokkiri-ka modun umma khokkiri tul tuye isseoyo?
   Is there a baby behind all the mummy elephants?

As shown in the shaded columns of Table 9, high rates of left spreading errors are found in Contexts 1 and 2. An average of 78% (28/36) errors is found.
(9/12) for modun; 83% (10/12) for kakkak-uy; and 75% (9/12) for modun -tul. For the contexts 3, 4, 5 and 6, which have a negative response as the right answer, an average of 32% (25/78) errors is found. Compared with the case of Experiment I (only 9% errors -7/76 found), this figure is high.

5.8.2.5 Summary

Overall 68% (300/443) left spreading errors were found in Experiment II: 67% (99/148) for modun; 67% (100/149) for kakkak-uy; and 69% (101/146) for modun -tul. No significant difference was found between quantifiers, or in the variation of the NP in subject position: a singular noun; plural NP; or ku (the)+NP.

Higher spreading errors were also found in the case of intransitive sentences than in the case of transitive sentences. For the contrast between transitive and intransitive sentences, the error rates of sentences 4, 5 and 6 in Contexts 3, 4 and 5 are compared with those of sentences 23, 24 and 25 in Contexts 1 and 2. The details are shown in Table 10:

<Table 10> Rates of left spreading errors: transitive vs. intransitive

<table>
<thead>
<tr>
<th></th>
<th>every</th>
<th>each</th>
<th>all</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>transitive (4,5,6)</td>
<td>71 (41/58)</td>
<td>68 (40/59)</td>
<td>73 (43/59)</td>
<td>70 (124/176)</td>
</tr>
<tr>
<td>intransitive (23,24,25)</td>
<td>75 (9/12)</td>
<td>83 (10/12)</td>
<td>75 (9/12)</td>
<td>78 (28/36)</td>
</tr>
</tbody>
</table>

In both cases very high spreading errors were found and no significant difference was found between them.
5.8.3 Bare Plurals

Two types of sentences are considered to test children's interpretation of bare plural NP: bare plural NP in subject position; and bare plural NP in both subject and object positions.

For bare plurals, Korean children, like English children in Experiment I, treat them just like the quantifiers and give them the same kind of interpretation. An average of 52% non-adult-like responses (79/151) was found from Contexts 1, 2, 4 and 5, which yield "yes" as the right answer. This figure is very similar to the one from Experiment I (53% - 80/151). That is, more than half of the children involved in this task in both experiments gave the exhaustive interpretation to the plural marker -tul and spread its scope to both arguments in the sentence.
5.8.4 *Ku (the) +NPpl*

Sentences which have a definite article *ku*+*NPpl* in subject position and a singular noun/plural NP in object position with a transitive verb, and also in an intransitive construction are considered.

### 5.8.4.1 *Ku*+*NPpl* with Transitive Verb

<table>
<thead>
<tr>
<th>Context</th>
<th><em>ku NP</em> Adult-like res.</th>
<th>/N Non-adult res.</th>
<th><em>ku NP</em> Adult-like res.</th>
<th>/pls Non-adult res.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>59 (yes)</td>
<td>41</td>
<td>47 (yes)</td>
<td>53</td>
</tr>
<tr>
<td>2</td>
<td>58 (yes)</td>
<td>42</td>
<td>53 (yes)</td>
<td>47</td>
</tr>
<tr>
<td>3</td>
<td>68 (no)</td>
<td>32</td>
<td>85 (no)</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>63 (no)</td>
<td>37</td>
<td>65 (no)</td>
<td>35</td>
</tr>
<tr>
<td>5</td>
<td>65 (no)</td>
<td>35</td>
<td>63 (no)</td>
<td>37</td>
</tr>
<tr>
<td>6</td>
<td>85 (no)</td>
<td>15</td>
<td>63 (no)</td>
<td>37</td>
</tr>
</tbody>
</table>

An average of 45% (39/86) non-adult-like responses "no" was found in Contexts 1 and 2. These children were concerned about the remaining honeypot in Context 1 and the honeypot being held by a piglet in Context 2. They gave an exhaustive interpretation to the honeypots as well as to *ku kom tul* (the bears). No significant difference was found in the results of Contexts 1 and 2 and the two types of sentences, 15 and 19.
5.8.4.2 *Ku+NP*pl with Intransitive Verb and PP

<Table 13>

<table>
<thead>
<tr>
<th>Context</th>
<th>ku NPpl / NP</th>
<th>ku NPpl / plural NP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adult-like</td>
<td>Non-adult</td>
</tr>
<tr>
<td>1</td>
<td>67 (no)</td>
<td>33</td>
</tr>
<tr>
<td>2</td>
<td>100 (no)</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>29 (yes)</td>
<td>71</td>
</tr>
<tr>
<td>4</td>
<td>50 (yes)</td>
<td>50</td>
</tr>
<tr>
<td>5</td>
<td>50 (yes)</td>
<td>50</td>
</tr>
<tr>
<td>6</td>
<td>86 (no)</td>
<td>14</td>
</tr>
</tbody>
</table>

An average of 69% (22/32) non-adult-like responses was found in Contexts 3, 4 and 5 for sentence 26, and Contexts 4 and 5 for sentence 27 which yield "yes" as the right answer. The children who answered "no" in these contexts were all concerned about the bears not holding a honeypot.

5.8.5 Floated Quantifiers

When the quantifiers *modun* and *kakkak-uy* are floated in the sentence, they take the forms *modwu* and *kakkak* respectively: forms which function as adverbials, and are generally placed next to the NP which they modify. Here six sentences with a floated quantifier, *modwu* or *kakkak*, were constructed and considered with the same six contexts.
5.8.5.1 Floated Quantifiers Quantifying Subject NP

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Is every bear holding a honeypot?</td>
<td>Is a bear each holding a honeypot?</td>
<td>Are the bears all holding a honeypot?</td>
</tr>
<tr>
<td>(Unit: %)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>50 (Yes)</td>
<td>50 (Yes)</td>
<td>50 (Yes)</td>
</tr>
<tr>
<td>2</td>
<td>25 (Yes)</td>
<td>75 (Yes)</td>
<td>75 (Yes)</td>
</tr>
<tr>
<td>3</td>
<td>67 (No)</td>
<td>33 (No)</td>
<td>33 (No)</td>
</tr>
<tr>
<td>4</td>
<td>67 (No)</td>
<td>33 (No)</td>
<td>33 (No)</td>
</tr>
<tr>
<td>5</td>
<td>75 (No)</td>
<td>25 (No)</td>
<td>25 (No)</td>
</tr>
<tr>
<td>6</td>
<td>60 (No)</td>
<td>40 (No)</td>
<td>40 (No)</td>
</tr>
</tbody>
</table>

An average of 43% (31/72) spreading errors was found in Contexts 1 and 2, which yield "yes" as the right answer. This figure is higher than the one (38% - 44/117) from the sentences 1, 2 and 3 in which the quantifiers are not floated. The children spread the scope of the floated quantifier to the object NP as well as to the subject NP. The spreading phenomenon does not seem to be affected by the positioning of quantifiers in the sentence. However, as we can see in Table 14, a significant difference is found between the floated quantifiers specially in Context 2. That is, 75% (9/12) for *modwu* is a much higher rate than 33% (4/12) for *kakkak* and 25% (3/12) for NP-tul *modwu*. High rates of errors were even found in Contexts 3, 4, 5 and 6, which have the negative response "no" as the right answer. In particular, the rates 78% (7/9) and 67% (6/9) in the case of *kakkak* for Contexts 5 and 6, and 67% (6/9) and 44% (4/9) in the case of NP-tul *modwu* for Contexts 4 and 5 are too high to be ignored.
5.8.5.2 Floated Quantifiers Quantifying Object NP

The reading on which the quantifiers modwu and kakkak quantify the object NP kkultong, to which they are adjacent, is a natural one, but another reading on which they quantify the remoted subject NP kom is also possible in adult grammar. So the sentences 31 to 33 are ambiguous.

<Table 15> 31. kom-i kkultong-ul modwu tulgo isseoyo?
Is a bear holding every honeypot?
32. kom-i kkultong-ul kakkak tulgo isseoyo?
Is a bear holding each honeypot?
33. kom-i kkultong-ul modwu tulgo isseoyo?
Is a bear holding all the honeypots?

<table>
<thead>
<tr>
<th>Sentence Context</th>
<th>31 Adult-like</th>
<th>Non-adult</th>
<th>32 Adult-like</th>
<th>Non-adult</th>
<th>33 Adult-like</th>
<th>Non-adult</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22 (No)</td>
<td>78</td>
<td>33</td>
<td>67</td>
<td>44</td>
<td>56</td>
</tr>
<tr>
<td>2</td>
<td>67 (No)</td>
<td>33</td>
<td>33</td>
<td>67</td>
<td>22</td>
<td>78</td>
</tr>
<tr>
<td>3</td>
<td>22 (Yes)</td>
<td>78</td>
<td>11</td>
<td>89</td>
<td>11</td>
<td>89</td>
</tr>
<tr>
<td>4</td>
<td>0 (Yes)</td>
<td>100</td>
<td>0</td>
<td>100</td>
<td>33</td>
<td>67</td>
</tr>
<tr>
<td>5</td>
<td>44 (Yes)</td>
<td>56</td>
<td>11</td>
<td>89</td>
<td>33</td>
<td>67</td>
</tr>
<tr>
<td>6</td>
<td>89 (No)</td>
<td>11</td>
<td>100</td>
<td>0</td>
<td>100</td>
<td>0</td>
</tr>
</tbody>
</table>

As we can see from the results of Contexts 1 and 2, more than half of the children involved in this task interpreted the floated quantifier as quantifying the subject NP kom rather than the object NP kkultong. That is, 64% (29/45) non-adult-like responses had the reading on which the floated quantifier quantifies the remote subject NP. Very high percentages of non-adult-like responses were given for Contexts 3, 4 and 5 which yield "yes" as the right answer. Children spread the scope of the floated quantifier to both object and subject NPs and gave the exhaustive interpretation, mentioning that for example, "one bear/caterpillar/train is holding/carrying/pulling all the honeypots/ladybirds/coaches, these two bears/caterpillars/trains are not holding/carrying/pulling anything" for Context 3; "one bear/caterpillar/train is not holding/carrying/pulling anything" for Context 4; and
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"three bears are holding only one each, one bear is holding a flower, this one is only carrying a butterfly, etc." for Context 5.

5.9 Discussion

The Korean children involved in this experiment, like the English children in Experiment I, show high rates of quantifier spreading. They made overall 58% spreading errors. This figure is a bit lower than the case of English children who made overall 68% errors, but still more than half.

5.9.1Effects between Universal Quantifiers: modun, kakkak-uy and modun NP-tul

Turning back to our main concerns, let us first look at whether there is any difference in Korean children's interpretation between the three different types of universal quantifiers: modun (every), kakkak-uy (each) and modun NP-tul (all). For the comparison, three categories are made:

Category A: for the sentences including \textit{modun}: 1, 4, 7, 11, 16, 20, 23
Category B: for the sentences including \textit{kakkak-uy}: 2, 5, 8, 12, 17, 21, 24
Category C: for the sentences including \textit{modun NP-tul}: 3, 6, 9, 13, 18, 22, 25

The test sentences are repeated here for the convenience:

Category A: 1. \textit{modun} kom-i kkultong-ul tulgo isseoyo?
4. \textit{kom-i modun} kkultong-ul tulgo isseoyo?
7. \textit{modun} kom-i kkultongul-ul tulgo isseoyo?
11. \textit{komtul-i modun} kkultong-ul tulgo isseoyo?
16. \textit{ku komtul-i modun} kkultong-ul tulgo isseoyo?
20. \textit{modun} modangbulle-ka ebulle-uye isseoyo?
23. aki kkokkiri-ka \textit{modun} umma kkokkiri tuye isseoyo?
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Category B:  2. kakkak-uy kom-i kkultong-ul tulgo isseoyo?
5. kom-i kakkak-uy kkultong-ul tulgo isseoyo?
8. kakkak-uy kom-i kkultongul-ul tulgo isseoyo?
12. komtul-i kakkak-uy kkultong-ul tulgo isseoyo?
17. ku komtul-i kakkak-uy kkultong-ul tulgo isseoyo?
21. kakkak-uy moodangbulle-ka ebulle-uye isseoyo?
24. aki kkokkiri-ka kakkak-uy umma kkokkiri tulgo isseoyo?

Category C:  3. modun komtul-i kkultong-ul tulgo isseoyo?
6. kom-i modun kkultongul-ul tulgo isseoyo?
9. modun komtul-i kkultongul-ul tulgo isseoyo?
13. komtul-i modun kkultongul-ul tulgo isseoyo?
18. ku komtul-i modun kkultongul-ul tulgo isseoyo?
22. modun moodangbulletul-i ebulle-uye isseoyo?
25. aki kkokkiri-ka modun umma kkokkiritul tulgo isseoyo?

For example, the result from sentence 1 is compared to that from sentence 2 and also to that from sentence 3, because the three sentences have only one variation: the different type of universal quantifiers in subject position. Table 21 shows overall error rates and p-values for the whole six contexts between the quantifiers: modun; kakkak-uy; and modun NP-tul:

<table>
<thead>
<tr>
<th>Category (quantifier type)</th>
<th>Error Rate (%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (modun)</td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>B (kakkak-uy)</td>
<td>42</td>
<td>0.99</td>
</tr>
<tr>
<td>C (modun NP-tul)</td>
<td>42</td>
<td></td>
</tr>
</tbody>
</table>

The error rates in Table 21 represent the children's wrong answers for the whole six contexts, not just the spreading errors with the relevant contexts. As shown in the table, no difference was found between the types of universal quantifier. According to the p-value test of 'no modun/kakkak-uy/modun-NP-tul effect' using binary logistic regression, no significant difference between the three universal quantifiers was found in all the six different contexts, resulting in p=0.99. That is, the change of the lexical item, universal quantifier, does not cause any effect in children's universal
quantification. Korean children involved in this experiment responded consistently to the three quantifiers.

If we concentrate on the spreading errors which are observed from the constructions with each different quantifier, we need to split each sentence type into its relevant context. For example, Contexts 1 and 2 are considered for the sentences 1, 2, 3, 7, 8, 9, 23, 24 and 25; Contexts 3, 4 and 5 for the sentences 4, 5, 6, 20, 21, and 22; and Contexts 4 and 5 for the sentences 11, 12, 13, 16, 17, and 18. The details are shown in Table 22:

<table>
<thead>
<tr>
<th>Sentence No.</th>
<th>Contexts considered</th>
<th>Error Rate (%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2/3</td>
<td>1,2</td>
<td>37/38/38</td>
<td>0.87</td>
</tr>
<tr>
<td>4/5/6</td>
<td>3,4,5</td>
<td>71/68/73</td>
<td>0.59</td>
</tr>
<tr>
<td>7/8/9</td>
<td>1,2</td>
<td>51/33/38</td>
<td>0.04</td>
</tr>
<tr>
<td>11/12/13</td>
<td>4,5</td>
<td>64/56/71</td>
<td>0.73</td>
</tr>
<tr>
<td>16/17/18</td>
<td>4,5</td>
<td>62/71/59</td>
<td>0.01</td>
</tr>
<tr>
<td>20/21/22</td>
<td>3,4,5</td>
<td>70/60/69</td>
<td>0.08</td>
</tr>
<tr>
<td>23/24/25</td>
<td>1,2</td>
<td>76/77/79</td>
<td>0.17</td>
</tr>
</tbody>
</table>

As we can see in Table 22, overall no big difference is found between each type of sentence, but a significant difference is found between the sentences 7, 8 and 9 (p=0.04) and also between the sentences 16, 17 and 18 (p=0.01). In the former, more errors are found in the case of the sentence with modun (every) than the sentences with kakkak-uy (each) and modun NP-tul (all): 51% is higher than 33% or 38%; and in the latter, higher errors, 71%, are found in sentence 17 with the quantifier kakkak-uy than the other two. Interesting here is that these sentences, 7, 8, 9, 16, 17 and 18, include more than one quantifying element, that is, plural marker -tul and universal quantifier, or ku(the)+NPpl and universal quantifier, if we regard the plural marker and ku(the)+NPpl, like universal quantifiers, as quantifying elements. Children
might be confused in making their decision on the test sentences when more than one quantifying element exists in the test sentence.

5.9.2 A Singular NP vs. Plural NP

The second concern was to find whether the change of a singular NP into a plural NP in the same position makes any difference in children's interpretation with universal quantifiers. That is, I wanted to find out whether the existence of the plural marker -tul had any effect on their interpretation. So sentences 1, 2 and 3 are compared to 7, 8 and 9; 4, 5 and 6 to 11, 12 and 13; 10 to 14; and 15 to 19, respectively. For comparison, 8 categories are made here:

<table>
<thead>
<tr>
<th>Category A</th>
<th>vs.</th>
<th>Category B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. modun kom-i kkultong-ul tulgo isseoyo?</td>
<td>7. modun kom-i kkultong-tul-ul tulgo isseoyo?</td>
<td></td>
</tr>
<tr>
<td>2. kakkak-uy kom-i kkultong-ul tulgo isseoyo?</td>
<td>8. kakkak-uy kom-i kkultong-tul-ul tulgo isseoyo?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category C</th>
<th>vs.</th>
<th>Category D</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. kom-i modun kkultong-ul tulgo isseoyo?</td>
<td>11. komul-i modun kkultong-ul tulgo isseoyo?</td>
<td></td>
</tr>
<tr>
<td>5. kom-i kakkak-uy kkultong-ul tulgo isseoyo?</td>
<td>12. komul-i kakkak-uy kkultong-ul tulgo isseoyo?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category E</th>
<th>vs.</th>
<th>Category F</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Category G</th>
<th>vs.</th>
<th>Category H</th>
</tr>
</thead>
<tbody>
<tr>
<td>15. ku komul-i kkultong-ul tulgo isseoyo?</td>
<td>19. ku komul-i kkultong-tul-ul tulgo isseoyo?</td>
<td></td>
</tr>
</tbody>
</table>
Table 23 shows the spreading error rates and p-values between each category:

<Table 23> Error rates in percentage and p-values between the sentences with a singular NP and plural NP

<table>
<thead>
<tr>
<th>Category (Sentence No.)</th>
<th>Error rate (%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A(1,2,3)/B(7,8,9)</td>
<td>38/41</td>
<td>0.70</td>
</tr>
<tr>
<td>C(4,5,6)/D(11,12,13)</td>
<td>70/64</td>
<td>0.18</td>
</tr>
<tr>
<td>E(10)/F(14)</td>
<td>48/56</td>
<td>0.76</td>
</tr>
<tr>
<td>G(15)/H(19)</td>
<td>42/50</td>
<td>0.24</td>
</tr>
</tbody>
</table>

Here no significant difference was found between the constructions with a singular NP and those with a plural NP, as shown in Table 23. That is, the substitution of a plural NP in place of a singular NP does not have any effect on children's interpretation.

5.9.3 Right Spreading vs. Left Spreading

One of the main goals of the present study was to find whether there is any effect in the variation of syntactic position in which universal quantifiers appear. Previous research showed that children find more difficulty in left-spreading than in right spreading. To see if I could replicate this finding, six categories were made:

Category A: the sentences 1, 2, 3 vs. Category B: 4, 5, 6
Category C: 7, 8, 9 vs. Category D: 11, 12, 13
Category E: 20, 21, 22 vs. Category F: 23, 24, 25

The sentences belonging to Categories A, C and E were designed to find right spreading errors and those in Categories B, D and F left spreading errors. The results for each category with the relevant contexts are described in Table 24:
As we can see in Table 24, children involved in this experiment made higher errors in the case of left spreading than in the case of right spreading. According to the \( p \)-values, a highly significant difference was found between the categories A and B in which the \( p \)-value is less than 0.001, and also C and D (\( p < 0.001 \)). However, in the case of intransitive constructions, the children demonstrated high errors in both right and left spreading, 66% and 78% respectively, resulting in no significant difference between them (\( p = .20 \)).

### 5.9.4 Transitive Constructions vs. Intransitive Constructions

For the comparison between transitive and intransitive constructions, four categories were made:

Category A:  the sentences 1, 2, 3  vs.  Category B:  20, 21, 22
Category C:  4, 5, 6  vs.  Category D:  23, 24, 25

<Table 25> Error rates and \( p \)-values between transitive and intransitive constructions

<table>
<thead>
<tr>
<th>Category (Sentence No.)</th>
<th>Error rates</th>
<th>( p )-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>A(1,2,3)/B(20,21,22)</td>
<td>38/66</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>C(4,5,6)/D(23,24,25)</td>
<td>70/78</td>
<td>0.19</td>
</tr>
</tbody>
</table>
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As shown in Table 25, in the case of right spreading, a highly significant difference between the transitive and intransitive constructions \((p<.001)\) was found. That is, the children involved in this task made higher errors in the intransitive constructions \((66\%)\) than in the transitive constructions \((38\%)\). On the other hand, in the case of left spreading, no significant difference was found between the transitive and intransitive constructions, with \(p=.19\). The children who participated in this task made very high errors, 70% and 78% respectively, in both constructions.

5.9.5 Bare Plurals

To find out whether there is any difference in children’s interpretation between bare plurals and universal quantifiers which occupy the same position in the sentence, the response of sentence 10 is compared to that of sentences 1, 2 and 3; and also the response of sentence 14 to that of sentences 7, 8 and 9:

**Category A:** vs. **Category B:**
10. komtul-i kkultong-ul tulgo isseoyo?
1. modun kom-i kkultong-ul tulgo isseoyo?
2. kakkak-uy kom-i kkultong-ul tulgo isseoyo?
3. modun komtul-i kkultong-ul tulgo isseoyo?

**Category C:** vs. **Category D:**
14. komtul-i kkultong\(tul\)-ul tulgo isseoyo?
7. modun kom-i kkultong\(tul\)-ul tulgo isseoyo?
8. kakkak-uy kom-i kkultong\(tul\)-ul tulgo isseoyo?
9. modun komtul-i kkultong\(tul\)-ul tulgo isseoyo?

<Table 26> Error rates and \(p\)-values between bare plurals and universal quantifiers

<table>
<thead>
<tr>
<th>Category (Sentence No.)</th>
<th>Error rates</th>
<th>(p)-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>A(10)/B(1,2,3)</td>
<td>48/38</td>
<td>0.18</td>
</tr>
<tr>
<td>C(14)/D(7,8,9)</td>
<td>56/41</td>
<td>0.05</td>
</tr>
</tbody>
</table>
As shown in Table 26, no significant differences were found in either case: A vs. B ($p=.18$); and C vs. D ($p=.50$). This indicates that the children involved in this experiment made their interpretation with bare plural NPpl similar to that which they did with universal quantifiers, *modun (every), kakkak-uy (each)* or *modun NP-tul (all)*, proving that bare plurals also have the property of being quantifying elements. This finding is discrepant to the findings from the previous research which reported that children made much lower errors with bare plurals than universal quantifiers.

### 5.9.6 Ku (the) +NPpl

The constructions with *ku+NPpl* and those with universal quantifiers are compared to find out the difference between them. Sentence 15 is compared to sentences 1, 2 and 3, and sentence 19 to sentences 7, 8 and 9.

**Category A** vs. **Category B**:

15. *ku komtul-i kkultong-ul tulgo isseoyo?*  
   1. *modun kom-i kkultong-ul tulgo isseoyo?*  
   2. *kakkak-uy kom-i kkultong-ul tulgo isseoyo?*  
   3. *modun komtul-i kkultong-ul tulgo isseoyo?*

**Category C** vs. **Category D**:

19. *ku komtul-i kkultongtul-ul tulgo isseoyo?*  
   7. *modun kom-i kkultongtul-ul tulgo isseoyo?*  
   8. *kakkak-uy kom-i kkultongtul-ul tulgo isseoyo?*  
   9. *modun komtul-i kkultongtul-ul tulgo isseoyo?*

<Table 27> Error rates and *p*-values between *ku+NPpl* and universal quantifiers

<table>
<thead>
<tr>
<th>Category (Sentence No.)</th>
<th>Error rates</th>
<th><em>P</em>-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>A(15)/B(1,2,3)</td>
<td>42/38</td>
<td>0.17</td>
</tr>
<tr>
<td>C(19)/D(7,8,9)</td>
<td>50/41</td>
<td>0.85</td>
</tr>
</tbody>
</table>
As we can see in Table 27, no significant differences were found in either comparison: A vs. B (p=.17); and C vs. D (p=.85). The children involved in these tasks made their interpretation of ku+NPpl similar to that which they did for universal quantifiers such as modun (every), kakkak-uy (each) or modun NP-tul (all). They showed the same spreading errors with the constructions with ku+NPpl.

In the case of intransitive constructions, the sentences with universal quantifiers and those with ku+NPpl were compared:

<table>
<thead>
<tr>
<th>Category A</th>
<th>vs.</th>
<th>Category B</th>
</tr>
</thead>
<tbody>
<tr>
<td>21. kakkak-uy moodangbulle-ka ebulle-uye isseoyo?</td>
<td>27. ku aki kkokkiritul-i umma kkokkiritul-tuye isseoyo?</td>
<td></td>
</tr>
<tr>
<td>22. modun moodangbulletul-i ebulle-uye isseoyo?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category (Sentence No.)</th>
<th>Error rates</th>
<th>P-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>A(20,21,22)/B(26,27)</td>
<td>66/69</td>
<td>0.61</td>
</tr>
</tbody>
</table>

Further, a comparison between transitive and intransitive constructions with ku+NPpl, without universal quantifiers, was made:

<table>
<thead>
<tr>
<th>Category A</th>
<th>vs.</th>
<th>Category B</th>
</tr>
</thead>
<tbody>
<tr>
<td>15. ku komtul-i kkultong-ul tulgo isseoyo?</td>
<td>26. ku aki kkokkiritul-i umma kkokkiri-tuye isseoyo?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category C</th>
<th>vs.</th>
<th>Category D</th>
</tr>
</thead>
<tbody>
<tr>
<td>19. ku komtul-i kkultongul-ul tulgo isseoyo?</td>
<td>27. ku aki kkokkiritul-i umma kkokkiri tul-tuye isseoyo?</td>
<td></td>
</tr>
</tbody>
</table>
<Table 29> Error rates and $p$-values between transitive and intransitive with $ku+NPl$

<table>
<thead>
<tr>
<th>Category (Sentence No.)</th>
<th>Error rate</th>
<th>$P$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A(15)/B(26)</td>
<td>42/58</td>
<td>Insufficient data</td>
</tr>
<tr>
<td>C(19)/D(27)</td>
<td>50/85</td>
<td>Insufficient data</td>
</tr>
</tbody>
</table>

Table 29 shows that the children involved in this task made more errors in the intransitive constructions than in the transitive constructions. The percentage figures 58% and 85% in the case of intransitive constructions are higher than the 42% and 50% found in the case of transitive constructions. However, the $p$-value was not available for the comparisons, that is, 15 vs. 26 and 19 vs. 27, because the data were not sufficient for the comparisons, due to the fact that for example, the same children who answered the sentence 15 did not answer 19 and therefore they were not informative for the comparison.

5.9.7 Floated Quantifiers

Experiment II included the extra constructions with floated quantifiers. No significant difference was found between the constructions with floated quantifiers and those with quantified NPs. In the case where floated quantifiers quantify the subject NP (the case of right spreading), 43% spreading errors were found. In comparison with the error rate 38% from the sentences 1, 2 and 3 which have the quantified NP, modun/kakkak-uy/modun kom(tul), in the subject position, this figure is higher, but not significantly with $p=0.74$. Further, in the case where floated quantifiers quantify the object NP (the case of left spreading), a much higher error rate, 82%, was found. Similarly, compared with the error rate 71% from the sentences 4, 5 and 6, the figure 82% is higher than in the case of the quantified NPs, but not significantly, with $p=0.23$. The pattern of error rates between the sentences...
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with floated quantifiers and those with quantified NPs are similar in both right and left spreadings, as shown in Table 30:

<Table 30>  Error rates in percentages and p-values between the constructions with a floated quantifier and those with a quantifying noun phrase from Experiment II

<table>
<thead>
<tr>
<th>Variations &amp; the sentences involved in brackets</th>
<th>Right Spreading (28,29,30) vs. (1,2,3)</th>
<th>Left Spreading (31,32,33) vs. (4,5,6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floated Q vs. Q-NP</td>
<td>43/38 p=0.74</td>
<td>82/71 p=0.23</td>
</tr>
</tbody>
</table>

That is, Korean children did not make a big difference in their judgement of sentences where there was a change in the position of universal quantifiers. Whether the quantifiers are floated or modifying the noun phrase in front of it, the children still give the same exhaustive interpretation to them, quantifying both arguments in the sentence.

In conclusion, the majority of Korean children involved in this experiment showed a high rate of quantifier spreading both ways, right and left, in all types of structure. The overall average rate of spreading is 58% (393/677): 48% of right spreading (cf. sentences 1,2,3,7,8,9,20,21,22); and 71% of left spreading (cf. 4,5,6,11,12,13,23,24,25). A very highly significant difference was found between right and left spreadings in the case of transitive constructions (p<.001): the children involved in this task made much higher errors in the case of left spreading than in the case of right spreading, 67% errors for left and 40% for right. However, in the case of intransitive constructions no significant difference was found between the right and left spreadings (p=.20): the children made high errors in both cases, 66% errors for right and 78% for left. That is, the children made more errors with intransitive constructions than with transitive constructions, and among transitive constructions, they made more errors with left spreading than with right spreading.
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No significant difference between the universal quantifiers, *modun* (every), *kakkak-uy* (each) or *modun* NP-*tul* (all), was found in this experiment: 62% (174/281) spreading errors in the sentences with *modun* (every); 58% (173/299) in the sentences with *kakkak-uy* (each); and 62% (179/288) in the sentences with *modun* NP-*tul* (all). The change of universal quantifiers in the same position of the sentence did not have any effect on children's interpretation with regard to universal quantification.

The substitution of a singular NP with plural NPs or *the*+NPs in the test sentences shows a slight difference, but not significantly, between them. The first comparison was made between Group 1 (sentences 1, 2 and 3) and Group 2 (sentences 7, 8 and 9). 38% spreading errors were found in the former and 41% in the latter, with p=.70. The second comparison was made between Group 4 (4,5 and 6), Group 5 (11, 12 and 13) and Group 6 (16, 17 and 18). The variation between the groups is that the subject position is filled with a singular NP (Group 4), plural NP (Group 5) or *ku+NPpl* (Group 6). 70% errors were found in the case of Group 4; 64% errors in the case of Group 5; and 64% errors in the case of Group 6 (p=.38).

In contrast to the claims of previous research, the children still showed an average 52% of non-adult responses, spreading errors, in sentences with bare plurals without a quantifier. Compared with the sentences with universal quantifiers, no significant difference was found between them: 52% errors with bare plurals; and 40% with universal quantifiers (p=.34). The children were as concerned about the honeypot left out or being held by the other agent as they were with the sentences with universal quantifiers. They still gave symmetrical and exhaustive interpretations to bare plural sentences.

More than half of the children involved in this task, 58%, also gave symmetrical and exhaustive interpretations to *the*+NPs. They interpreted the *babies* as *all the babies* in the sentence "Are the babies behind a mummy elephant?" and insisted that the sentence is true only when every baby is behind a mummy elephant.
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The results we discussed above are summarized in the following Tables:

<table>
<thead>
<tr>
<th>Table 31</th>
<th>Spreading rates: right/left spreading</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>right</td>
</tr>
<tr>
<td></td>
<td>48%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 32</th>
<th>Spreading rates of each lexical item</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>every</td>
</tr>
<tr>
<td></td>
<td>62%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 33</th>
<th>Spreading rates: transitive/intransitive+PP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>transitive</td>
</tr>
<tr>
<td></td>
<td>54%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 34</th>
<th>Spreading rates: quantifiers and a singular NP/plurals/the+NPs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Q - a singular noun</td>
</tr>
<tr>
<td></td>
<td>54%</td>
</tr>
</tbody>
</table>
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General Discussion

The present experiments provide evidence that the phenomenon of quantifier spreading is consistently observed in the age group from four to seven in both English and Korean children. Overall, English children made 68% spreading errors, and Korean children made 58% errors. As discussed earlier, previous research has reported that this phenomenon occurs in children acquiring French (Inhelder & Piaget (1958; 1964)), English (several studies such as Donaldson & Lloyd (1974) and Philip (1995)), Dutch (Philip & Verrips (1994)), Chinese (Chien & Wexler (1989) and Lee (1991)), Japanese (Philip (1995)), Catalan (Philip (1995)), etc., and now from the present experiment children acquiring Korean are added to give crosslinguistic, perhaps universal, evidence of the existence of quantifier spreading in language acquisition.

The spreading errors were found consistently in both Experiments I (English) and II (Korean), irrespective of different universal quantifiers (every/modun; each/kakkak-uy; and all/modun NP-tul), different sex (boy and girl), the session (1st
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and 2nd) or the four different picture sets: Bear-Honeypot; Caterpillar-Ladybird; Train-Coach; and Baby-Mummy Elephant. The details of the results in each category are shown in Tables 1, 2, 3 and 4:

<Table 1> Overall error rates and p-values between the universal quantifiers

<table>
<thead>
<tr>
<th>Quantifier Type</th>
<th>Experiment I (English)</th>
<th>Experiment II (Korean)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Error Rate (%)</td>
<td>p-value</td>
</tr>
<tr>
<td>every/modun</td>
<td>70</td>
<td>0.94</td>
</tr>
<tr>
<td>each/kakkak-uy</td>
<td>71</td>
<td></td>
</tr>
<tr>
<td>all/modun NP-tul</td>
<td>70</td>
<td></td>
</tr>
</tbody>
</table>

Neither English nor Korean children showed a significant difference among the individual universal quantifiers, every (modun)/each (kakkak-uy)/all (modun NP-tul), in their comprehension in the various contexts. In Experiment I, 70% errors were made in the case of every; 71% in the case of each; and 70% in the case of all, with p=0.94. In Experiment II, 62% errors were made in the case of modun; 58% in the case of kakkak-uy; and 62% in the case of modun NP-tul, with p=0.48. The syntactic and semantic differences between the quantifiers described by Vendler (1967) had no apparent effect on children's interpretation of universal quantification. Drozd & Philip (1992) also found that there was no significant difference between children's interpretation of all and every as symmetrical operators. The individual data for the quantifiers every (modun), each (kakkak-uy) and all (modun NP-tul) are shown in the Appendix (A4 and A5).

<Table 2> Overall correct/incorrect responses between the different sexes

<table>
<thead>
<tr>
<th>Sex</th>
<th>Experiment I (English)</th>
<th>Experiment II (Korean)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Correct</td>
<td>Incorrect</td>
</tr>
<tr>
<td>Boy</td>
<td>61</td>
<td>39</td>
</tr>
<tr>
<td>Girl</td>
<td>64</td>
<td>36</td>
</tr>
</tbody>
</table>
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<Table 3> Overall correct/incorrect responses between the 1st and 2nd sessions

<table>
<thead>
<tr>
<th>Session</th>
<th>Experiment I (English)</th>
<th>Experiment II (Korean)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Correct</td>
<td>Incorrect</td>
</tr>
<tr>
<td>1st</td>
<td>63</td>
<td>37</td>
</tr>
<tr>
<td>2nd</td>
<td>63</td>
<td>37</td>
</tr>
</tbody>
</table>

Each child appeared in two separate sessions which were carried out with an interval of around one week between them, and their interpretation of quantifiers was consistent through the 1st and 2nd sessions, as shown in Table 3.

<Table 4> Overall correct/incorrect responses between four different picture sets

<table>
<thead>
<tr>
<th>Picture Set</th>
<th>Experiment I (English)</th>
<th>Experiment II (Korean)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Correct</td>
<td>Incorrect</td>
</tr>
<tr>
<td>Bear-Honeypot</td>
<td>66</td>
<td>34</td>
</tr>
<tr>
<td>Caterpillar-Ladybird</td>
<td>62</td>
<td>38</td>
</tr>
<tr>
<td>Train-Coach</td>
<td>62</td>
<td>38</td>
</tr>
<tr>
<td>Baby-Mummy Elephant</td>
<td>62</td>
<td>38</td>
</tr>
</tbody>
</table>

Children's interpretation of quantifiers was not affected by the use of different pictures and words, as shown in Table 4.

Another general finding from the current experiments is that in the case where the right answer was "no", that is, in the case of pictures which did not correspond to the stimulus sentence, the majority of children responded correctly, giving the negative response "no". In Experiment I (English), in 1,481 trials, 1,223 responses (83%) were "no" and only 258 (17%) "yes". The use of "false pictures" induces clear negative responses. On the other hand, when the right answer was "yes", i.e. in the case of pictures which agree with the test sentence, in 1,130 trials, only 385 responses (34%) were correctly answered, that is, "yes", and the rest 745 (66%) gave the wrong answer "no", as shown in Table 5:
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<Table 5> Experiment I (English): rates of children's responses based on the right answer "yes" and "no" (Unit: %)

<table>
<thead>
<tr>
<th>Child response Right answer</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>34 (385/1130)</td>
<td>66 (745/1130)</td>
</tr>
<tr>
<td>No</td>
<td>17 (258/1481)</td>
<td>83 (1223/1481)</td>
</tr>
</tbody>
</table>

The shaded column in Table 5 represents evidence of spreading errors by children.

Korean children also gave many "no" responses in the contexts which agree with the test sentences, even though the figure is a bit less than in the case of English children. 59%, 761 out of 1287 trials, were the negative response "no" to stimulus sentences which yield "yes" as the right answer, and 41% were the right positive response "yes" in the same situation. On the other hand, the Korean children gave 67%, 1215 out of 1806 trials, correct answer for the contexts which yield the negative response "no" as the right answer, and the remaining 33% still gave the wrong answer "yes". This figure 33% is evidence of underexhaustive search in the sense of Freeman & Stedmon (1982; 1986). The details of children's responses based on the right answer "yes" and "no" are shown in Table 6:

<Table 6> Experiment II (Korean): rates of children's responses based on the right answer "yes" and "no" (Unit: %)

<table>
<thead>
<tr>
<th>Child response Right answer</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>41 (526/1287)</td>
<td>59 (761/1287)</td>
</tr>
<tr>
<td>No</td>
<td>33 (591/1806)</td>
<td>67 (1215/1806)</td>
</tr>
</tbody>
</table>

From this reaction by the children, we can assume that when there is an odd entity in the context, that is, when the symmetrical one-to-one relationship between arguments and objects in the domain is not satisfied, children easily respond in the negative without thinking further. If we consider the six control contexts used in the experiments, all of them include one or more odd entities. Context 1 has two odd entities: one remaining...
honeypot and a different agent; Context 2 has one odd entity: one of the objects is being related to a different agent; for Context 3, one of the agents has all the objects and the other agents have nothing and there is a different agent as well; for Context 4, one of the agents is isolated; for Context 5, one of the agents is engaged with a different object; and Context 6 is as in Context 3 plus one remaining item in addition. Children's logical thinking could be affected by the odd entities in the context and they could respond in the negative easily. Therefore, it is assumed that context affects children's logical thinking about an input sentence containing a quantifying item. The presence of the odd entity is somehow salient in their comprehension.

The fact that both English and Korean children show significantly different behaviour between the contexts which correspond to the stimulus sentences and those which do not indicates that they are sensitive to the task, in other words, they know the rule of quantification in general. The figures for the negative responses in the case of the right answer being "yes", that is, 66% from Experiment I in Table 5 and 59% from Experiment 2 in Table 6, are the main concern of the present study, because they are the paradigm examples of quantifier spreading.

On the basis of this result, just those contexts among the six control contexts which produce the positive response "yes" as a right answer to the relevant test sentences are considered the core concern of the present study. Each group of the test sentences and their relevant contexts to be considered are summarized in Table 7:
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Table 7

List of each group of test sentences according to the variations and the relevant contexts considered. (All the right answers to the sentences with regard to the contexts are "yes."

<table>
<thead>
<tr>
<th>Group (Variables)</th>
<th>Serial no. of the test sentences</th>
<th>Contexts</th>
</tr>
</thead>
</table>
| 1 (RT)            | 1. Is every bear holding a honeypot?  
|                   | 2. Is each bear holding a honeypot?  
|                   | 3. Are all the bears holding a honeypot? | 1, 2    |
| 2 (RTP)           | 7. Is every bear holding honeypots?  
|                   | 8. Is each bear holding honeypots?  
|                   | 9. Are all the bears holding honeypots? | 1, 2    |
| 3 (RINT)          | 20. Is every ladybird on a caterpillar? 
|                   | 21. Is each ladybird on a caterpillar? 
|                   | 22. Are all the ladybirds on a caterpillar? | 3, 4, 5 |
| 4 (LT)            | 4. Is a bear holding every honeypot?  
|                   | 5. Is a bear holding each honeypot?  
|                   | 6. Is a bear holding all the honeypots? | 3, 4, 5 |
| 5 (LTP)           | 11. Are bears holding every honeypot? 
|                   | 12. Are bears holding each honeypot? 
|                   | 13. Are bears holding all the honeypots? | 4, 5    |
| 6 (LTthe)         | 16. Are the bears holding every honeypot? 
|                   | 17. Are the bears holding each honeypot? 
|                   | 18. Are the bears holding all the honeypots? | 4, 5    |
| 7 (LINT)          | 23. Is there a baby behind every mummy elephant? 
|                   | 24. Is there a baby behind each mummy elephant? 
|                   | 25. Is there a baby behind all the mummy elephants? | 1, 2    |
| 8 (Bare Pls)      | 10. Are bears holding a honeypot?  
|                   | 14. Are bears holding honeypots?  | 1, 2, 4, 5 |
| 9 (the+NPs)       | 15. Are the bears holding a honeypot? 
|                   | 19. Are the bears holding honeypots? | 1, 2    |
| 10 (the+NPs INT)  | 26. Are the babies behind a mummy elephant? 
|                   | 27. Are the babies behind mummy elephants? | 3, 4, 5 |

Further, based on the examples where no significant differences were found between the three quantifiers, as shown in Table 1, and between the contexts which yield the positive response "yes" as their right answer listed in the column of Contexts in Table 7, the variations are collapsed here to arrive at the main concern of the study. For example, the individual children's responses to the stimulus sentences 1, 2 and 3 in Contexts 1 and 2 are combined to give conflated judgement for the case of right spreading.

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Concentrating on the main concern, significant difference in the errors was found in both Experiments I (English) and II (Korean) between some of the variations controlled for: for example, the position of the universal quantifier in the sentence, that is, its placement in subject position (right spreading) vs. in object position (left spreading); and the difference between sentences with a transitive verb vs. those with an intransitive verb and pre/postpositional phrase. The comparison between the categories is shown in Table 8:

<table>
<thead>
<tr>
<th>Variations &amp; the sentences involved in brackets</th>
<th>Experiment I (English)</th>
<th>Experiment II (Korean)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right vs. Left (1,2,3,7,8,9,20,21,22) vs. (4,5,6,11,12,13,23,24,25)</td>
<td>58/80</td>
<td>48/71</td>
</tr>
<tr>
<td>Trans vs. Intrans (1,2,3,4,5,6) vs. (20,21,22,23,24,25)</td>
<td>62/79</td>
<td>54/72</td>
</tr>
</tbody>
</table>

The figures in parentheses refer to the different input sentences. The percentage figures in the table, as mentioned in the previous chapters, are summed figures across children. The details of individual responses are shown in the Appendix (A1 and A2). As shown in Table 8, in both experiments, left spreading errors were found to be significantly higher than right spreading errors: 80%>58% in Experiment I; and 71%>48% in Experiment II. According to the p-values test using 'Binary Logistic Regression', these results are significant at p<.001 in the former and p<.001 in the latter. Significantly higher spreading errors were also found in the case of intransitive constructions than in the case of transitive constructions: 79%>62% in EI and 72%>54% in EII, with p=.002 and p=.004 respectively. More interestingly, the pattern of significant difference between right/left and transitive/intransitive in Experiment I is parallel to that in Experiment II, as shown in Table 9:
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<table>
<thead>
<tr>
<th>Table 9</th>
<th>Log odds: Right vs. Left and Transitive vs. Intransitive in Experiments I and II</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Experiment I (English)</td>
</tr>
<tr>
<td>Right vs. Left</td>
<td>-1.46 (0.24) p&lt;.001</td>
</tr>
<tr>
<td>Trans vs. Intrans</td>
<td>-1.08 (0.35) p=.002</td>
</tr>
</tbody>
</table>

The figures in Table 9 are log odds ratios, from logistic regression analysis, for the right-left and transitive-intransitive comparisons, with their standard errors in brackets. That is, the first (second) row shows the natural log of the ratio of the odds of an error in a right spreading (transitive) case to the odds of an error in a left spreading (intransitive) case. The figures show that left spreading gives more errors than right spreading, so the odds of an error for left are greater than for right, so the ratio of the odds (right/left) is less than 1, so its log is negative. Similarly intransitive gives more errors than transitive so the log odds ratio (trans/intrans) is also negative. The results are not significantly different between the two experiments, as can be seen by comparing the differences with the standard errors: the differences in log odds ratios being -1.46-(-1.87)=0.41 (se 0.35, p=0.24); and -1.08-(-1.13)=0.05 (se 0.52, p=0.92) respectively. ('se' stands for the standard errors of difference calculated.)

The differences between right and left spreading, and between transitive and intransitive sentences are clear from a comparison of the individual children's performance on different stimulus sentences (see the details in the Appendix (A1 and A2)). To specify, in Experiment I, for control group 1 (sentences 1, 2 and 3, the case of right spreading), 16 out of 59 children got all their answers correct and 15 children got all the answers wrong. On the other hand, for control group 4 (sentences 4, 5 and 6, the case of left spreading), only 6 children got all their answers correct and 30 children got all their answers wrong. Similarly, for control group 3 (sentences 20, 21 and 22, the case of right spreading with intransitive verb), 10 children got all their answers right and 31 children got them all wrong, whereas for control group 7 (sentences 23, 24 and 25,
the case of left spreading with intransitive verb), only 1 child got her answer right and 42 children got all their answers wrong. To compare the figures themselves, 16 vs. 6 and 10 vs. 1, or 15 vs. 30 and 31 vs. 42 are big differences. The same phenomenon is also found in Experiment II. For control group 1, 26 out of 62 children got all their answers correct and 13 children got all their answers wrong. On the other hand, for group 4, only 9 children got them all right and 30 children got them all wrong. For group 3, 13 children got them all right and 30 children got them all wrong, whereas for group 7, only 6 children got them all right and 39 children got them all wrong. The numbers of children who got all their answers correct are significantly more in the case of right spreading than in the case of left spreading, and also more in the case of transitive constructions than in the case of intransitive constructions in both experiments.

The preference for left spreading over right spreading has perhaps little to do with left/right linear order, but may be due to the relative ease of detachment from the object rather than from the subject. This is reflected in island effects (universally) where the subject (unlike the object) is typically an island. As was discussed in Chapter 3, Huang's (1982) CED (Condition on Extraction Domains) asserts that adverbial phrases and subject NPs constitute islands for extraction. Further, from Kampen's (1997) data we found that subextractions in child grammar occur only out of direct object DPs and predicative DegPs, not out of subject DPs. (See the sentences (31a,b,c) in p.94.)

The asymmetry between subject DPs and object DPs has been widely discussed in the relevant literature, and this asymmetry might be related to our experimental results, regarding the difference in children's interpretation of quantifiers in subject position and in object position. That is, young children made significantly higher errors in the latter than in the former. An interesting interpretation of this experimental result is that a quantifier in subject position can be easily mis/re-analyzed as being generated separately

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1 The effects of syntactic position on scope have been described by Ioup (1975).
from the subject DP, on a par with adverbial quantifiers (suggested by Ad Neeleman in p.c.), as in (1):

(1) 

As represented in (1), the quantifier *every*, like an adverbial, can be base generated in the top position of the sentence without any need for appeal to movement.

However, contrary to the situation with the attachment of adverbs, I assume that quantifiers in object position cannot be independently generated as those in subject position can be. To have sentential scope, they have to raise to the top of the sentence by movement, as shown in (2):

(2) 

Under this analysis, the experimental results of quantifiers in subject and object positions have to be treated separately. That is, children have to learn two kinds of grammatical fact with regard to universal quantification: (i) they have to learn the status of the quantifier as a functional head of DP so that it has to be positioned inside DP; and (ii) they have to learn the Left-Branch Condition which specifies that movement of a
left-branch element is possible only by pied-piping the entire phrase. Once they learn
the requirement (i) above, right spreading errors would disappear, and then when they
master both requirements (i) and (ii), left spreading errors would disappear. The
present experiments indicate that children in the range of ages four to seven are at the
stage of learning requirement (i) (though the existence of right spreading errors shows
that they have not mastered it completely), but from the evidence of the high rates of left
spreading errors, not both of the requirements (i) and (ii).

Adults' mistakes which have been reported in previous research, for example,
Bucci (1978) and Freeman et al. (1982), can be explained in this framework. They
both used only test sentences with the quantifier all in subject position, not in object
position. Their sentences are repeated here:

(3) Bucci (1978, p.60)
   a. Make a building in which all the yellow blocks are square.
   b. Make a building in which all the square blocks are yellow.

(4) Freeman et al. (1982)
   a. Are all the lids on the saucepans?
   b. Are all the cups on the saucers?

To explain the adults' mistakes on the above sentences, we need to emphasize that both
groups used the quantifier all in subject position. That is, under an analysis like that in
(1), the quantifier all can mistakenly be base-generated at the front of the structure,
outside of DP. Due to the properties of the quantifier all, specifically its adverbial
classification (cf. previous research such as Roeper & Matthei (1974) and Roeper & de
Villiers (1991)), all can have sentential scope to cover both arguments in its domain,
giving comparable results to those of the children. Further, among the quantifiers, all in
particular can be followed by another complex DP structure, for example, 'all the lids,'
'*every the lid(s),' '*each the lid(s),' etc. If the adult errors are due to their interpreting the quantified sentences as though they had the structure in (1), we need to ask why this happens. As adults, they presumably have the appropriate grammatical knowledge to analyze such sentences correctly. However, in this respect, *all* can be more easily detached from the DP where it belongs than the other quantifiers. Here I would like to claim that these adult mistakes are not due solely to grammatical defects, but are partly cognitive in origin, being a function of processing considerations, resulting from the intrinsic (and independent) properties of the quantifier. If adults consider the structure logically, their grammatical knowledge (of DP structure) would cause this kind of error to disappear.

An interesting question arises here: will adults still make similar mistakes on sentences which have the quantifier *all* in object position instead of in subject position? This question is prompted by the fact that quantifiers in subject position can occur outside the DP without movement, whereas those in object position have to move to give rise to the spreading phenomenon. No previous research has paid attention to this case so that no reports have been made. I predict, on the assumption that adults have full grammatical knowledge of quantification and of the possible interpretation of quantifiers, that adults would not make the same errors that they made in sentences with a quantifier in subject position. If this is true, the fact that young children made many spreading errors with quantifiers in object position (as shown by much previous research and also the current experiments) is evidence for a maturational kind of explanation for the quantifier spreading phenomenon. That is, at a stage when the quantifier has to be inside the DP structure as a functional head, young children do not know what its proper status is. Rather, as was discussed in Chapter 3, they treat quantifiers as modifying items which are syntactically freer than a functional head. In addition, they do not have knowledge of the left-branch condition yet, so the left-branch element can be stranded. In contrast, if adults still make similar mistakes, just as they did in the case where quantifiers are in subject position, this can be attributed to
processing considerations which can be explained from a cognitive point of view. I leave the question open for future study.

The detachment of the quantifier from the phrase in object position of the verb (in transitive constructions) is comparable to the detachment of the quantifier from the object of the preposition in intransitive constructions. Both are markedly easier than detachment from the subject. That is perhaps why the children involved in the current experiments showed more spreading errors in structures where quantifiers are in the object position of the verb (e.g. *Is a bear holding every honeypot?*) or of the preposition (e.g. *Is a ladybird on every caterpillar?*) in the intransitive construction, than in the transitive construction where the quantifier is in the subject position (e.g. *Is every bear holding a honeypot?*). That is, the semantic detachment might be influenced by the (universal) island effect of syntactic detachment.

The difference in the current experiments between transitive and intransitive sentences, that is, the finding that significantly higher errors were found in the case of intransitive sentences than the transitive sentences, can also be explained in the framework of general syntactic theory. That is, while the transitive sentences include accusative verbs such as *hold, carry and pull*, the intransitive sentences involve unaccusative verbs, in our case the copular verb *be*. For example, in the sentence *Is there a baby behind every mummy elephant?*, 'a baby behind every mummy elephant' constitutes a small clause and the quantifier *every* is inside the predicate of the small clause, as shown in (5):
It is well known in the literature that an element inside a small clause predicate can be extracted out of it. For example,

(6)  
   a. What do you consider John good at?
   b. Who do you consider John a friend of?

In (6a), what is extracted out of the predicate of small clause, and similarly, in (6b), who is extracted out of it. This kind of extraction from a small clause, whatever the syntactic condition is, is well justified in the relevant literature. If we approach our phenomenon in the light of this analysis, the high number of spreading errors by children which was found in the case of intransitive sentences can be accounted for. That is, the extraction of the quantifier every from inside the predicate of the small clause can be motivated in the same way as the extraction of what and who in (6).

The finding that the children involved in the current experiments showed significantly higher errors in the case of intransitive sentences than in the case of transitive sentences does not support Philip and Aurelio's (1991) finding: no difference was found between right and left spreading, which was reviewed in section 2.5. They found very high rates of spreading errors in both cases: 84% of right spreading and 90% of left spreading. However, they did not use the same constructions to test for directionality effects. They used intransitive sentence (Is every mouse in a cup?) in the case of right spreading and transitive sentence (Is a dog holding every bone?) in the
Chapter Six

case of left spreading. On the evidence of the current study the degree of right/left spreading errors is not comparable because children are sensitive to the structural cue, i.e., transitive vs. intransitive. If I compare the test sentences and contexts used in Philip and Aurelio with those used in the current experiments, their test sentence, *Is every mouse in a cup?*, and the given context in which three mice are in a cup each and there is an extra cup left (see p. 23) are compatible with my sentence *Is every ladybird on a caterpillar?* and Context 4 in which three ladybirds are on a caterpillar each and there is one extra caterpillar alone (see p. 253). 67% spreading errors were found in the current study, which is lower than Philip and Aurelio's result, 84%. On the other hand, their sentence *Is a dog holding every bone?* and the given context in which three dogs are holding a bone each and there is an extra dog without a bone (see the picture in p. 23) are matched with my sentence *Is a bear holding every honeypot?* and Context 4 in which three bears are holding a honeypot each and there is an extra bear without a honeypot (see the picture in p. 109). 84% errors were found in the current study and 90% errors were found in Philip & Aurelio's experiment. Therefore, Philip and Aurelio cannot justifiably assert that no directionality effect is found in children's interpretation of quantifiers, because they did not use the same kind of structural cue for the comparison of right/left spreading.

Most previous research including Freeman et al. (1982), Philip (1995), Crain et al. (1996) and Drozd (1998) stressed that this phenomenon is just limited to the interpretation of sentences with universal quantifiers. That is, they assumed that children respond like adults if the question includes not a universal quantifier but a bare plural NP (e.g. *farmers*) or a definite plural NP (e.g. *the farmers*). However, this claim is found not to be true in my experiments. Children still show high rates of the spreading error with plural NPs and *the+NPs in the same contexts as those of universal quantifiers. The details of the results are shown in Table 10:
As we can see in Table 10, for the constructions with bare plurals, both experiments showed similar rates of spreading errors in comparison to the constructions with universal quantifiers. Overall 53% (80 out of 151 trials) errors were found in Experiment I and 52% (79 out of 151 trials) errors in Experiment II. More than half the responses in both experiments indicated that the bare plural NP is treated just like a phrase containing the universal quantifier _every_ (modun), _each_ (kakkak-uy) or _all_ (modun NP-tul). Comparing the two different constructions using the Binary Logistic Regression, the constructions with bare plurals and those with universal quantifiers (here just the sentences 1, 2, 3, 7, 8 and 9 were considered for the calculation to avoid any other variation), no significant difference was found in the error rates between them in Experiment I: 53% errors for the former and 51% for the latter, with p=0.73. On the other hand, in Experiment II 52% errors were found in the constructions with bare plurals and fewer errors, 39%, were found in those with universal quantifiers, with a significant difference (p=0.002).

The English children interpreted the sentences *Are bears holding a honeypot?* or *Are bears holding honeypots?* as meaning 'Are all the bears holding a honeypot?' or 'Are all the honeypots being held by a bear?', so that they denied the truth of the sentences, for example, in Contexts 1 and 2, showing concern about the remaining honeypot in Context 1 or the honeypot being held by a piglet in Context 2. The Korean plural marker -tul is also treated as a quantifying item by children who interpreted the plural NP, for example, *kom-tul*, in the sentence *Komtul-i kkultong-ul tulgo isseoyo?* as

---

### Table 10

<table>
<thead>
<tr>
<th>Variations &amp; the sentences involved in brackets</th>
<th>Experiment I (English)</th>
<th>Experiment II (Korean)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bare Pls vs. Uqs (10,14) vs. (1,2,3,7,8,9)</td>
<td>53/51</td>
<td>52/39</td>
</tr>
<tr>
<td>The+NPs vs. Uqs (15,19,26,27) vs. (1,2,3,7,8,9,20,21,22)</td>
<td>51/58</td>
<td>52/48</td>
</tr>
</tbody>
</table>
if the noun phrase [kom-tul] had a covert quantifier *modun* (all) in front of the noun *kom* (bear), resulting in [ø kom-tul]. This finding does not agree with Philip's (1995) event quantification hypothesis which predicts that children would make fewer errors on constructions with bare plurals, without universal quantifiers, than on those with universal quantifiers.

In current theory, it is often suggested that every NP needs a determiner. For example, Carlson (1977) focused on the 'generic' use of the bare plural (as in *Dogs bark*) and mentioned that these NP's contain a null determiner. Further, Cartwright (1975) noted a similarity between bare plurals and mass nouns that have no determiner associated with them, and Longobardi (1994) claimed that bare nouns are not really bare, they are embedded in a full-fledged DP structure, with an empty D head. Under this view, we can assume that bare plural constructions have a covert (or zero) quantifier as a determiner. Then, the simplified syntactic representation of the sentence, *Bears are holding a honeypot*, will be as in (7):

(7)

$\text{CP} \rightarrow \text{Spec} \rightarrow C' \rightarrow \text{DP/NP} \rightarrow V \rightarrow \text{DP/NP}$

$\rightarrow D/\text{Mod} \rightarrow \text{NP} \rightarrow \text{NP}$

$\rightarrow \emptyset \rightarrow \text{bears} \rightarrow \text{are holding} \rightarrow \text{a} \rightarrow \text{honeypot}$

In (7) the position of the determiner in the subject DP is filled by a zero (or null) quantifier, ø. This analysis can be supported by the examples which we discussed in the previous section. For example, sentences such as *Tigers are striped* and *Children are noisy* mean that 'tigers in general are striped' and 'most children are noisy' (or 'generally all children are noisy'). So such sentences are said to contain generic (or zero)
quantifiers. Even though the determiners in the above sentences are phonetically empty, they are syntactically and semantically represented, so that the exhaustive reading which general quantifying items show is possible.

Alternatively, Roeper & de Villiers (1991) entertain B. Schein's (p.c.) suggestion which states that 'plural and negation both receive a kind of "concord", the plural spreads from one NP to another just as negation spreads' (p. 249). They assume that plurality can function as an operator, and therefore allow movement so that the operator can be attached to the sentence as a whole initially.

Whichever is right, the experimental finding that young children treat bare plural constructions just like constructions with universal quantifiers supports the essential premises of both analyses of bare plurals discussed above.

For the constructions with the+NPs, both English and Korean children showed spreading error rates similar to those with other quantifying items: 51% for the former and 52% for the latter, as shown in Table 10. The children interpreted the+NPs (or the Korean equivalent ku+NPtul), the bears (ku komtul), in the sentence Are the bears holding a honeypot? (ku komtul-i kkultong-ul tulgo isseoyo?) as meaning 'Are all the bears holding a honeypot?' and also 'Are all the honeypots being held by the bears ?' They gave the exhaustive interpretation to the+NPs and spread the scope of the definite article the to the other argument, for example, a honeypot, in the sentence.

The log odds ratios between the constructions with bare plurals (or the+NPs) and those with universal quantifiers are given in Table 11:

<table>
<thead>
<tr>
<th>Construction</th>
<th>Experiment I (English)</th>
<th>Experiment II (Korean)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bare pls vs. Uqs (10,14) vs. (1,2,3,7,8,9)</td>
<td>-0.09 (0.28) p=.7</td>
<td>0.93 (0.30) p=.002</td>
</tr>
<tr>
<td>The+NPs vs. Uqs (15,19,26,27) vs. (1,2,3,7,8,9,20,21,22)</td>
<td>-0.85 (0.29) p=.003</td>
<td>0.32 (0.30) p=.3</td>
</tr>
</tbody>
</table>
For the comparison between the constructions with bare plurals and those with universal quantifiers, as shown in the first row of Table 11, the difference between Experiments I and II is 1.02 [(0.93)-(0.09)] with a standard error of 0.41, *p*=.01. There is evidence that the effects differ in the two experiments. The difference comes as the result of a lower error rate, 39%, in the case of constructions with a universal quantifier in Experiment II. For the comparison between the constructions with *the+NPs* and those with universal quantifiers, as shown in the second row of Table 11, the difference is 1.17 [(0.32)-(-0.85)] with a standard error of 0.42, *p*=.005. Thus there is an effect in the English experiment but not in the Korean one, and there is a significant difference between the two experiments.

It is often suggested in the relevant literature that the definite article *the* has the property of a universal quantifier. For example, Hawkins (1978) supports this idea by describing the properties of the definite article in detail. He suggests the following examples (p.159):

(8)  
   a. Bring *the wickets* in after the game of cricket.  
   b. I must ask you to move *the sand* from my gateway.

In (8a) the speaker would not be satisfied if the hearer brought him/her only four or five of the six wickets, and in (8b) he/she would not be happy if the hearer only moved part of the sand away. That is, in this situation both speaker and hearer expect that *the wickets* and *the sand* refer to all the six wickets and all the sand respectively. These examples indicate that definite descriptions typically refer to the 'totality' of the object, or to the whole mass, in the relevant shared set, that is, to all the wickets and all the sand.

On the basis of such examples and also the experimental findings from the current research, that is, that children involved in the present experiments showed similar rates of spreading errors in constructions with the definite article *the* to those with universal quantifiers, it seems that the definite article is very similar to a universal
quantifier. One difference between the definite article and the universal quantifier is that the former refers to all the objects within a domain of quantification which is pragmatically delimited on the basis of their existence in a set of objects shared by speaker and hearer, whereas the latter refers to all objects in the absolute sense. Sentences with the definite article therefore assert that the sentence quantified into holds only of all the objects in some pragmatically delimited domain of quantification, and they logically presuppose the existence of such objects in the speaker-hearer's shared set of objects. This property of the definite article to refer to all the objects or all the mass in the pragmatically limited domain of quantification, Hawkins (1978) refers to as 'inclusiveness' (p.161).

Based on his view and the idea of individual quantification discussed in section 3.2.6, we would expect the children's interpretation of plural nouns with the definite article the (or ku in Korean). The definite article refers to all the objects available in the domain of quantification. In one of our examples, for instance, each individual entity (such as three different bears, four different honeypots and a piglet (see the picture of Context 1 in p. 107)) is in the domain of quantification. When the children interpret the sentence with the definite article, for example, Are the bears holding a honeypot?, they try to include all the objects within the domain of quantification, where again the domain of quantification includes all the entities in the visual (picture) and the auditory (test sentence) inputs. These entities are represented in their conceptual representation and when the odd entity is left out, children give a negative response because the definite article, just like universal quantifiers, has the property of 'totality' or 'inclusiveness' as mentioned by Hawkins, so that it covers all the available objects in its scope domain, resulting in children's spreading errors.

In addition, from the result in Experiment II we have seen that Korean children did not make a big difference in their judgement of sentences where there was a change in the position of universal quantifiers. Whether the quantifiers are floated or modify

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2 Though even the domain of a universal quantifier is usually contextually restricted.
the noun phrase in front of them, the children still give the same exhaustive interpretation to them, quantifying both arguments in the sentence. No significant difference was found between the constructions with floated quantifiers and those with quantified NPs. In the case where floated quantifiers quantify the subject NP (the case of right spreading), 43% spreading errors were found. In comparison with the error rate 38% from the sentences 1, 2 and 3 which have the quantified NP, *modun/kakkak-uy/modun kom(tul)*, in the subject position, this figure is higher, but not significantly with p=0.74. Further, in the case where floated quantifiers quantify the object NP (the case of left spreading), a much higher error rate, 82%, was found. Similarly, compared with the error rate 71% from the sentences 4, 5 and 6, the figure 82% is higher than in the case of the quantified NPs, but not significantly, with p=0.23. The pattern of error rates between the sentences with floated quantifiers and those with quantified NPs is similar in both right and left spreadings. (See Table 30 in section 5.9.7 for the comparison.)

Turning to the individual data, let us have a close look at the individual children's performance on all different stimulus sentences. (See the details in the Appendix A.) A particularly interesting result is found in the analysis of the data in terms of the four different age groups. Table 12 shows the details of the four different age groups and error rates in Experiments I and II:

<Table 12> Details of the four different age groups and error rates: Experiment I and (Experiment II shown in parentheses)

<table>
<thead>
<tr>
<th>age group</th>
<th>no. of subjects</th>
<th>mean age (yr;mt)</th>
<th>error rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>9 (15)</td>
<td>4;8 (4;5)</td>
<td>36 (37)</td>
</tr>
<tr>
<td>5</td>
<td>26 (27)</td>
<td>5;6 (5;4)</td>
<td>65 (55)</td>
</tr>
<tr>
<td>6</td>
<td>18 (16)</td>
<td>6;7 (6;3)</td>
<td>74 (77)</td>
</tr>
<tr>
<td>7</td>
<td>6 (4)</td>
<td>7;2 (7;1)</td>
<td>76 (79)</td>
</tr>
</tbody>
</table>

For the four different age groups, as shown in Table 12, the overall error rates from Experiment I are 36% in the four year old group (9 children); 65% in the five year old (26); 74% in the six year old (18); and 76% in the seven year old (6). There are
significant differences between the error rates for the different ages (p=.002), with the evidence for this coming from the difference between the 4-year olds and the rest (no significant differences are found between the rest). The statistical analysis was a one way analysis of variance on the logistically transformed error rates for the 59 children with age as a 4-level factor. Similar differences are also found in Experiment II. The error rates are 37%, 55%, 77% and 79% in the order of the four age groups, 4 (15 children), 5 (27), 6 (16) and 7 (4). The differences are similar to the English data, with an overall test for differences giving p<.001, and now we have significant differences (with p<.05) between the 4-year olds and each of the others, and between the 5 year olds and each of the others (but not between 6 and 7).

As shown in Table 12, the pattern of error rates is basically the same in both experiments, with 4 < 5 < 6&7 in the order of the degree of spreading errors, it is just that the 5 versus 6 comparison is significant for the Korean children, but does not quite reach significance for the English data. What is of interest here is that the older children made more spreading errors than the youngest. If we have a close look at the individual children's data on all the trials given, more interesting results are found: the very high rates of correct responses are made by the youngest 4 and 5 year old children and, in contrast, the lowest rates of correct responses are made by the oldest, 7 year old, children. Let us have a look at the distribution of children in each age group, based on the rate of their correct responses.

<table>
<thead>
<tr>
<th>Rate of correct responses</th>
<th>100-75%</th>
<th>74-50%</th>
<th>49-25%</th>
<th>24-0%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age group</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>4</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>2</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4</td>
<td>10</td>
<td>20</td>
<td>25</td>
</tr>
</tbody>
</table>

Chapter Six
Table 13 shows that 4 children performed markedly better than the others and, more interestingly, they are the younger children at ages around 4 and 5. If we specify each of them here, child no. 42 made 100% correct responses through all the trials (16 correct responses out of 16 trials) and she is 5 years and 3 months old. Child no. 22 made 93% correct responses (14 out of 15). He made only one error in Control Group 4 (the case of left spreading with transitive verb, e.g. *Is a bear holding every honeypot?*) and he is only 4 years and 6 months old. Child no. 5 made 83% correct responses (20 out of 24). She made 3 errors in Control Group 4 and 1 error in Control Group 10 (the+NPs with intransitive, e.g. *Are the babies behind a mummy elephant?*), but performed perfectly on all the other control groups. She is also 4 years and 8 months old. Child no. 6 made the same 83% correct responses (20 out of 24) and she is 5 years and 5 months old. On the other hand, strikingly, the oldest children performed badly, for example, child no. 41 is 7 years and 3 months old and she made only 1 correct response out of 14 trials; child no. 47 is 7 years and 1 month old and she made 3 correct responses out of 20 trials; and child no. 53 is 7 years old and he made 3 correct responses out of 18 trials.

This interesting result is also mirrored in the Korean children’s performance, as shown in Table 14.

<table>
<thead>
<tr>
<th>Rate of correct responses</th>
<th>Age group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100-75%</td>
</tr>
<tr>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
</tr>
</tbody>
</table>

The eleven high scorers over 75% are all 4 or 5 year old children, and all the oldest 6 and 7 year old children made low percentages of correct responses, less than 50%, as
shown in the table. To specify their results individually, child no. 42 made 100% correct responses, 15 out of 15, and she is only 4 years and 4 months old, and the other six 4 year old children got 1 or 2 answers wrong, leading the scores up to around 90% correct responses. Child no. 22 also made 100% correct responses, 20 out of 20, and he is just 5 years old, and the other three 5 year old children made 1 or 2 errors out of the total trials, leading to the scores 95% or 92% of correct responses. That is, the youngest 11 children performed nearly perfectly in the Korean experiment, just as in the English experiment. Here again, the oldest four 7 year old children performed badly: child no. 12 got all the responses wrong, 0 out of 16 (0%); child no. 20 got 2 right out of 21 (10%); child no. 4 got 4 right out of 23 (17%); and child no. 8 got 10 right out of 24 (42%).

This distribution of the numbers of children based on the rate of correct responses between each age group, represented in Tables 13 and 14, shows the classic pattern of the U-shaped developmental curve, which has been demonstrated as a general phenomenon in acquisition (or in maturation) in the relevant literature on child development. This finding is reminiscent, for example, of Karmiloff-Smith’s (1992) Representational Redescription Hypothesis. A typical example of this hypothesis is provided by her results for the behaviour of young children, aged from 4 to 9, attempting to balance blocks of different shapes and sizes on a metal support. In her experiments some blocks balanced at their geometric centre; others, which looked identical, had been filled with lead at one end and so balanced off-centre, and yet others had a weight visibly glued at one end so that they balanced off-centre as well. The youngest 4-year-olds performed far more successfully than 6- or 7-year olds in the experiments. While it is not obvious that her explanation of this phenomenon (in terms of the transition from an implicit to an explicit form of representation) generalizes to the syntactic domain, (for discussion, see Smith, 1994), some version of her account may well be relevant in the current ‘mixed’ domain where both visual and linguistic stimuli have to be integrated.
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An interesting alternative interpretation of this experimental results can be derived from Grimshaw & Rosen's (1990) argument that knowing a linguistic rule and obeying it have to be distinguished. They challenge the position of previous researchers concerning the acquisition of binding, which holds that young children do not have knowledge of Principle B of the binding theory (cf. Lust (1986) and Wexler & Chien (1985)). Through their own experiment on Principle B and C violations, they demonstrate that children know all aspects of Binding Principle B, the coreference aspects and its variable-binding aspects, that is, children are innately endowed with the knowledge, as also reviewed and argued by Grodzinsky & Reinhart (1993), and argue that experimental results indicating that children do not know the coreference aspects of the standard binding theory are due to performance factors that mask this knowledge. They comment that "children need not obey the binding theory, in order to demonstrate knowledge of the binding theory" (G&R 1990, p.189). Where children's performance differentiates between grammatical and ungrammatical cases, this indicates that they know the rule in question. Their account is compatible with the current experimental findings in which children showed significantly different performance between the contexts which do match to target test sentences (yielding 'yes' as their right answer) and those which do not match to them (yielding 'no' as their right answer). Their performance differentiates between the former and the latter. Further, the youngest children, around the age of 4, and the younger 5 year olds, performed significantly better than the older children. From the results, it can be assumed that children as young as 4 years old have appropriate knowledge of quantification. However, the existence of spreading errors at the ages of 4 and 5 (the rest of the children in the age groups 4 and 5, that is, 30 children except the 4 superior children in Experiment I and 31 children except the 11 superior children in Experiment II) indicates that the relevant syntactic rules have not been completely mastered yet at this stage. Depending on individual children's ability, the error rate can vary. They more or less know the grammatical function of quantifiers as modifiers to quantify the noun phrase, and most of them are in
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the stage of learning (or fixing) the relevant grammatical knowledge, e.g. quantifiers as
functional heads and the Left-Branch Condition, as mentioned earlier. But in addition,
pragmatic factors seem to be operating here. I argue that aspects of the acquisition of
quantification, just like the coreference aspects of Principle B, involve pragmatic
considerations.

It has been reported that pragmatic effects appear late in acquisition, later than
syntactic knowledge. For example, Grodzinsky & Reinhart (1993) report that they
appear around the age of 6. On this view, children can make mistakes on certain tasks,
even though they have the relevant grammatical knowledge, because the mistakes are due
to pragmatic factors. From the evidence of the current experiments, where some
children as young as 4 years old performed perfectly in all different control groups, it
can be assumed that children at the age of 4 can have grammatical knowledge of
quantification, say, the status of a quantifier as a functional head of DP and the Left-
Branch Condition. In contrast, it can be assumed that the experimental results leading to
the poor scores on the tasks, especially by the older 6 and 7 year old children, and also
the fact that they gave many more 'no' responses, are to be attributed to pragmatic
factors. It clearly indicates that children suffer from a processing deficiency. On this
view, the errors made by younger children and the errors made by older children have to
derive from different sources. The former are attributable to a deficiency of grammatical
knowledge, whereas the latter are due to the interference of pragmatic factors, even
though relevant grammatical knowledge is available.

Here I argue that the pragmatic factors are the function of the central systems, as
already discussed in Chapter 3. On the basis of their interpretation of the stimulus
pictures, children take the quantifier to be salient, introducing new information. As a
result they overgeneralise its scope to include objects which, while not mentioned, are
depicted. As for the phenomenon of quantifier spreading, in the process of integrating
conceptual representations and representations produced by the language faculty,
pragmatic (cognitive) influence is stronger than syntactic influence; that is, conceptual
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factors are more strongly acting than grammatical factors. On this view, it is hypothesised that learning in at least three domains is needed for children's development: first, they need to acquire syntactic knowledge; second, they need to master the pragmatic considerations; and finally, they need to learn that pragmatics cannot overrule syntax. The majority of children involved in the current experiments, at the ages of 6 and 7, are in the second phase in which they are struggling with pragmatic misunderstanding. I assume that from the evidence of the current experimental data, children at the age of 4 (at latest 5) have the syntactic knowledge of quantification, but this knowledge is masked by the emergence of pragmatic consideration around the age of 6. Conceptual representations predominate over grammatical knowledge, leading to the spreading errors. Gradually, as soon as they learn the third phase, when their grammatical knowledge becomes sufficiently established to get rid of the overruling pragmatic facts, the phenomenon of quantifier spreading would disappear. The current experiments show that this mastery has not been achieved by 7 years old. A natural question is whether this stage is mastered abruptly at a certain age or gradually over a longer period. I leave this issue for future research, covering age groups older than 7.

Therefore, I argue that the phenomenon of quantifier spreading is neither exclusively cognitive nor exclusively linguistic, but is dependent on contributions from the language faculty and from the central system of the child's mind in the sense of Fodor (1983). That is, a non-linguistic cognitive factor is clearly operative in this phenomenon, and conceptual representations caused by this cognitive factor interact closely with the linguistic representations computed by the language faculty. Then the difference between children's and adults' conceptual representations with universal quantification is attributed to the interplay between their cognitive abilities and their linguistic abilities as these mature.

The visual input, the picture, plays a predominant role in children's comprehension. They are preoccupied with the individual entities available in the picture and find specific items from it, matching one to one between agents and objects, when
they listen to the test sentence. The quantifier, for example, every, in the test sentence is salient enough to provide them with enough information in a mismatching situation to make them answer in the negative without thinking further. Children interpret the salient word every as covering each individual object available in the picture. As was discussed in section 3.2.6, in their conceptual representation the domain of quantification might be the set of objects (or arguments) available in both visual and auditory inputs, so that this phenomenon must be analysed in terms of "individual (or argument) quantification" rather than Philip's (1995) "event quantification". Regarding the sort of representations the children form from the pictures, the entities such as [a bear], [a piglet] or [a honeypot] can be individually shown, but a relationship or an action such as [holding] cannot be shown without showing the individuals involved in that relationship or action. So the entities have some kind of priority over the action. Each of those entities in the picture seems to be treated by the children as having to be put into some sort of thematic relation with another. This individual quantification analysis is supported by the children's spontaneous reaction to the picture. The children involved in the present experiments generally enumerate the individual entities one by one. For example, to the question What can you see here?, they normally answer "a bear, a honeypot, and a piglet, three bears are holding a honeypot, (and pointing to each item and repeating) this bear is holding a honeypot, this bear is holding a honeypot and this bear is holding a honeypot, but this honeypot is not, nobody is holding this honeypot, this piglet is going to get it because he hasn't got it", etc.. This enumeration of each individual entity by children is also found in their responses to the second input, the test question, for example Is every bear holding a honeypot?. After their answers "yes" or "no" (they were asked to answer "yes" or "no" in the introduction of the experiment), children normally enumerate each item again, for example, "this bear, this bear, and this bear are holding a honeypot, but this honeypot is left out and a piglet too" Some children preferred to answer without the definite response of "yes" or "no", just saying "only three, three bears are holding a honeypot and one honeypot has nobody and a piglet has
nothing." When they were asked to answer with "yes" or "no," they responded with "yes, but" and enumerated the items again. From their spontaneous reaction to the picture I got the strong impression of the existence of the exhaustive representation suggested by Brooks & Braine (1996) in children's conceptual representation. They assign an exhaustive representation to a sentence with a universal quantifier so that the quantifier covers all the entities available in its scope in their conceptual representation.

We have seen that the pictures which were used for the visual input, and the lexical item, the quantifier, which was one of the items of the auditory input, both made significant impacts on the phenomenon of quantifier spreading. Pictures, especially odd entities in the picture, were salient to children's imagination so that the pictures play a predominant role over the auditory input, as argued in Chapter 3. Individual entities in the picture are given a conceptual representation prior to the auditory input. On the other hand, the presence of the quantifier from the linguistic (auditory) input is also salient to children because of its intrinsic property, as also discussed in Chapter 3. Here it has to be noted that the two inputs, that is, pictures and test sentences, have to be treated separately, because pictures induce the individual's central cognitive processing via the visual system, whereas test sentences trigger a prior linguistic analysis. In other words, the interpretation of the pictures has to be analysed by reference to cognitive processing, whereas the interpretation of the test sentences has to be analysed first by reference to linguistic processing.

The current experiments, including most of the previous research, for example, Philip & Aurelio (1991), Roeper & de Villiers (1991), Philip (1995), etc., used the same kind of methodology, with pictures for visual input and test sentences for linguistic input. However, they tried to find evidence only for linguistic factors underlying children's interpretation of universal quantifiers, ignoring cognitive factors, even though they used non-linguistic inputs (pictures) in their experiments. A problem arises from the failure to integrate non-linguistic and linguistic aspects to explain the phenomenon. If they try to explain the phenomenon purely from the linguistic point of view, the
experimental methodology has to be changed. They should not use pictures as the input. Rather, the stimulus should be administered to individuals linguistically by telling them the story of the scene, not by depicting it with pictures. If the same kind of spreading error is still observed, then, it can be argued that this spreading phenomenon is exclusively linguistic. As long as pictures are used as visual inputs and children show concern about an unmentioned but pictured object, as observed in the current experiments, the phenomenon has to be analysed from both cognitive and linguistic points of view.

Interestingly, focusing on this fact, Crain et al. (1996), as introduced in section 2.10, carried out two different experiments, using different methodologies. One used the same kind of picture verification task as most previous experiments, including the current ones, and the other used a different methodology, the real acting toy performance, to deliver the story (see the details in p. 39). They found that 14 children, out of 34 children, showed 84% spreading errors in the former, but the same children did not make errors in the latter. On the basis of these results, they argued that the methodology used in the previous research was not appropriate and that spreading errors disappeared when an appropriate methodology was used in the experiment. However, the high rates of correct responses by the children in their second experiment could be accounted for not only because the children who gave the correct answers could recognize the property of the quantifiers, but because they had a clear visual image which could predominate over the auditory input. They also used visual input, but they used toy figures performing actions in real time instead of pictures. The visual input of real actions which clearly described what happened in the story was specific enough for the children to grasp the correct content of the story. The 'real acting' stimulus could provide a more powerful effect than looking-at-pictures to enable children to achieve the correct interpretation for the target test question, because the former provides children with overt clues while the latter depends on the individual's imagination.
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I have been interested in this thesis in finding how immature young children are in their interpretation of quantifiers, compared with adults, and what kind of grammatical knowledge they have at this stage, if it is different from adults'. To compare these, simple sentences need to be considered, because complicated sentences cause different effects, due to different variables (remember that some of the complex sentences, as reported in previous research, occasionally caused problems to some adults). One of my examples, *Is every bear holding a honeypot?*, consists of a simple transitive verb and has a given context in which three bears are holding a honeypot each, one honeypot is left out and there is a piglet alone. None of the adults whom I informally asked to answer 'yes' or 'no' to the question had any problem with it in their interpretation, responding correctly in the affirmative. In contrast, from the present research, 50% of the children involved in the task (10 out of 20 children) made spreading errors (see Table 1 in p.126). Donaldson and Lloyd reported even higher errors: 79% of the children (11 out of 14 children) made spreading errors in their experiment. I am here interested in why more than half of the young children give a negative (incorrect) response in the context while adults give a positive (correct) response. That is, I focus on the difference between them and try to explain the difference in terms of the maturation (or development) of logical reasoning and grammatical knowledge. In this respect, Crain et al's argument that young children have the same kind of grammatical knowledge as adults have with regard to universal quantification is premature.

Given that the children involved in the previous research and also in the current experiments are too young to understand the story itself when only linguistic inputs are used, without the help of pictures or toys performing actions, it is inevitable that we include those kinds of visual input in the experimental methodology for dealing with young subjects. But the important thing is that the non-linguistic (cognitive) inputs must be treated separately from the linguistic inputs and both factors must be counted as equally important for the analysis of the phenomenon. Therefore, I emphasize that the
spreading phenomenon is a function of the mixture of cognitive and linguistic aspects and so it has to be analysed in both ways.

Then, the difference between children and adults with regard to universal quantification can be attributed to the adults' ability to deal with this mixture of cognitive and linguistic variables. Even though children and adults have access to the same cognitive mechanisms, and further, the quantifier might be salient to both of them because of its intrinsic property (i.e. the quantifier as focused element), their interpretation could be different, depending on their grammatical knowledge and their mastery of the principle that cognitive considerations cannot overrule grammatical knowledge. That is, the interpretation of quantification might be effected through close interaction between the conceptual representation and the language faculty, as shown by the arrows in the diagram of mental comprehension in section 3.2.7. The diagram is repeated here for convenience:
If we consider the earlier example, *Is every bear holding a honeypot?*, with a context in which three bears are holding a honeypot each, one honeypot is left out and there is a piglet alone, individual items in the picture inputed by the vision module are represented in the LOT representation (say, LOTv) and the test sentence inputed by the audition module is represented in the other LOT representation (LOTA), and these two representations are integrated, as shown in (9):
In the process of integration of the two inputs, the overlapping items, such as bear, honeypot and the relationship between the two arguments, hold, are matched one-by-one, but the odd entities such as a piglet, the remaining honeypot and also the lexical item, the quantifier every, are left out, and hence salient. In particular, the quantifier can be treated as new information and further, due to its intrinsic property, it can be specially focused and raised to the top of the structure to cover all the evoked entities. In this process, the LOT representations interact closely with the conceptual structure, and the conceptual structure is closely linked to the language faculty. Accordingly, LOT representations are dependent on grammatical knowledge even when these conceptual representations are most affected by the saliency of the quantifier and by the odd entities. Depending on differences in the individual's grammatical knowledge, this predominance of the visual input and also the intrinsic property of the quantifier can have various manifestations. That is, the cognitive factors are triggers of this peculiar behaviour of

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\[^3\] See the other possible conceptual structures for this representation and the detailed discussion in section 3.2.7.
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spreading and the linguistic factors are consolidations of the phenomenon. As far as children's grammatical knowledge is concerned, as discussed earlier, they have to learn both: (i) the status of the quantifier as a functional head selecting its complement, NP or DP, within its own functional category, QP; and (ii) that the left-branch item itself cannot be moved out of its own extended projection. When these two rules are acquired in the process of language development, and children consequently control the bases for both representations through integration, the errors should disappear.

However, from the current experimental data which show that some children as young as 4 years old performed nearly perfectly on all different stimuli, whereas the older children at the ages of 6 and 7 made very high errors, it is strongly suggested that another factor must be operating in this phenomenon. Hence I have argued that pragmatic (cognitive) factors are playing a very important role in children's universal quantification and in consequence their interpretation of quantifiers is interrupted by these, even though they have the relevant grammatical knowledge. Predominance of these factors over grammatical knowledge causes spreading errors in their interpretation. Therefore, children have to learn one more fact: that their conceptual representations cannot be independent of their grammatical knowledge, that is, the former always has to be checked by the latter to master the phenomenon of quantifier spreading. I assume that spreading errors gradually disappear under the influence of two forces: first, the acquisition of grammatical knowledge which requires, for example, a strict restriction with regard to the head-complement relationship within the extended projection; and second, the maturation of children's logical thinking through the emergence of pragmatic considerations. From the evidence of the present experiments, it can be assumed that the grammatical knowledge might be acquired as early as 4, but the ability to deal with the combination of the conceptual representation and the language faculty, that is, full acquisition of these complexities, seems to be delayed until beyond seven years or so.
Conclusion

Throughout the parallel experiments on English and Korean four-to-seven year old children, we have seen that quantifier spreading is a general phenomenon which is found in a certain young age group crosslinguistically, perhaps universally. The occurrence of these errors has been analysed in two different ways, linguistically and cognitively. The experimental data which indicate that children are sensitive to positional and also structural cues of the syntax of quantifiers support a linguistic interpretation of the phenomenon. On the other hand, the results from individual children's data which show different error rates in the performance of four different age groups lead us to consider the function of pragmatic (cognitive) factors in this phenomenon.

For the linguistic analysis, it is first argued that the phenomenon gives rise to island effects, where the subject is typically an island. Specifically, the error rates of children's interpretation of quantifying items are affected by the syntactic position of the quantifiers in a sentence (i.e., directionality to right or left) and also by the syntactic structure (i.e., transitive and intransitive). Both the English and Korean children involved in the present experiments made more errors where the quantifiers were in object position or in adjunct position than in subject position. A highly significant difference was found between the comprehension of the former and the latter, and more interestingly, the pattern of significant differences was found to be
parallel in English and Korean. The children performed consistently better on sentences in which the quantifiers, *every* (*modun*), *each* (*kakkak-uy*) or *all* (*modun NP-tul*), modify the subject NP rather than the object NP, and in transitive constructions rather than in intransitive constructions. The preference for left spreading over right spreading is claimed to be due to the relative ease of detachment of items from the object rather than from the subject. The detachment of the quantifier from the object position of the verb in transitive constructions is compared to the detachment of the quantifier from the object of the preposition in intransitive constructions. Both are markedly easier than detachment from the subject. This is perhaps why the children involved in the current experiments showed more spreading errors in structures where quantifiers are in the object position of the verb or of the preposition in the intransitive construction than where the quantifier is in the subject position of a transitive construction. It is therefore claimed that the semantic detachment might be influenced by the (universal) island effect of syntactic detachment.

One of the main reasons for children's peculiar behaviour with quantification is taken to be their lack of the relevant grammatical knowledge. It is argued that children have to learn two kinds of grammatical fact with regard to universal quantification: (i) they have to learn the status of the quantifier as the functional head of DP, so that it has to be positioned inside DP; and (ii) they have to learn the Left-Branch Condition, which specifies that movement of an element to the left-branch position is possible only by pied-piping the entire phrase. Once they learn requirement (i), right spreading errors should disappear, and then when they master both requirements (i) and (ii), left spreading errors should disappear. On the basis of the current experimental data which show that some children in the range of ages four to five react nearly perfectly to all different stimulus sentences, I assume that children as young as four years old are at the stage of learning the requirements (i) and (ii),
Conclusion

though the existence of errors made by the rest of children in the same age group shows that they have not mastered them completely.

Next, the categorial status of the quantifier in the young children's interpretation (putatively before the acquisition of the two kinds of grammatical knowledge) is considered, focusing on the movement of the quantifier out of its own extended projection to FP. It is claimed that children initially treat quantifiers as modifiers, rather than functional heads, and that the phenomenon of quantifier spreading by children can be attributed to delay in the development of the relevant functional category, i.e., DP. This is therefore naturally related to the debate on language development, specifically to the two main hypotheses of 'continuity' and 'maturation' regarding the (controversial) development of functional categories in child grammar. The delay in the emergence of functional categories in language acquisition has been well discussed in the relevant literature, though generally with regard to a much younger age. According to Radford (1990), the phrasal categories such as NP, VP, AP and PP emerge around 20 months after birth, and the use of function words such as *a, the, this, that*, etc. starts around 24 months of age. Compared to these periods, the proper use (or interpretation) of phrases with a universal quantifier seems to be delayed till much later, around the ages of four or five from the present experimental results. I assume that the delay is attributable to the intrinsic property of quantifiers, that they are inherently focus marked, and that this property influences children's interpretation. Moreover, the functional category DP seems not to be completely developed at this stage, and thus the D-element can be freely detached from the category which it belongs to and raised to the highest position to range over all the arguments available in the sentence, and, by extension, in the picture.

In this respect, an analysis in terms of individual quantification is superior to Philip's (1995) event quantification analysis. The reason is that individual entities have some kind of priority over the event (or action), that is, in the formation of the
Conclusion

children's representations, the entities such as 'bear,' or 'honeypot' can be individually shown, but a relationship or an action such as 'holding,' 'carrying,' or 'pulling' cannot be shown without showing the individuals involved in the event. Further the children's concern with the third element which is not a part of the whole event, which was observed repeatedly in the present experiments, can support the argument for individual quantification.

At the same time, it is argued that pragmatic facts have to be considered as another main reason for this behaviour. The children involved in the present experiments made very high correct responses to those contexts which did not correspond to the stimulus sentences, so that the right answer was the negative "no", whereas they made more than 50% errors in the contexts which did agree with the target sentences so that the right answer was the positive "yes". Focusing on the fact that all the pictures used as a visual input include one or two odd entities, children can easily be misguided by the presence of this odd entity so that the negative answer "no" is more easily produced than the positive answer "yes", without further thinking. In addition, the salience of the quantifier from the second, linguistic, input impacts on their interpretation. The experimental finding that younger children at the ages of 4 and 5 performed significantly better than the older children at the ages of 6 and 7 gives rise to the classic pattern of a U-shaped developmental curve. On this view, the errors made by the older children arise not only because of their lack of grammatical knowledge, rather, the occurrence of the errors has to be attributed to the interference of pragmatic (cognitive) factors coming to predominate over their existing grammatical knowledge.

I have tried to explain the nature of these pragmatic factors in terms of the function of the central system, suggesting a modified form of Smith & Tsimpli's (1995) version of Fodor's (1983) modularity hypothesis. Conceptual representations of two kinds are in competition with each other and they are integrated into a neutral LOT representation at some point. In the process of this integration, the
representations from the visual input predominate over those from the auditory input, though the quantifier (treated as new information provided by the latter) is salient in the final representations. When visual conceptual representations predominate over purely linguistic ones, spreading errors occur. By contrast, when the relevant grammatical knowledge has developed sufficiently to counteract the conceptual representations, this peculiar behaviour by children should disappear. Assuming that pragmatic considerations come into effect later than syntactic knowledge, say, around the age of six, the error rates characteristic of the younger group and the older group have to be different in origin. The errors of the former have to be explained in terms of their lack of the relevant grammatical knowledge, whereas those of the latter are due to the emergence of pragmatic considerations subverting existing grammatical knowledge.

Therefore, I argue that the phenomenon of quantifier spreading has to be analysed from both linguistic and cognitive points of view. On the assumption that our logical reasoning, like our grammatical knowledge, develops gradually (matures), the fact that spreading errors are commoner in the young age groups, from 4- to 7-year-olds approximately, and then gradually disappear is explicable in terms of the maturation of both the linguistic system and the cognitive system. The interpretation of quantification is effected through close interaction between the central system and the language faculty. First, children need to learn the relevant grammatical knowledge. However, even when they have acquired this, the emergence of pragmatic factors (the competition of conceptual representations in my terms) at a somewhat later stage in development masks the knowledge. From the current experimental data, two of the 4-year-old children who performed remarkably well on all the different tasks might have had the relevant grammatical knowledge of quantification, but they seemed not to manifest the interference of pragmatic factors. On the other hand, the high rate of spreading errors by 6- and 7-year-old children indicates that they suffer from this interference. Therefore, to master the
**Conclusion**

phenomenon, they have to learn one more fact: that pragmatics cannot overrule syntactic knowledge. From the current experimental results, this mastery seems not to develop until 7 years or so.

In general, the disagreement in the literature on how to explain children's quantifier spreading can be attributed to a failure to integrate linguistic and non-linguistic (cognitive) aspects of the phenomenon. The current study is a step towards such integration.
Appendix

A. Experiments I (English) and II (Korean): Individual children’s data on all different stimulus sentences

B. The six different contexts for the main sets: caterpillar-ladybird; train-coach; and baby-mummy elephant

C. Examples of distracting sentences and the matching pictures

D. Samples of English and Korean test sets
Appendix

A. Experiments I (English) and II (Korean): Individual children's data on all different stimulus sentences

Rows represent the numbers of each child's correct responses out of the total trials shown in brackets on each control group, and columns distinguish each different control group of test sentences:

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<tr>
<th>Group</th>
<th>Test Sentences</th>
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<tr>
<td>1</td>
<td>1, 2, 3 (right spreading/transitive)</td>
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<td>7, 8, 9 (right spreading/transitive/plurals)</td>
</tr>
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<td>20, 21, 22 (right spreading/intransitive)</td>
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<td>11</td>
<td>(only in E II) 28, 29, 30 (floated quantifiers quantifying subject NP)</td>
</tr>
<tr>
<td>12</td>
<td>(only in E II) 31, 32, 33 (floated quantifiers quantifying object NP)</td>
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Based on the examples where no significant differences were found between the three quantifiers every (modun), each (kakkak-uy) and all (modun NP-tul), and further between the contexts which yield the positive response 'yes' as their right answer, the variations are collapsed here to arrive at the main concern of the study. For example, Column 1 represents the number of individual children's correct responses out of the total opportunities given, which are shown in bracket, in the case of the [every (modun)/each (kakkak-uy)/all (modun NP-tul) - a noun] type in Contexts 1 and 2.
A1. Experiment I: 59 English Children

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<td>NONE</td>
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</tr>
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</tr>
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</tr>
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<td>0(2)</td>
<td>0(2)</td>
<td>1(3)</td>
<td>0(3)</td>
<td>1(2)</td>
<td>0(1)</td>
<td>4(19)</td>
<td>21%</td>
</tr>
</tbody>
</table>
Shaded columns in Table 1 show the 100% correct responses achieved.

Table 2: Numbers of children who made all their responses right to each control group (in the first row) and numbers of children who made all their responses wrong to each control group (in the second row).
### A2. Experiment II: 62 Korean Children

<Table 3> Rows: child  Columns: control group (test sentences)  Figures: correct responses (out of total trials given)

<table>
<thead>
<tr>
<th>GROUP/CHILD</th>
<th>1 (1,2,3)</th>
<th>2 (7,8,9)</th>
<th>3 (20,21,22)</th>
<th>4 (21,22,23)</th>
<th>5 (11,12,13)</th>
<th>6 (16,17,18)</th>
<th>7 (23,24,25)</th>
<th>8 (10,14)</th>
<th>9 (15,19)</th>
<th>10 (26,27)</th>
<th>11 (28,29,30)</th>
<th>12 (31,32,33)</th>
<th>Total</th>
<th>Age</th>
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<td>1 3(3)</td>
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<td>1(2)</td>
<td>1(3)</td>
<td>1(1)</td>
<td>0(1)</td>
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<td>3(6)</td>
<td>NONE</td>
<td>12(23)</td>
<td>52%</td>
<td>4.6</td>
</tr>
<tr>
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<td>1(2)</td>
<td>2(3)</td>
<td>1(1)</td>
<td>1(1)</td>
<td>0(2)</td>
<td>1(3)</td>
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<td>61%</td>
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<td>0(2)</td>
<td>0(3)</td>
<td>0(1)</td>
<td>0(1)</td>
<td>0(2)</td>
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<td>0(2)</td>
<td>0(3)</td>
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<td>NONE</td>
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<td>17%</td>
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<td>3(5)</td>
<td>3(5)</td>
<td>3(3)</td>
<td>2(2)</td>
<td>1(1)</td>
<td>2(2)</td>
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<td>3(3)</td>
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<td>1(1)</td>
<td>2(2)</td>
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<tr>
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<td>0(2)</td>
<td>0(1)</td>
<td>0(2)</td>
<td>NONE</td>
<td>1(1)</td>
<td>NONE</td>
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<tr>
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<td>2(3)</td>
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<td>0(2)</td>
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<td>1(2)</td>
<td>0(1)</td>
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<td>0(3)</td>
<td>0(2)</td>
<td>0(2)</td>
<td>0(2)</td>
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<td>0(1)</td>
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<td>5.5</td>
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<tr>
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<td>0(2)</td>
<td>0(3)</td>
<td>0(2)</td>
<td>0(2)</td>
<td>0(2)</td>
<td>1(1)</td>
<td>0(1)</td>
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<td>1(16)</td>
<td>0%</td>
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<td>1(2)</td>
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<td>1(4)</td>
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<td>0(3)</td>
<td>2(4)</td>
<td>0(2)</td>
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<td>NONE</td>
<td>9(24)</td>
<td>38%</td>
<td>6.0</td>
</tr>
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<td>0(1)</td>
<td>1(1)</td>
<td>0(1)</td>
<td>0(3)</td>
<td>1(2)</td>
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<td>NONE</td>
<td>6(24)</td>
<td>25%</td>
<td>6.8</td>
</tr>
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<td>5(6)</td>
<td>1(1)</td>
<td>3(5)</td>
<td>2(2)</td>
<td>1(1)</td>
<td>1(2)</td>
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<td>81%</td>
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<td>0(2)</td>
<td>0(1)</td>
<td>1(2)</td>
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<td>7(21)</td>
<td>33%</td>
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<td>1(2)</td>
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Table 4: Numbers of children who made all their responses right to each control group (in the first row) and numbers of children who made all their responses wrong to each control group (in the second row)

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<th>4(4,5,6)</th>
<th>5(11,12,13)</th>
<th>6(16,17,18)</th>
<th>7(23,24,25)</th>
<th>8(10,14)</th>
<th>9(15,19)</th>
<th>10(26,27)</th>
<th>11(28,29,30)</th>
<th>12(31,32,33)</th>
<th>Total</th>
</tr>
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<td>26</td>
<td>15</td>
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<td>9</td>
<td>18</td>
<td>16</td>
<td>6</td>
<td>17</td>
<td>20</td>
<td>10</td>
<td>5</td>
<td>1</td>
<td>156</td>
</tr>
<tr>
<td>All wrong</td>
<td>13</td>
<td>7</td>
<td>30</td>
<td>30</td>
<td>36</td>
<td>31</td>
<td>39</td>
<td>19</td>
<td>18</td>
<td>22</td>
<td>1</td>
<td>9</td>
<td>255</td>
</tr>
</tbody>
</table>
A3. The pattern of the correct responses between English and Korean groups on different stimulus sentence groups

Overall, English and Korean children showed a similar pattern in their performance on the stimulus sentences. However, Korean children made fewer errors in the case of the sentences in Group 1 than in the other cases: they made 38% errors on this task, whereas English children made 52% errors. Further, if we compare the number of children who got all their responses right in the task, 26 Korean children got them all right, whereas 16 English children got them all right. The former group clearly performed better than the latter in this task. This difference might be explicable in terms of the development of their grammatical knowledge about QP. Thus Korean children who performed well on this task seem to have more advanced grammatical knowledge than English children do about the status of quantifiers as functional heads, that is, Q as a head which selects NP as its complement within its own functional projection QP. As shown in the graph, Korean children performed better than English children in all conditions, even though the pattern of the correct responses (or conversely, the error rates) between the groups does not reach statistical significance. Following my analysis in the main chapters of this thesis, I have to assume that Korean children have more advanced grammatical knowledge of quantification than English children in the same age range do; and further that they have more ability to control the pragmatic factors. For detailed discussion of this, see Chapter 6.
## Appendix

### A4. Experiment I: The individual data for the quantifiers: every; each; and all

**Rows:** Child  
**Columns:** 1 = *every* (1, 4, 7, 11, 16, 20, 23) ; 2 = *each* (2, 5, 8, 12, 17, 21, 24) ;  
3 = *all* (3, 6, 9, 13, 18, 22, 25)  
(0 = Incorrect; 1 = Correct)

<table>
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<th></th>
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<th></th>
<th>3</th>
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### A5. Experiment II: The individual data for the quantifiers: modun; kakkak-uy and modun NP - tul

Rows: Child  Columns: 1= modun (1,4,7,11,16,20,23); 2= kakkak-uy (2,5,8,12,17,21,24); 3= modun NP-tul (3,6,9,13,18,22,25)  (0=Incorrect; 1=Correct)

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% 252
B. The six different contexts for the main sets: caterpillar-ladybird; train-coach; and baby-mummy elephant

B1. Caterpillar-ladybird

Context 1

Context 2

Context 3

Context 4

Context 5

Context 6
Appendix

B2.  Train-coach

Context 1  Context 2

Context 3  Context 4

Context 5  Context 6

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B3. Baby-mummy elephant

Context 1

Context 2

Context 3

Context 4

Context 5

Context 6
Appendix

C. Examples of distracting sentences and the matching pictures

C1. Are mice dancing?

C2. Are mice in the hole?

C3. Are horses standing?

C4. Are zebras striped?

C5. How many blue stars are there?

C6. Is every snail sleeping?
### Appendix

#### D. Samples of English and Korean test sets

#### D1. English test set

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### Appendix

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### Appendix

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**D.O.B.:**

**Test Date:**

#### Part 2

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