FOCUS PARTICLES AT SYNTACTIC, SEMANTIC AND PRAGMATIC INFERFACES: THE ACQUISITION OF *ONLY* AND *EVEN* IN ENGLISH

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Abstract

The present study aims to investigate how English-speaking children comprehend sentences with a focus particle such as *only* or *even.*

Experiments 1 and 2 provided novel results regarding how English-speaking children interpret sentences containing *only* in terms of scope assignment and pragmatic inferencing. Children were able to employ discourse information to infer contrast information. However, they made errors by adopting a strong object-focused scope analysis regardless of the syntactic position of *only* (e.g., *Only Red Bear bought a balloon* or *Red Bear bought only a balloon*). For direct experimental investigation into a more detailed picture of children's grammatical restrictions on the scope of *only*, sentences containing *only* preceding two nouns connected by the preposition *about* (e.g., *Toto bought only a book about Mickey Mouse*) or the preposition *to* (e.g., *Toto brought only a book to Mickey Mouse*) were employed. Children were more likely to associate *only* with the second noun (e.g., *Mickey Mouse*) than with the first noun (e.g., *a book*). The results from Experiments 1 and 2 indicate that children have adult-like pragmatic inferencing in computing contrast information but make syntactic errors by identifying the last nouns as focus.

Experiments 3 and 4 explored English-speaking children's construal of sentences containing *even* in terms of pragmatic inferencing, that is, scalar implicature. Overall, the children succeeded in understanding affirmative *even* sentences (e.g., *Even Larry was able to reach the cookie* or *Bear was able to reach only the vanilla cookie*) and negated *even* sentences (e.g., *Even Larry was not able to reach the cookie* or *Bear was not able to reach only the vanilla cookie*) only slightly less than half the time. From a detailed examination of the results, a general picture emerged of two child groups with different capabilities for computing scalar implicature. The first group consistently failed for both sentence types with *even*; the second group consistently succeeded for both sentence types with *even*.

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Chapter 1
Introduction

In human communication, interlocutors share certain assumptions about their language use. One expectation is that speakers will express in a sentence what they want to convey and that hearers will understand their message based on what the sentence encodes. However, certain linguistic devices lead hearers to access information that is not explicitly denoted by a sentence. In order to reach the intended interpretation of the sentence, hearers must make inferences based on pragmatic knowledge or the discourse context (Paterson et al., 2006; Sedivy, 1997). Focus particles, such as the English words *only, also, even*, and so on, trigger and facilitate this process for hearers. These elements are used to indicate that a particular entity or event is to be contrasted with a set of implicit alternatives, which are not expressed in the sentence (Crain et al., 1992, 1994; Paterson et al., 2003).

For example, for a sentence without a focus particle like *John bought a balloon*, a parser constructs a discourse model or a mental representation of a person, an object, a relation, and an event, all of which are made explicit in the sentence (Altmann, 1976; Jacobs, 1983; König, 1991; Rooth, 1992; Garrod & Sanford, 1994; Johnson-Laird, 1983; Paterson et al., 2003). However, with the minor change of introducing a particle such as *only* into the sentence, as in *Only John bought a balloon,* the resulting discourse model involves a more complex representation than for corresponding sentences without the focus particle. The contrast is made between the referent John, identified as a focused set,

and other people who did not buy a balloon, inferred as a set of alternatives with respect to John.

Interpreting structures involving a focus particle requires the integration of information from multiple levels of language including syntax, semantics, and pragmatics (Matsuoka et al., 2006); parsers construe a structural representation in accordance with relevant syntactic constraints to identify focus. Based on the semantic function of focus particles, the built-up structures are combined with discourse context or world knowledge through which parsers are able to compute a set of contextually determined alternatives.

How do children comprehend sentences containing a focus particle for which different linguistic domains and interfaces are relevant for the correct interpretation during sentence comprehension? This dissertation aims to investigate the acquisition and development of syntactic and pragmatic constraints that a focus particle exerts on sentence interpretation. To pursue these goals, my dissertation is devoted to two focus particles, *only* and *even,* that induce different sets of alternatives

The properties and functions of these focus particles have attracted theoretical and experimental attention over the past twenty years. Most psycholinguistic research has employed the contrastive function of *only* to determine whether non-syntactic information can guide the processing of syntactic ambiguities such as those found in reduced relative clauses (Clifton et al., 2000; Liversedge et al., 2002; Ni et al., 1996; Paterson et al., 1999; Sedivy, 2002). However, few studies have focused solely on the role of the focus particle *even.* Only very recently was an online study conducted on how different properties of *only* and *even* are processed in adult sentence comprehension (Filik et al., 2009). This study made empirical contributions by providing definite evidence of

the more complicated nature of *even* compared to *only*, going beyond the intuitive judgments on which theories have largely been based.

Within the theoretical literature, there has been considerable interest in analyzing the syntactic, semantic, and pragmatic properties of *only* and *even* (König, 1991; Gruyter, 2003; Jacobs, 1983; Jackendoff, 1972; Anderson, 1972; Rooth, 1985; Kay, 1990). The intriguing characteristics of the focus particles pose serious challenges for purely formal approaches to interpretation, and raise interesting questions about children's acquisition of the focus particles.

In the past twenty years, the question of how focus particles are acquired by children has inspired a number of experimental studies (Crain et al., 1992, 1994; Paterson et al., 2003; Gualmini et al., 2003; Notley et al., 2009; Höhle et al., 2009). Several studies have found that the comprehension of sentences containing focus particles is difficult for children aged three to six years. Two competing accounts of children's interpretive errors in sentences containing *only* have been advanced in the literature. First, it has been suggested that children make syntactic errors by failing to correctly assign the scope of *only* (Crain et al., 1992, 1994). Second, it has been proposed that children are not able to draw the inference necessary for interpretation due to their non-adult-like pragmatic knowledge (Paterson et al., 2003) or their limited computational resources (Reinhart, 2006). More interestingly, studies have revealed variation in children's performance across tasks (Brooks & Braine, 1983; Crain et al., 1992, 1994; Drozd, 2001; Gualmini et al., 2003; Paterson et al., 2006). Whereas some tasks used in previous studies induced an abnormally high proportion of erroneous responses of a syntactic or pragmatic nature to sentences containing *only* (Crain et al., 1992, 1994; Paterson et al., 2003), others resulted

in a dramatic enhancement of their performance (Gualmini et al., 2003; Notley et al., 2009).

In retrospect, this variation across tasks seems to be due to task demands. As already mentioned, understanding sentences containing a focus particle requires access to shared information between speaker and listener, which can be provided by context or shared world-knowledge (Höhle et al., 2009). Clearly, without contextual support, children, with less pragmatic knowledge than adults, experience greater processing burdens to compute alternative information using their limited pragmatic knowledge (Paterson et al., 2003). This task demand is likely to lead children to diverge from adult grammar. In studies that have reported high error rates, sentences were usually isolated from their contexts in the tasks that were used. Ostensibly, the cause of the high error rate may have been the children's inability to comprehend focus particles. However, the high number of errors could also be attributed to a lack of appropriate discourse context, which highlights the need to create tasks including contexts that can contribute to a reliable picture of children's competence for interpreting focus particles.

My dissertation consists of four experiments that were designed and conducted based on the view that information pertaining to the context of an utterance is important in the comprehension of focus particles. The aim of this dissertation is to revisit how children understand sentences containing the focus particles *only* or *even,* using a methodology that is appropriate for contexts. However, in contrast to the bulk of extensive research on *only*, there are, to my knowledge, no studies of children's acquisition of *even*. This disparity in the quantitative terms and scope of previous studies has led to different purposes for my investigation of *only* and *even*.

Experiments 1 and 2 explore how English-speaking children interpret sentences containing *only* in terms of scope assignment and pragmatic inferencing in natural contexts. These studies have the research orientation of complementing previous findings derived from task demands. The results drawn from them help adjudicate between the two competing accounts described above of children's non-adult-like performance.

Experiments 3 and 4 examine how English-speaking children with the same age span as Experiments 1 and 2 comprehend sentences containing *even*. From the description in theoretical linguistics of the peculiar properties of *even* in grammar, meaning, and usage, it can be inferred that children's acquisition of *even* might be more difficult than *only.* The most distinct characteristic of *even* is its evocation of an ordering of alternatives. The values denoted by this particle are characterized as ranking lower than the value given in a sentence in terms of likelihood related to the event. For example, given a sentence like *Even John got an A+*, *John* is interpreted to be the least likely one to get an A+ among a set of alternatives. These experiments are mainly interested in English-speaking children's construal of sentence containing *even* only in terms of pragmatic inferencing, that is, scalar implicature in natural contexts. My investigation of the acquisition of *even*, alongside my experiments on *only*, contributes to research on the developmental trajectory of children's ability to integrate pragmatic knowledge in order to compute an alternative set.

This dissertation is organized as follows. Chapter 2 reviews the theoretical literature on the syntactic and semantic properties of the focus particles *only* and *even*. Chapter 3 focuses on *only*, beginning with a summary of previous developmental work. I then describe the aim, methodology, and results of Experiment 1, which examines how

children comprehend sentences with *only*. This is followed by a similar description of Experiment 2, designed to investigate the possibility of a syntactic constraint on focus identification in child language. Combining the two experiments, chapter 3 concludes with a general discussion of the acquisition of *only*. In similar fashion, chapter 4 covers the two experiments on *even*. I present Experiment 3, which explores children's understanding of sentences with the scalar focus particle *even* in pre-subject position, and Experiment 4, which concerns *even* in pre-object position. A general discussion on *even,* based on results from Experiments 3 and 4, concludes chapter 4. Chapter 5 comprises a summary and discussion of the findings of all four experiments.

CHAPTER 2

THEORETICAL BACKGROUND OF FOCUS PARTICLES *ONLY* AND *EVEN*

2.1 Syntax of English focus particles *only* and *even*

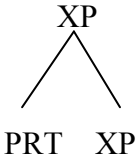
Among the various syntactic analyses of focus particles in the literature, there is a disagreement about how to define their syntactic status. Some theoretical studies seem to indicate that focus particles are a heterogeneous class (König, 1991; Gruyter, 2003). This impression emerges from the observation that prototypical focus particles exhibit their own unique characteristics and that a small number of focus items belonging to the same group behave differently. As a result, some of the experiments to be reviewed below were restricted to only a few particles. Despite the pessimism about the possibility of generalizing them into a single category, English focus particles such as *only*, *even*, *also*, *too*, and so on have a large number of properties in common. They are traditionally grouped into a subclass of adverbs, because of their shared distributional behavior with respect to this positions in which they can occur.

With respect to the distribution of focus particles within an utterance, *only* and *even* manifest an adverb-like behavior (Quirk et al., 1985; König, 1991). As is well known, they occur independently adjacent to various syntactic categories like adjective, adverb, verb, numeral, and sentence as a whole and serve to modify them, as exemplified in (1a-e). However, these focus items, unlike prototypical adverbs, frequently appear with nouns, as illustrated in (1f). In co-occurring with these categories, *only* and *even* usually precede the focused elements with which they are associated.

(1) a. **Adjective**: He is only handsome.
b. **Adverb**: He finished the job only partially.
c. **Verb**: He only slept.
d. **Numeral**: Only <u>two</u> people joined the election.
e. **Sentence**: Only, he wasn't in his room last night.
f. **Noun**: Only God can do it.

Jacobs (1988:95) claims that every focused item in a sentence should be analyzed as the focus of some operator. The constituents with which focus particles are associated are therefore considered to be their focus in the relevant sentences. All types of phrases (NP, VP, AdjP, PP) in addition to adverbs and numerals can be their foci when co-occurring with the particles. The particles are referred to as overt focus inducers.[1] Bayer (1988) describes the configuration of focus particles and focus in more formal terms. In his view, focus particles are a minor functional head. The syntactic domain of a focus particle is a phrase at the XP level. The particle and the XP to which it attaches form one constituent as in (2). Based on this analysis, focus particles are co-constituents of their foci.

(2)



Another striking property that these focus particles exhibit is positional flexibility. Focus particles are not restricted to one particular position in an utterance. They can

[1] Interrogatives or declarative operators are postulated as covert focus inducers (König 1991).

appear in different positions in a sentence, as exemplified in (3). Here, the focus of the sentence is generally on an element to the right of the particle. For instance, the focus of *only*$_1$ in utterance-initial position is restricted to the subject element (*Fred*). For the particle preceding the verb, the focus is either the verb directly following the particle (*showed*) or the VP as a whole (*showed the exhibition to Mary*). The focus of *only*$_3$ is restricted to the direct object (*the exhibition*). In the case of *only*$_4$, the focus is the prepositional phrase to the right of it (*to Mary*).

(3) (Only$_1$**)** Fred (only$_2$**)** showed (only$_3$) the exhibition (only$_4$) to Mary.

In addition to the characteristics related to the focus particle's occurrence within an utterance, focus particles are characterized as being co-related with a focus structure that partitions the sentence into a focused, or highlighted part and a background part (König, 1991). They are treated as formal exponents of focus structure in determining the focus along with prosodic prominence.[1] Consider a case in which prosodic information is needed to identify the focus.

(4) a. What did John wash?
    b. What did John do?
    c. What happened?

(5) John washed the **CAR**.

[1] Along with focus particles and prosodic information, morphological markers, word order, and specific syntactic constructions can also be formal exponents of focus structure in identifying the focused part.

The wh-interrogatives like (4a-c) above are examples of a well-known test to examine conditions on the appropriateness of question-answer pairs in the discourse. In questions like (4a-c), the focus of the sentence can be defined as the part corresponding to the wh-phrase (König, 1991; Ross & Cooper, 1979). In an answer like (5), the focus is typically identified by a pitch accent. The prosodic prominence on *car* marks three different possible focus structures, with focus on the direct object, the VP, or the whole sentence.[1] In other words, the same sentence uttered in exactly the same way—sentence (5), with a pitch accent on *car*—is a possible answer for any of the questions in (4), but the focus structure is different depending on which of the three questions is being answered. As these three possible foci from the answer sentence—direct object, VP, or whole sentence—match with the interrogative words from the question sentences (4a, b, and c respectively), each pair is judged to be acceptable in the discourse. These question-answer pairs demonstrate that prosodic prominence in (5) can be used to identify the focus of a sentence, but not on its own: prosodic realization is not a sufficient means to circumscribe the focus (Rochemont, 1986:19ff) because it can cause focus ambiguity.

Focus particles are also used as a syntactic cue to determine the focus of a sentence. Recall that focus applies to a constituent in the sentence with which the particle is associated. Example (3) above illustrates this: when *only* is in the initial position, the focus is on the subject noun phrase *Fred*. According to König (1991), however, the linear

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[1] According to Reinhart's (2006) interface theory, the focused constituent must bear the nuclear stress of the phrase, which is generally expressed by the intonation center (rising-fall). A sentence typically contains a default prosodic structure, with the last noun phrase of the utterance in focus. For instance, a sentence like *John only bought a banana,* the rightmost direct object bears nuclear stress. The focus of the sentences can be the elements bearing this nuclear stress.

position of the focus particle cannot delimit focus. Consider the following example illustrating König's point.

(6) Fred only showed the exhibition to Mary.

When considering only the serial order of elements in relation to *only*, the preverbal *only* in (6) can take as its focus the adjacent elements: the verb, *showed*, or the verb phrase as a whole, *showed the exhibition to Mary*. However, Bayer points to the fact that a focus particle preceding a verb can take as the focus not only its maximal projections (i.e., VP) but also internal units of its lower level (i.e., verb, direct object, etc.). In other words, these non-adjacent constituents such as direct object or indirect object are possible foci of this sentence. The *only* in this position therefore can cause focus ambiguity if no other means than its syntactic position is employed for focus marking.

(7) a. Fred only **showed** the exhibition to Mary.
b. Fred only **showed the exhibition to Mary**.
c. Fred only showed **the exhibition** to Mary.
d. Fred only showed the exhibition to **Mary**.

The examples (7a-d) show that *only* correlates with the different locations of prosodic prominence (indicated by bold font). Depending on which prosodically prominent constituent is associated with *only*, the focus can be varied in the resultant sentences (Anderson, 1972; Jackendoff, 1972; Ross & Cooper, 1979; Taglicht, 1984; Quirk et al., 1985). The non-adjacent elements with prosodic prominence can be in focus as in (7c) and (7d). However, it is not surprising that in most cases, the focus is still not clearly identified by the correlation of focus particles with prosodic information. In other

words, not just any prosodically accentuated argument can integrate with the focus particle and be the focus. Consider the following sentences.

(8) a. Only **Fred** showed the exhibition to Mary.
b. *Only Fred **showed** the exhibition to Mary.
c. *Only Fred showed **the exhibition** to Mary.
d. *Only Fred showed the exhibition to **Mary**.

In line with the previous analysis that focus can be on the element to the right of *only*, the subject constituent following *only* should be focus of the sentence in (8a). However, when prosodically marked focus is further away than the subject, as in (8b-d), the resulting impossible foci (marked with asterisks) are puzzling. Unlike (7c-d), where non-adjacent constituents (i.e., direct object and indirect object) are in focus by means of prosodic prominence, sentences (8b-d) are not grammatical. This implies an underlying syntactic constraint that influences the determination of focus. This assumption becomes clearer when we observe examples (7) and (8) together.

These examples demonstrate that the identification of the particle's focus is complex because it involves both the syntactic structure and the prosodic structure of the utterance. Although elements non-adjacent to *only* can be selected as the focus of the sentence, as demonstrated by (7c-d), when the focus identification involves prosodic information integrated with the syntactic cue of a focus particle, not just any prosodically accentuated element can be correlated with the particle. Taking into consideration only the serial order of foci with respect to *only* within an utterance, we might not find a way to account for the ungrammaticality of (8b-d).

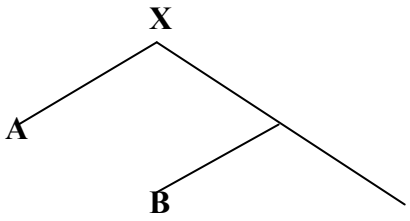
In the past, syntacticians attempted to define the nature of the relation between focus particles and their foci under the assumption that language consists of elements that are ordered in a hierarchical system. Their analysis started from the observation that the semantic properties of sentences are sensitive to the structural relations between nodes in the syntactic tree. The syntactic relations are defined in terms of the concept of 'domain' or 'scope'. The constraints on possible positions of particles relative to their focus are formulated in terms of c-command (Reinhart, 1976). The c-command relation between the focus particle and its constituent is assumed to account for the 'scope' relation between them. The term 'c-command' was first introduced by Reinhart (1976) and the relation has been formalized as follows (Chomsky, 1981; Reinhart, 1976):

(9) **C-command**

Node A c-commands node B if and only if

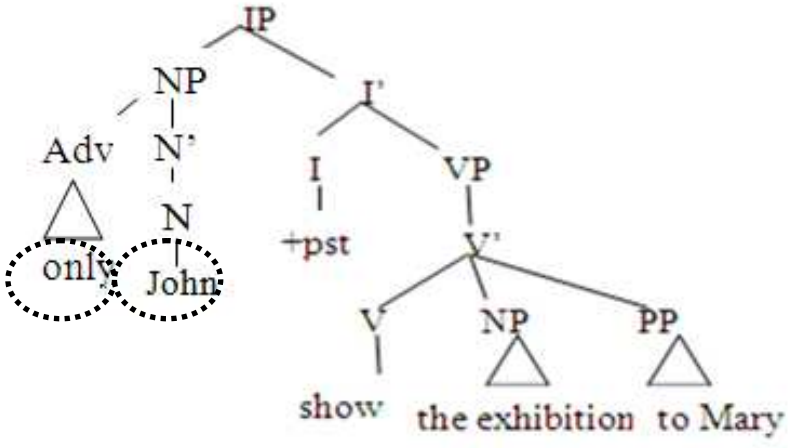
(i) A does not dominate B and B does not dominate A; and

(ii) The first branching node dominating A also dominates B.

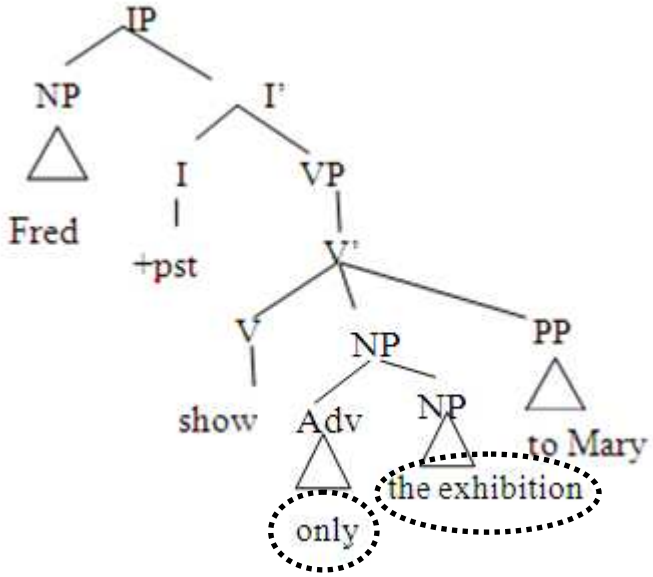


The scope of a focus particle is restricted to those linguistic constituents that it c-commands in the parse tree (Crain et al., 1994; Reinhart, 1983; Jackendoff, 1972; König, 1991), and eligible focus elements in a sentence must be within the scope of the focus particle (Crain et al., 1994; Reinhart, 2006). That is, the interpretation of *only* is subject to the 'c-command constraint', meaning that the scope of *only* is limited to the XPs in its c-

command domain. Following this principle, the focus particle is said to have different scopes in sentences with *only* in pre-subject position, as in figure 2.1, and in pre-object position, as in figure 2.2



<Figure 2.1. Pre-subject *only*>

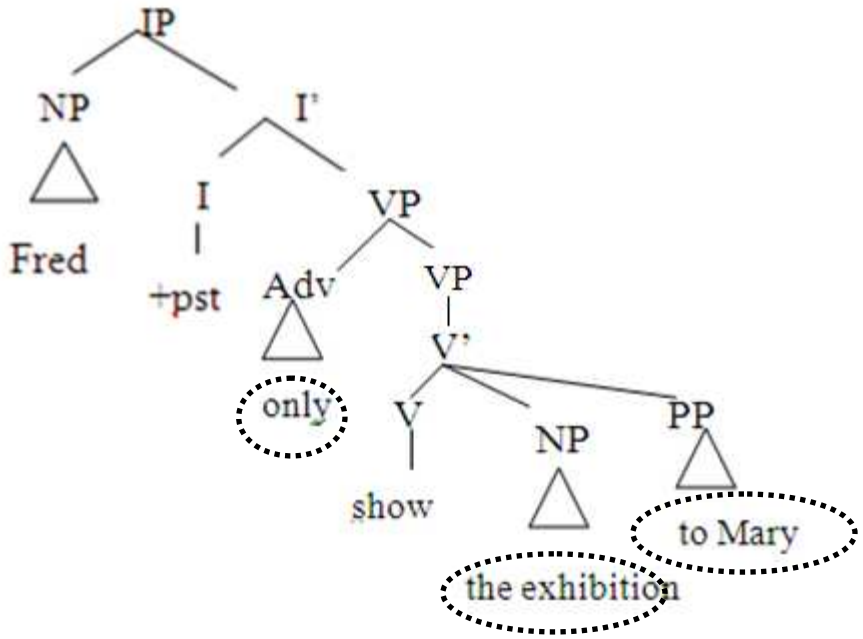


<Figure 2.2. Pre-object *only*>

An *only* that occupies a pre-subject position must take exclusively the following subject NP as its c-command domain; it cannot assign scope beyond that NP. Therefore, the particle cannot be associated with the VP as a whole or with any constituents within the

VP, as shown in figure 2.1. Likewise, *only* in a pre-object position takes scope over the object constituent, but excludes the upper constituent (e.g., the subject NP) in the parse tree, as illustrated in figure 2.2.

However, when *only* is in a pre-verbal position, as in figure 2.3, the node immediately above it is VP, which means the internal constituents of the VP are in the c-command domain of the focus particle. Therefore, the direct object, the indirect object, and the verb are all in the c-command domain of *only*, and thus are all eligible focus constituents, whereas the subject, *Fred*, is beyond the scope of *only* and cannot be the focus.



<Figure 2.3. Preverbal *only*>

2.2 Semantics of English Focus Particles *only* and *even*

Semantic theories have largely centered on a parameter that plays a crucial role in the meaning of focus particles (Jackendoff, 1972; Jacobs, 1983; Rooth, 1985; König, 1991): the relevant factor that contributes to the meaning of focus particles is 'focus'. In order to discuss the interaction of focus particles with the focus in a sentence, it is necessary to clarify how the focus itself can be interpreted.

A discussion of the definitions of focus that have been suggested is beyond the scope of this dissertation. However, at this point, it is useful to provide an account of how focus is interpreted whenever it is associated with a focus particle. The focus of a particle relates the value of the focused expression to a set of alternatives (Jacobs, 1983; Rooth, 1992; Jackendoff, 1972; Crain et al., 1994; Paterson et al., 2003). A sentence with *only* constructs a discourse model in which a set of entities that is made explicit by the sentence (a so-called focus set) is contrasted with a set of alternatives that is inferred (a so-called contrast set or alternative set). For example, on encountering a sentence like *Only John walks a dog,* readers or listeners construct the mental model involving *John*, *a dog*, and an event described by the sentence, *w*ith *John* circumscribed as a focus set. In addition, they posit unspecified people who do not walk a dog and compute them as an alternative set in contrast to *John.*

The members of the set of alternatives are always of the same semantic category as those of the focus set. For instance, if a focus set is a person or an object, the alternative set should be someone or something, respectively. The set of alternatives is inferred from the common background of a speaker and a listener. This shared information between them can be based on either world knowledge, if there is no

discourse context, or a referential context (e.g., Frazier, 1999; Sedivy, 2002). For instance, for a sentence like *Only John walked a dog*, readers or listeners compute unspecified people who did not walk a dog from their pragmatic knowledge when there is no discourse context. However, if a referential context is provided where John and Mary went to the park, they can infer that Mary did not walk a dog. In this sense, the selection of alternatives is highly context-dependent.

Depending on how a focus set is related to a set of alternatives, most focus particles can be categorized into three groups: exclusive or restrictive focus, additive or inclusive focus, and scalar focus. The English focus particle *only* indicates an exclusive contrast in that a property assigned to the focus set is not shared by the alternatives. Therefore, a property that is specified as being true of the focus set is false for the alternative set (Paterson et al., 2003). For example, (10) indicates that Fred and no one else bought a new car. Focus is assigned to *Fred*, and the alternatives to Fred must be inferred by the reader. A sentence containing *only* is analyzed as giving rise to two propositions, as in (10a) and (10b).

(10) Only Fred bought a new car.
   a. Fred bought a new car. (presupposition)
   b. Nobody other than Fred bought a new car. (assertion)

This division is made according to König's (1991) proposal about the meaning carried by the interaction between focus particles and their focus constituents. He claims that sentences with a focus particle entail the corresponding sentences without the particle. Focus particles also contribute quantificational force to the meaning of a sentence: that is, they quantify the value of the focused expression over the set of alternatives. Adopting

these principles for the semantic analysis of focus particles, the sentence containing *only* can be interpreted to entail the relevant sentence without *only*, as in (10a). The contribution made by *only* to the meaning of a sentence can be described by substituting a negated existential quantifier as in (10b).

On more formal grounds, the proposition of (10a) is called a 'presupposition,'[1] and the proposition of (10b) is an 'assertion'.[2] How to define 'presupposition' has been a subject of controversy in the field of semantics (Burton-Roberts, 1989) over the last twenty years. However, there is a consensus in the relevant literature that a presupposition is a proposition that has been established or taken for granted by the participants in a verbal interaction. It is characterized by not being the subject matter of truth conditional semantics; therefore, it should always be true (König, 1991). On the other hand, an assertion contrasts with a presupposition in that if a speaker asserts a certain proposition, the possibility that that proposition may be false can be postulated in speakers' minds (König, 1991).

Before I give an overview of the properties of *even*, the English focus particle *also* must be reviewed due to its similarity with *even. Also* indicates an additive contrast in which a property of a focus set is shared with alternative sets (Paterson et al., 2003). In other words, a property that is specified as being true of the alternative set is true for the focus set (Paterson et al., 2003). The meaning of a sentence containing *also* can also be

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[1] According to Karttunen & Peters (1979), 'presupposition' is defined as a proposition that has already been established prior to the utterance of the sentence in order for the communication to go smoothly.

partitioned into two conjoined propositions: sentence (11), for example, is partitioned into (11a) as a presupposition and (11b) as an assertion (Horn, 1969).

(11) Fred also bought a new car.
   a. Somebody other than Fred bought a new car. (presupposition)
   b. Fred bought a new car. (assertion)

The introduction of *also* presupposes that someone other than Fred bought a new car. This presupposition is always true. Unlike *only*, the contribution made by *also* to the meaning of the sentence is spelled out by substituting an existential quantifier for the focus of the particle. The sentence with *also* asserts (11b), which is equivalent to a sentence without *also*. Sentence (11) is true if Fred bought a new car and false otherwise. The truth condition of this sentence is determined by the proposition denoted by the sentence without *also*. It shows that this additive particle is unlike *only* in that it does not influence truth conditions of the relevant sentence.

There is general agreement in the literature that *even* has an additive meaning just as *also* does (König, 1991; Karttunen & Peters, 1979; Rooth, 1985). However, it presents intriguing properties of meaning. The use of *even* gives rise to an interpretation in three parts, as in (12).

(12) Even Fred bought a new car.
   a. Fred bought a new car. (assertion)
   b. Other people besides Fred bought a new car. (existential implicature)
   c. Of the people under consideration, Fred is the least likely one to buy a new car. (scalar implicature)

First, (12) asserts (12a). This is taken to indicate that a sentence with *even* asserts a proposition equivalent to a sentence without *even*. It demonstrates that *even* does not contribute to the truth condition of the sentence as the additive particle *also* does.

Another interpretation that the sentence conveys is that other people besides Fred bought a new car. However, the reading of (12b) poses something of a controversy in terms of the relation between (12) and (12b). Some propose that (12b) is a presupposition of (12) (Horn 1969). Then (12b) must be true whether or not (12) is true. That is, the proposition that other people besides Fred bought a new car should always be true. On the other hand, others argue that (12b) cannot simply be taken to be a presupposition of (12). If someone utters (12) and is then informed that no one other than Fred bought a new car, (12) can be either true or false depending on native speakers' intuitions. According to this latter interpretation, (12b) is taken to be an implication of (12). Because this dissertation supports this latter view with empirical evidence, (12b) will be treated as an existential implicature of (12) rather than a presupposition.

The last characteristic of *even* that makes it different from other additive particles is that it selects a set of alternatives that are ordered with respect to the focus value in a certain way, as in (12c). A sentence with *even* gives rise to a 'scalar implicature' in which the value included by this particle is characterized as ranking lower in probability than the one given in the sentence. As a consequence, the focus value is characterized as an unexpected or surprising one. In many contexts, this ordering can be described in terms of likelihood in relation to the event denoted by the sentence (Karttunen & Peters, 1979). In example (12c), *even* suggests that Fred is the least likely person to buy a new car.

In the semantics literature, Rooth (1985) suggests that the English focus particle *even* has two different types: positive polarity (henceforth PP) and negative polarity item (henceforth NPI). In an affirmative sentence such as (13a), PP-*even* indicates that the value of the *even* phrase is associated with the lowest or near-lowest ranked element on the likelihood scale. Therefore, in (13a), Bill is the least likely person for Tom to have invited. However, if the sentence is negated, as exemplified in (13b), the opposite is true: Bill no longer appears to be the least likely person, but instead the most likely person for Tom to have invited. An instance of *even* that appears in a negative sentence is called NPI-*even*. The examples in (13) indicate that depending on whether polarity is reversed, the value of the *even* phrase can be changed in terms of the expectation scale/favorableness scale. Bill, who is the least expected person in the affirmative sentence, can be the most expected person in the negative sentence.

(13) a. Tom invited even Bill to the party.
=Bill is the least likely person for Tom to have invited to the party.
b. Tom didn't invite even Bill to the party.
=Bill is the most likely person for Tom to have invited to the party.

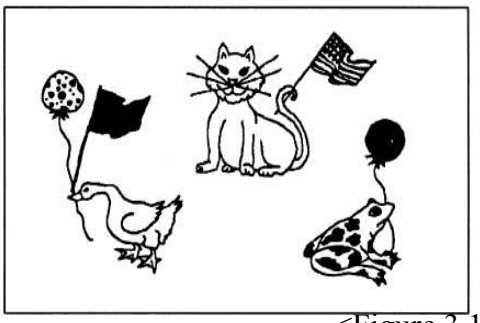
CHAPTER 3

DEVELOPMENTAL INVESTIGATION OF EXCLUSIVE PARTICLE *ONLY*

3.1 Previous research on *only*

Cross-linguistically, developmental research has shown that 3- to 6-year-old children have difficulty acquiring the exclusive focus particle *only* (Brooks & Braine, 1983; Crain et al., 1994; Drozd, 2001; Lee, 2003; Matsuoka et al., 2006). In order to investigate children's knowledge of *only*, a variety of experimental methodologies have been employed in previous studies and have led to divergent results (Crain et al., 1992; Drozd, 2001; Paterson et al., 2003; Notley et al., 2009). Yet the majority of studies on children's comprehension of *only* have almost exclusively focused on the two major interpretive error types—errors involving syntactic competence and errors involving pragmatic inferencing to generate contrast information.

Based on their 1992 study, Crain et al. (1994) claimed that children's erroneous responses to sentences containing *only* are due to their lack of syntactic knowledge. Children are simply deficient in assigning the scope of *only* to the constituent that it c-commands. Using a picture truth value judgment task, Crain et al. (1992) examined how 3- to 6-year-old English-speaking children comprehend sentences with pre-subject *only* and sentences with preverbal *only.* In their task, the children were presented with a picture in which, for example, a cat is holding a flag, and another character— say, a duck—is holding a balloon as well as a flag, as in figure 3.1.



- **Preverbal *only***: The cat is only holding a flag. →children's answer: Yes
- **Pre-subject *only***: Only the cat is holding a flag. →children's answer: Yes

<Figure 3.1. A picture of Crain et al. (1992)>

Within this design, a sentence with pre-subject *only* such as *Only the cat is holding a flag* did not match the picture, since another character was also holding a flag. Therefore, adults would judge the sentence to be false. In contrast, a sentence with preverbal *only* like *The cat is only holding a flag* matched the picture because the cat is doing nothing other than holding a flag, which elicits 'yes' answers. The findings showed that the children correctly accepted preverbal *only* sentences as an accurate description of the pictures, whereas over half of the children (21 out of 38) incorrectly accepted pre-subject *only* sentences as correctly describing the pictures. Crain et al. argued that these non-adult responses to pre-subject *only* arose because the children associated pre-subject *only* with the VP. That is, they misassigned the scope of *only* to the VP, in violation of the c-command constraint. This 'scope-spreading error' led Crain et al. (1994) to claim that children failed to use syntactic cues to analyze the scope of *only* to the intended constituents of the sentences.

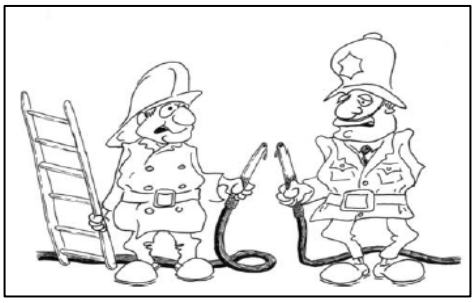
An alternative discourse-based account of children's errors with sentences containing *only* has been advocated by Paterson et al. (2003). According to their claim, Crain et al.'s 1992 study had a methodological flaw, which led to the fairly strong scope-spreading error. As noted by Crain et al. (1992), children consistently produced a high rate of responses compatible with the VP scope analysis in responding to both preverbal

only sentences and pre-subject *only* sentences. However, if the same sentences, but with *only* deleted (e.g., *The cat is holding a flag*), were tested as control items, the target answer would be the same as for the sentences with preverbal *only*. This indicates that even if the participants judged the preverbal *only* sentences to be true, their underlying reasoning might not be solely from assigning the scope of *only* to the VP. Instead, children might evaluate the sentences with *only* as having the same meaning as the counterparts without *only.* If children made such an '*only*-deletion error' (they ignore *only* in judging a sentence containing it), there would have been no way to distinguish it from the VP scope analysis simply based on their 'yes' answers. Thus, the absence of such control sentences weakens Crain et al.'s (1992, 1994) claim that the children adopted a strong VP-oriented interpretation regardless of surface positions of *only*.

Following this logic, Paterson et al. (2003) posed the possibility that children's non-adult-like semantic interpretation of sentences with *only* might derive from a failure to generate contrast information. With the introduction of *only* to a sentence, the computation of contrast sets becomes crucial for parsers to be able to reach the intended interpretation of the sentence containing it. However, given that children are not adult-like in their employment of pragmatic knowledge required to infer contrast information, it is highly probable that they would process *only* sentences without this set computation. This lack of computation could lead to *only*-deletion errors.

To address this issue, Paterson et al. (2003) tested whether 4- to 7-year-old English-speaking children were capable of managing a mental model that necessarily included a contrast set as well as a focus set. They employed an improved version of a picture truth value judgment task to avoid the methodological flaw observed in Crain et al.

(1992). They used pre-subject *only* (e.g., *Only the fireman is holding a hose*) and preverbal *only* (e.g., *The fireman is only holding a hose*) as test items, and sentences without *only* as control items (e.g., *The fireman is holding a hose*), using six pictures depicting events that matched or mismatched the sentences one at a time. Among the six pictures, a certain crucial picture, as in figure 3.2, was presented against the test items and the control items. While the adult judgment of control sentences was 'yes,' both of the pre-subject *only* and preverbal *only* sentences were judged to be 'no' for this picture.



- **Pre-subject *only***: Only the fireman is holding a hose. →target answer: No, because the policeman is holding a hose, too.
- **Preverbal *only***: The fireman is only holding a hose. →target answer: No, because he is holding a ladder, too.
- **Control sentence without *only***: The fireman is holding a hose. → target answer: Yes

<Figure 3.2. A picture of Paterson et al. (2003)>

This experimental design has two advantages for an experimenter to be readily able to analyze the origin of children's erroneous responses. First, *only*-deletion errors can be distinguished from target scope analysis through that true/false distinction, unlike in the study by Crain et al. (1992). For example, if children didn't know how to compute a contrast set based on this critical picture, thus making *only*-deletion errors, they would elicit 'yes' answers to the test sentences with *only* as they did to the control sentences without *only*. Second, this design made it possible to distinguish between *only*-deletion errors and scope-spreading errors. For instance, if children erroneously judged the sentences that did not match the pictures to be true, the responses would be consistent with *only*-deletion errors but inconsistent with scope-spreading errors.

The main result drawn from this study is that children aged 4 to 5 years made substantial *only*-deletion errors over 50 percent of the time. The same kind of error was witnessed 36 percent of the time in older children aged 6 to 7 years. In contrast to the results of Crain et al. (1992), the children principally made errors by neglecting contrast information rather than by misanalyzing scope. These findings indicate that while they can perceive a focus set, children tend not to take account of contrast information. This result contradicts the claim of Crain et al. (1994) that children's errors with *only* sentences are a consequence of lack of syntactic knowledge of the focus element.

To adjudicate between the two prevailing accounts of children's non-adult-like responses (scope-spreading errors vs. *only*-deletion errors), Notley et al. (2009) extended previous studies to Chinese children's interpretation of sentences containing the focus particle *zhiyou,* 'only,' in a truth value judgment task (Crain & Thornton, 1998). *Zhiyou* is one of the Mandarin focus particles corresponding to *only*. Like English *only*, *zhiyou* precedes elements in focus and must c-command eligible focus phrases. Chinese children (aged 4 to 5 years) were presented with a set of sentences with pre-subject *zhiyou* (e.g., in English translation, *Only Mr. Pig got a silver spoon* or *Only Mr. Cat got a carrot*). For the target sentences, two types of contexts were created that either matched the sentence with pre-subject *zhiyou* ('Adult True Context') or mismatched the sentence with it ('Adult False Context'). The children rejected sentences with *zhiyou* in both the Adult True Context and the Adult False Context for the same reason: because the character in question in the picture performed an action in addition to the one denoted by the sentence. This is evidence that Mandarin-speaking children produced VP scope responses to sentences with pre-subject *zhiyou*, which supports the claim by Crain et al. (1992, 1994).

At this point, it is worth noting that different methodologies produced different results. Comparing previous methodologies in terms of how they manipulated the features of *only* might clarify the reasons for this variation. As mentioned earlier, understanding sentences containing *only* requires access to additional shared information between the speaker and listener, information that can be supplied by either discourse context or shared world-knowledge when discourse context is nonexistent (Höhle et al. 2009:4-5). Given that children have non-adult-like pragmatic knowledge, it is clear that methodologies with contextual support would likely enable them to better understand sentences containing focus particles than those without such support.

Recall that children made errors consistent with failing to attend to contrast information in Paterson et al. (2003). They employed a picture-based truth value judgment task in order to overcome the flaws in the study of Crain et al. (1994). However, Paterson et al.'s methodology appears not to be the best way to investigate children's understanding of sentences containing *only* since it is characterized by a static picture presentation and requires children to judge whether a picture matches a sentence containing *only*. Accordingly, target sentences are presented isolated from contexts in which the use of *only* is reasonable and natural. Children are therefore forced to compute a contrast set based only on a picture. Furthermore, they are required to use extra-linguistic cognitive skills to check the felicity of the pictures (Höhle et al., 2009). For these reasons, the cause of the *only*-deletion error in Paterson et al. (2003) might be attributed not to their inability to compute a contrast set but rather to the lack of an appropriate discourse context.

In line with this claim, Notley et al. (2009) also suggest that an abnormally high proportion of *only*-deletion errors in Paterson et al. (2003) might be due to task demand. When they examined the data more closely, Notley et al. found no recognizable pattern of correct or incorrect responses by any of the children's groups or even by the adults. This suggests the possibility that the task was quite confusing for both groups. In their own study, Notley et al. (2009) employed a truth value judgment task (Crain & Thornton, 1998), which has advantages over other methodological techniques for assessing children's comprehension in developmental studies: the experimenter, who acts out a story in front of the child, can control the story context. Notley et al. (2009) supplied contexts that assist children to take account of contrast information, which led to a dramatic decrease in the rate of *only* deletion.

3.2 The Present Study: Research Questions for Experiment 1

Where does this leave us? To date, relatively little attention has been paid to developmental changes over time in children's ability to comprehend sentences containing *only*. Notley et al. (2009) conducted a longitudinal study on how young English-speaking children understand sentences with *only*. Two English-speaking children from different families took part in the study; one child started testing at age 2;4 and participated until age 3;1and the other started testing at 2;1 and participated until age 2;11. According to the results of three experimental tasks—an act-out task, a yes/no question task, and a wh-question task—the participants' non-adult-like responses to sentences with *only* were mainly due to a failure to generate contrast information.

However, there has been no consensus as to the source of errors produced by children aged 4 to 5 years. One claim is that their errors are predominately due to neglecting contrast information rather than misanalyzing a syntactic cue for *only* (Paterson et al., 2003); another claim is that the errors show children beginning to converge on an adult-like ability to generate contrast information but continuing to make errors due to misanalysis of the syntactic cue of *only* (Notley et al., 2009). Based on these inconsistent findings, one could argue that age 4 to 5 years is a period of developmental transition toward adult-like competence.

To provide more compelling evidence of children's developmental knowledge of *only,* it is worthwhile to retest, using a well-controlled methodology, 4- to 5-year-old English-speaking children for comprehension of sentences containing this focus particle. An improved task should present a context that helps children compute contrast information but does not favor any scope analysis. In addition, contexts need to be constructed in a way that keeps children from a 'yes-bias' in their performance as much as possible. Children, who are generally eager to co-operate, tend to answer 'yes' irrespective of sentences types. To reduce this tendency, contexts should be controlled with regard to 'plausible deniability'. Although the influence of this tendency on children's performance has not been thoroughly tested empirically, it has appeared in developmental research in recent years. The true version of a statement with *only* is considered in the context story when the statement ends up being false. Similarly, the false version of a statement with *only* is considered in the story for which the 'true' answer is expected. This manipulation can help children give 'true' answers based on correct reasoning rather than because of a yes-bias.

Experiment 1 examines how English-speaking children aged 4 to 5 years interpret sentences with an *only* that applies to a subject or an object constituent, under well-controlled contexts in a truth value judgment task (Crain & Thornton, 1998). With this methodological improvement, this experiment revisits the issue of how adult-like children of this age are in their interpretations of sentences containing *only*. If children are not able to perform in an adult-like way, the main concern of this experiment will be to determine what types of interpretive errors they will produce. The two primary research questions are as follows:

- Are children able to compute a contrast set in the interpretation of sentences containing *only*?
- Are children able to correctly assign the scope of *only* to the subject or object constituent? In other words, are they able to compute qualitatively different contrast sets for *only* in different syntactic positions?

3.3 Experiment 1

3.3.1 Participants

Thirty-nine English-speaking children aged 4 and 5 years (mean age 5;2) with normal hearing and normal vision were recruited from preschools in the Mānoa area of Honolulu, Hawai'i. Twenty-one native speakers of English, most of whom were undergraduate students at the University of Hawai'i at Mānoa (UHM), served as a control group in the experiment. All of the participants were naive with respect to the purpose of the experiment. Parental consent was obtained prior to conducting the experiment. Children were given a small bag of snacks in compensation for their participation, and

adults participated in exchange for a small bag of snacks or for credit in an introductory course in linguistics or psychology.

3.3.2 Methodology

My study involved a minor modification to the basic design of the truth value judgment task. In this revised version, each participant was instructed to view a series of pictures (Microsoft Office PowerPoint slides) on the computer screen while listening to the story. To reduce children's memory burden, the last picture always presented a summarized description of the story. At the end of the story, a puppet was asked to describe what happened in the story. Participants were asked to judge whether the puppet's statement containing *only* correctly matched the depiction of the summary picture. They were asked to answer 'yes' (=true) when what the puppet said was right, and 'no' (=false) otherwise. They were also asked to justify their responses when answering 'no' to the puppet's statement.

Prior to the actual test, each child was given a practice session, which consisted of two trials. The target answers were 'yes' on the first trial and 'no' on the second. This session allowed an experimenter to check whether children were able to answer 'yes' and 'no' correctly. It also helped children to know that the puppet would not always be right. The full test was only administered to those children who correctly rejected the puppet's statement in the practice item. The test session lasted approximately 30 minutes.

3.3.3 Materials

There were two types of test sentences, one type with *only* taking scope over a subject constituent (henceforth 'pre-subject *only*'), as in (14a), and the other type with *only* taking scope over an object constituent (henceforth 'pre-object *only*'), as in (14b).

(14) a. **pre-subject *only***: Only Red Bear bought a balloon.

b. **pre-object *only***: Red Bear bought only a balloon.

Three types of story contexts were created for these target sentences. Each context was presented with pre-subject *only* (=three test items) and pre-object *only* (=three test items) to each participant: thus, each participant responded to six test items (see table 3.1). Such a context manipulation (that is, an identical context combined with pre-subject *only* in some cases and with pre-object *only* in others) was intended to test which scope reading in the same setting elicited more adult-like responses from children. All the contexts were created to make a truth distinction between the two sentence types.

Conditions	Contexts	Sentence type	Target answer
condition1	context1	pre-subject *only*	Yes
condition2	context1	pre-object *only*	No
condition3	context2	pre-subject *only*	No
condition4	context2	pre-object *only*	Yes
condition5	context3	pre-subject *only*	No
condition6	context3	pre-object *only*	No

<Table 3.1. The six conditions presented to each participant>

For example, as illustrated in table 3.1, context 1 elicited opposite target answers to pre-subject *only* and pre-object *only*. The true/false pattern of context 1 was reversed in context 2. In context 3, regarded as a crucial condition, pre-subject *only* and pre-object

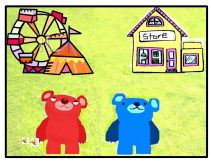
only sentences should both be judged to be false. For all conditions, children who judged sentences containing *only* to be false were instructed to provide reasons for why they answered false. In cases with the same truth values between the two sentences, children's justifications for why they answered false could indicate whether their negative responses were the result of correct reasoning. Therefore, all the explanations about their judgments were written by hand for the data analysis.

All the contexts were constructed to satisfy the condition of plausible deniability for both sentence types. For instance, since a target answer for pre-subject *only* was judged to be true in a certain context, the false version of the sentence was also considered in the context story. Likewise, since a target answer for pre-object *only* was judged to be false in the same context, the true version of the sentence was also included in the story.

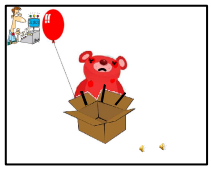
Each context initially presented background information by introducing who the story was about, who the characters were, where they went, and so on. After that, three pieces of critical information followed, providing clues that were essential to compute a focus referent, a subject-focused contrast set, and an object-focused contrast set. The first piece of information always involved the proposition that the main character performed an action involving one object mentioned in the test sentence. The second piece of information was pertinent to whether the second character, who was not mentioned in the test sentence (i.e., a character implied by the sentence), performed an action involving an object mentioned in the sentence. The third piece of information was about whether the main character carried out an action involving a different object not mentioned in the test sentence (i.e., an object implied by the sentence).

Based on this design model, the contexts, some of which are shown in the following examples, were created and employed in the real test. The full set of pictures for context 1 is provided here, whereas only the last pictures for contexts 2 and 3 are presented below. In context 1 (see example below), the main character (Red Bear) performs an action involving an object mentioned in the *only* test sentence (buys a balloon) and also performs an action involving an object that is implied in the test sentence (buys a yoyo). However, a second character (Blue Bear) doesn't carry out the action at all (in this case, buying). Since the main character is involved with two objects, a balloon and a yoyo, I will refer to this context as 'Two Objects Context'. The context was designed to elicit a 'true' answer to pre-subject *only* (*Only Red Bear bought only a balloon*), but a 'false' answer to pre-object *only* (*Red Bear bought only a balloon*).

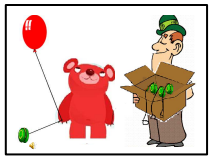
Example of Two Objects Context **(=context 1) *The bear on the left is Red Bear.**



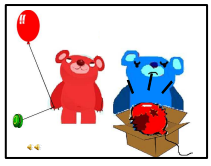
Today Red Bear and Blue Bear went to the carnival and saw a store. They decided to look inside.



Red Bear saw a balloon and bought it. Red Bear also wanted to buy a yo-yo. But there were none left in the store, so he couldn't buy one.



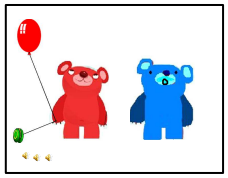
Just when he was about to look for something else, a store worker brought in a box filled with new yo-yos, so Red Bear finally bought a yo-yo.



After seeing Red Bear's balloon, Blue Bear also wanted to have a balloon. When he checked the balloon section, there was one left, but there was hardly any air in it. So Blue Bear didn't buy a balloon after all.

- experimenter: Hey Smurf, tell me something that happened at the carnival.

<summary picture>



Protocol for pre-subject *only*

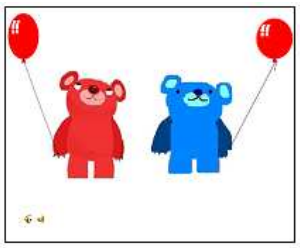
- puppet (Smurf): Okay, I can do that. *Only Red Bear bought a balloon*.
- target answer: **Yes (true)**, because Blue Bear didn't buy a balloon.

Protocol for pre-object *only*

- puppet (Smurf): Okay, I can do that. *Red Bear bought only a balloon*.
- target answer: **No (false)**, because Red Bear bought a yoyo, too.

In context 2, to be referred to as the 'Two Characters Context', the main character (Red Bear) as well as the implied character (Blue Bear) carry out an action involving an object mentioned in the sentence. (Blue Bear as well as Red Bear buy a balloon.) In this context, the sentence with pre-subject *only* should be judged to be false while the sentence with pre-object *only* should be judged to be true.

***Example of Two Characters Context* (=context 2)**



Story: Today Red Bear and Blue Bear went to the carnival and saw a store. They decided to look inside. Red Bear saw a balloon and bought it. Red Bear also wanted to buy a yo-yo. When he checked the yo-yo section, there was one left, but it was broken, so Red Bear didn't buy a yo-yo after all. After seeing Red Bear's balloon, Blue Bear also wanted to have a balloon. However, there were none left in the store, so he couldn't buy one. When he was about to look for something else, a store worker brought in a bunch of new balloons, so Blue Bear finally bought a balloon.

- experimenter: Hey Smurf, tell me something that happened at the carnival.

Protocol for pre-subject *only*

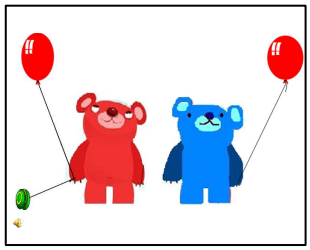
- puppet (Smurf): Okay, I can do that. *Only Red Bear bought a balloon*.
- target answer: **No (false)**, because Blue Bear also bought a balloon.

Protocol for pre-object *only*

- puppet (Smurf): Okay, I can do that. *Red Bear bought only a balloon*.
- target answer: **Yes (true)**, because Red Bear didn't buy a yoyo.

The last but crucial context 3, the 'Two Characters/Two Objects Context', is a combined version of both the Two Objects Context and the Two Characters Context. In this case, the story describes a situation in which the main character carries out an action involving both an object mentioned in the test sentence and an object implied by the test sentence (Red Bear buys not only a balloon but also a yoyo). In addition, the second character implied in the test sentence performs an action involving the object in the test sentence (Blue Bear buys a balloon). In this case, participants should consider both pre-subject *only* and pre-object *only* to be false.

***Example of Two Characters/Two Objects Context* (=context 3)**



Story: Today Red Bear and Blue Bear went to the carnival and saw a store. They decided to look inside. Red Bear saw a balloon and bought it. Red Bear also wanted to buy a yo-yo. But there were none left in the store, so he couldn't buy one. When he was about to look for something else, a store worker brought in a box filled with new yo-yos, so Red Bear finally bought a yo-yo. After seeing Red Bear's balloon, Blue Bear also wanted to have a balloon. However, there were none left in the store, so he couldn't buy one. When he was about to look for something else, a store worker brought in a bunch of new balloons, so Blue Bear finally bought a balloon.

- experimenter: Hey Smurf, tell me something that happened at the carnival.

Protocol for pre-subject *only*

- puppet (Smurf): Okay, I can do that. *Only Red Bear bought a balloon*.
- target answer: **No (false)**, because Blue Bear also bought a balloon.

Protocol for pre-object *only*

- puppet (Smurf): Okay, I can do that. *Red Bear bought only a balloon*.
- target answer: **No (false)**, because Red Bear also bought a yoyo.

In order to ensure that participants knew the meaning of *only* per se, sentences without *only* (e.g., *Red Bear bought a balloon*) were presented as control items against the same contexts used for test sentences with *only.* Participants were asked to provide a truth value judgment for these sentences, which always called for an answer of 'yes'. Filler sentences without *only* were also included, which were always 'no', and a truth value judgment requested. These filler items were important because an experimenter could check whether children's performance was influenced by a yes-bias effect when they should consider the sentence to be false. The following table shows the full set of test sentences (i.e., sentences including *only*) used in the task.

Three types of contexts	Test sentences
Two Objects Context Two Characters Context Two Characters/Two Objects Context	pre-subject *only*: *Only Red Bear bought a balloon.* pre-object *only*: *Red Bear bought only a balloon.*
Two Objects Context Two Characters Context Two Characters/Two Objects Context	pre-subject *only*: *Only Charlie colored a star.* pre-object *only*: *Charlie colored only a star.*
Two Objects Context Two Characters Context Two Characters/Two Objects Context	pre-subject *only*: *Only Big Pig ate an apple.* pre-object *only*: *Big Pig ate only an apple.*

<Table 3.2. Six experimental sentences in all conditions>

Three tokens for each of the six conditions were created, resulting in 18 target trials. If the same number of fillers and control sentences as test sentences had been presented to participants, children would likely have lost their concentration during the lengthy task. Therefore, three lists were created, each comprising six experimental sentences, three control sentences, and three fillers. The lists were randomized across participants and were pseudo-randomized in terms of truth values so that children would not find any consistent answer pattern.

3.3.4 Predictions

Table 3.3 shows predictions as to how children would respond to sentences with *only* if they were not taking into account the contexts.

context types	**sentence types**	**target answers**	***only*-deletion error**	**scope-spreading errors**	
				subject scope analysis is preferred	**object scope analysis is preferred**
Two Objects Context	pre-subject *only*	Yes	Yes	Yes	No
	pre-object *only*	No			
Two Characters Context	pre-subject *only*	No	Yes	No	Yes
	pre-object *only*	Yes			
Two Characters/Two Objects Context	pre-subject *only*	No	Yes	No, but due to wrong scope readings	
	pre-object *only*	No			

<Table 3.3. Predictions across conditions>

If children ignore *only* due to an inability to compute a contrast set for the focused constituent (i.e., if they make *only*-deletion errors), they will judge the test sentences to be true (yes answer) across all three contexts. This is because the sentences without *only* are always true regardless of the contexts.

On the other hand, if children know how to compute a contrast set but are confused about assigning the scope of *only*, they will allow for spreading of the scope of *only* to the constituents to the left or right (i.e., they will make scope-spreading errors). Thus, they are more likely to interpret pre-subject *only* as pre-object *only* or vice versa in Two Objects Context and Two Characters Context.

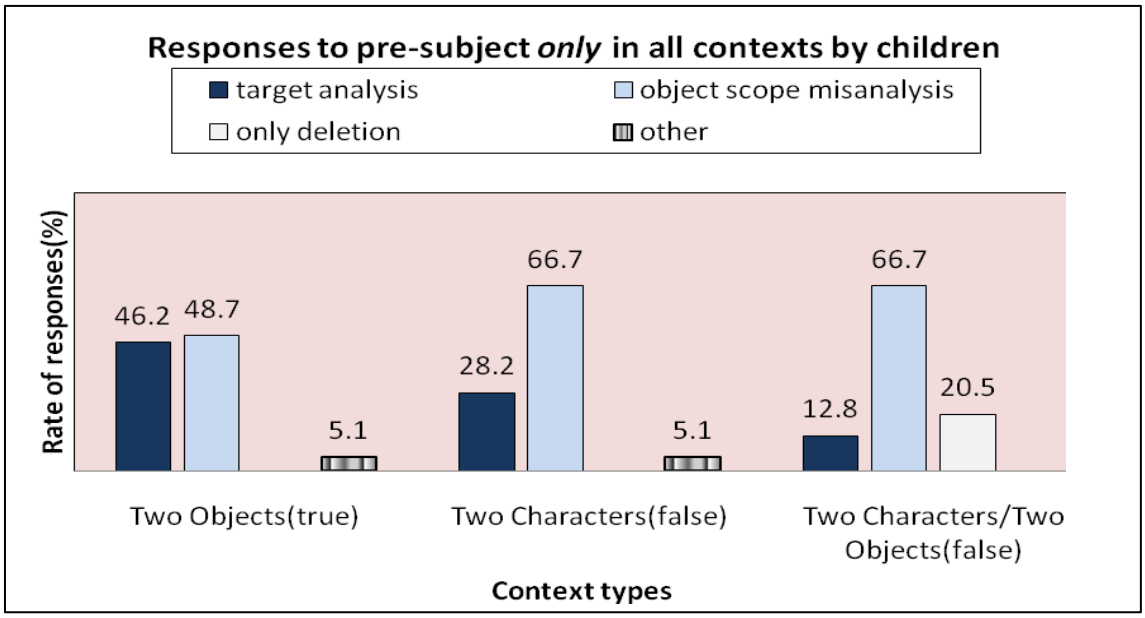
The Two Characters/Two Objects Context serves as a crucial condition to be able to discriminate between *only* deletion errors and scope spreading errors. If children made *only* deletion errors, they will accept the target sentences as a correct description of the event in this context. However, if children make scope spreading errors, the two sentence types both elicit the same no answers. However, children's justification for why they answer 'no' will reveal their reasoning: they will give negative responses to sentences with *only*, but for the wrong reason.

3.3.5 Results

I classified participants' responses into four categories. First, responses were coded as 'target analysis' if children judged pre-subject *only* and pre-object *only* in an adult-like way. This corresponded to the subject scope analysis of pre-subject *only* and the object scope analysis of pre-object *only*. Second, erroneous responses were coded either as an 'object scope misanalysis' if the participants misassigned the scope of pre-subject *only* to the object NP or as a 'subject scope misanalysis' if they misassigned the scope of pre-object *only* to the subject NP. Third, erroneous responses by participants who understood sentences with *only* as sentences without *only* were coded as '*only*-deletion errors'. The fourth category comprised other types of responses, in which

children either answered correctly for the wrong reason or answered incorrectly for the right reason.

Both adults and children gave correct responses on filler items 100 percent of the time. This indicates that child participants were not affected by a yes-bias: they were able to answer 'no' when this response was called for, just as adults did. Both groups also showed a high rate of correct responses—more than 95 percent—on control items. As expected, English-speaking adults correctly comprehended the sentences with *only* more than 98 percent of the time across all contexts. In contrast, children showed a high proportion of non-adult-like responses involving scope-spreading errors, particularly in the comprehension of pre-subject *only* sentences. Figures 3.3 and 3.4 show the mean percentage frequency of responses to pre-subject *only* and pre-object *only* across the three contexts by the children.



	Two Objects(true)	Two Characters(false)	Two Characters/Two Objects(false)
target analysis	46.2% (18/39)	28.2% (11/39)	12.8% (5/39)
object scope misanalysis	48.7% (19/39)	66.7% (26/39)	66.7% (26/39)
only deletion error	0% (0/39)	0% (0/39)	20.5% (8/39)
others	5.1% (2/39)	5.1% (2/39)	0% (0/39)

<Figure 3.3. Children's responses to pre-subject *only* sentences>

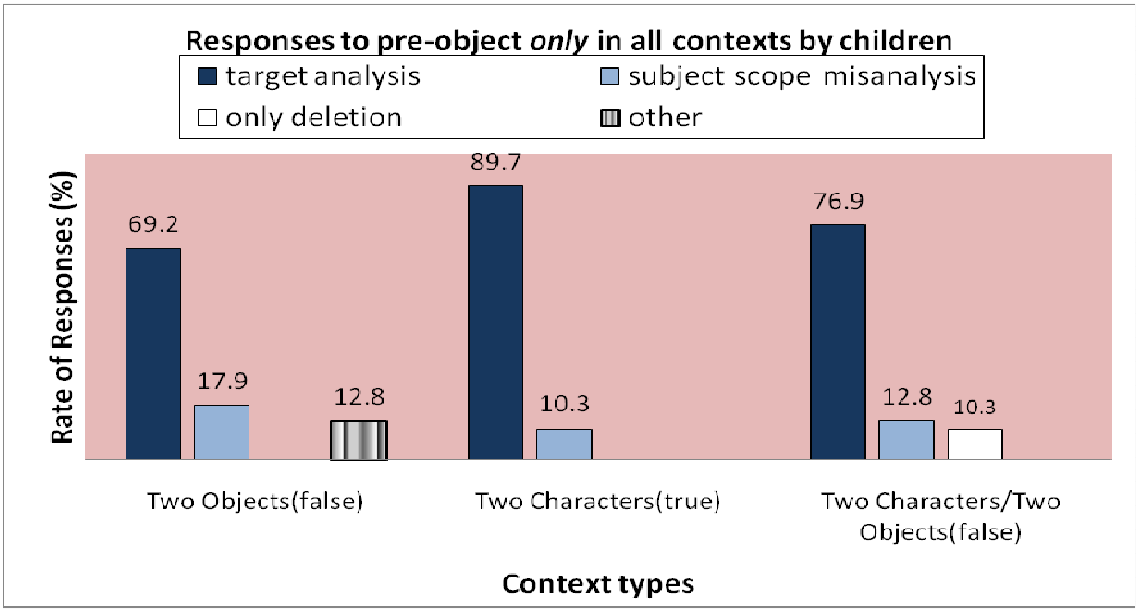
As seen in figure 3.3, overall the children produced the target responses less than 50 percent of the time for pre-subject *only* sentences in all the contexts, making a large proportion of object scope misanalysis responses. The rate of occurrence of this error type was much higher than that of the target response, particularly in the Two Characters Context (66.7% vs. 28.2%) and the Two Characters/Two Objects Context (66.7% vs.12.8%). This result indicates that understanding pre-subject *only* was challenging for the child participants.

To distinguish between scope-spreading errors and *only*-deletion errors, it is necessary to inspect the children's answer patterns in the crucial Two Characters/Two Objects Context. As noted earlier, children with *only*-deletion errors are expected to give 'yes' responses, whereas children with scope-spreading errors (in this case, object scope misanalysis) should produce 'no' answers in this context. As shown in figure 3.3, the children had a much higher rate of object scope-spreading errors (66.7%) than *only*-deletion errors (20.5%).

The 'other' responses, which constituted 5.1 percent in the Two Objects Context and 5.1 percent in the Two Characters Context, were errors in which children responded correctly but justified their responses by invoking an incorrect reason.

Noticeably, the target response rate in the Two Objects Context (46.2%) is higher than in both the Two Characters Context (28.2%) and the Two Characters/Two Objects Context (12.8%). The reason for the higher success rate seems to lie in the fact that the target answer ('yes') in this context is identical with the one produced if an *only*-deletion error is made. This makes it difficult to distinguish the responses that are due to the target analysis (subject scope analysis) from those due to the *only*-deletion error in the Two Objects Context.

In contrast to the result in the Two Objects Context, children's response patterns in the Two Characters Context and Two Characters/Two Objects Context point to a strong object scope misanalysis. The rates of the object scope misanalysis in these two contexts were higher than 65 percent. The results from these contexts are more reliable than from the Two Objects Context because the children's justification for why they answered negatively gives us a clear clue about their scope reading. They justified their answers by noting the presence of another object that the main character was involved with besides the object mentioned in the sentence. Thus, the evidence obtained from their justifications supports the conclusion that children had a fairly strong tendency to adopt an object scope analysis even with pre-subject *only*.



	Two Objects(false)	Two Characters(true)	Two Characters/Two Objects(false)
target analysis	69.2% (27/39)	89.7% (35/39)	76.9% (30/39)
object scope misanalysis	17.9% (7/39)	10.3% (4/39)	12.8% (5/39)
only deletion error	0% (0/39)	0% (0/39)	10.3% (4/39)
others	12.8% (5/39)	0% (0/39)	0% (0/39)

<Figure 3.4. Children's responses to pre-object *only* sentences >

An inspection of the data shown in figure 3.4 shows how children responded to pre-object *only* across the three contexts. Children correctly associated *only* with the following object NP to a high degree, producing the target response more than 65 percent of the time across all the contexts (69.2%, 89.7%, and 76.9%, respectively). The rate of a subject scope misanalysis amounted to less than 20 percent in all the contexts. In addition, the children produced a lower rate of *only*-deletion errors in the Two Characters/Two Objects Context for pre-object *only* (10.3%) than for pre-subject *only* (20.5%).

With respect to target response rates across contexts, children produced more target responses in the Two Characters Context (89.7%) than in other two contexts

(69.2% in the Two Objects Context and 76.9% in the Two Characters/Two Objects Context). The target answer in this context is the same as the one derived from *only*-deletion errors. It is likely, then, that *only*-deletion errors inflated the target response rate in the Two Characters Context. The 'other' responses that make of 12.8% of the answers in the Two Objects Context involved errors in which children responded correctly but for the wrong reason, as evidenced by their explanations.

In summary, children correctly evaluated sentences without *only* and filler items, but they made many more errors for sentences with pre-subject *only* than for sentences with pre-object *only*. Children also had a strong object-focused scope analysis regardless of the syntactic position of *only*.

3.3.6 Discussion of Experiment 1

The results from this experiment showed that children aged 4 to 5 years were able to compute a contrast set for both pre-subject *only* and pre-object *only* sentences. The crucial context, the Two Characters/Two Objects Context, led children to judge the sentences with *only* to be true if they made *only*-deletion errors and false if they made scope-spreading errors. On average, children made *only*-deletion errors less than 20 percent of the time when evaluating pre-subject *only* and pre-object *only* in this context. Furthermore, the rate of *only*-deletion errors (20.5% for pre-subject *only* and 10.3% for pre-object *only*) was much lower than the rate of scope-spreading errors (66.7% of errors for pre-subject *only* and 76.9% for pre-object *only*). This indicates that children at this age are aware of the pragmatics of *only*.

However, the children still had difficulty in analyzing the scope of *only*, and they also exhibited asymmetry between pre-subject *only* and pre-object *only*. This finding reinforces the claim by Crain et al. (1994) and Notley et al. (2009) that children show a lack of syntactic knowledge in scope assignment. Specifically, the children in my study made more errors for sentences with pre-subject *only* than for those with pre-object *only*. The children's justifications for their errors provided compelling evidence that they associated pre-subject *only* with the object constituent. This suggests that the object-scope analysis might be children's default scope analysis at this age. If that is so, why do children prefer to associate *only* with the object constituent even for pre-subject *only*? To answer this question, it is necessary to consider—and to rule out, if possible—some potential explanations for this behavior.

First, and above all, the effect of prosody on children's performance in response to sentences involving *only* must be considered. In other words, if the object constituent bears more prosodic prominence than the subject constituent, children may prefer to associate *only* with the object rather than the subject constituent. However, in my experimental setting, both of the constituents following *only* were manipulated to bear the same prosodic prominence. Furthermore, even if the object constituents were more prosodically prominent than the subject constituents, the prosodic bias might not directly influence the children's responses. The exclusion of children's employment of prosody is supported by Gualmini et al.'s (2003) claim that prosody by itself cannot explain children's interpretation of *only*. They investigated English-speaking children's sensitivity to contextual support in comprehending *only* sentences, using a truth value judgment task. Gualmini et al. (2003) took the case of the English dative construction

with a direct object and an indirect object, in which *only* could be associated with either of the objects (e.g., *The Troll only brought an onion ring to Superman*). In their task, a target sentence was manipulated by prosodic prominence upon the direct object (e.g., *onion ring*) or the indirect object (e.g., *Superman*). Without contexts that support either of the scope readings, the majority of the children preferred to associate *only* with the indirect object in spite of prosodic prominence upon the direct object. This invites the conclusion that the children did not make use of prosodic information to determine the scope of *only* and instead had a default reading that associated *only* with the indirect object. To help children access a direct object-focused analysis, the study even provided discourse information that favored the direct object-focused interpretation. When contextual information was integrated with prosody effects, children could access the direct object analysis. This showed that the prosody alone is not enough for children to use a direct object-scope analysis.

A second possible explanation for a default object scope analysis concerns the visual information in the summary pictures of Experiment 1, which might have influenced the children's scope interpretation. Paterson et al. (2003) used only pictures containing two characters (e.g., a fireman and a policeman). According to Notley et al. (2009), this type of picture could lead children to a subject scope analysis because it allows them to make a strong contrast between the main character and the implied character. Consequently, it may have led to the high rate of subject scope analysis in Paterson et al.'s study. However, although all of the pictures employed in Experiment 1 were partially based on the stimuli of Paterson et al.'s study, the results of Experiment 1 turned out to be inconsistent with Notley et al.'s (2009) claim. Even though the summary

picture of each story in Experiment 1 contained two characters, children adopted a strong object-focused analysis for both pre-subject *only* and pre-object *only* sentences. This finding suggests that, like prosodic information, this picture feature also does not play an important role in children's scope assignment of *only*.

With these two possibilities ruled out, I propose that children's preferential object scope analysis might be attributed to their non-adult-like syntactic knowledge at this stage. To address this issue in more detail, I will explore in the next section the question of whether children's interpretation of *only* is subject to the c-command constraint.

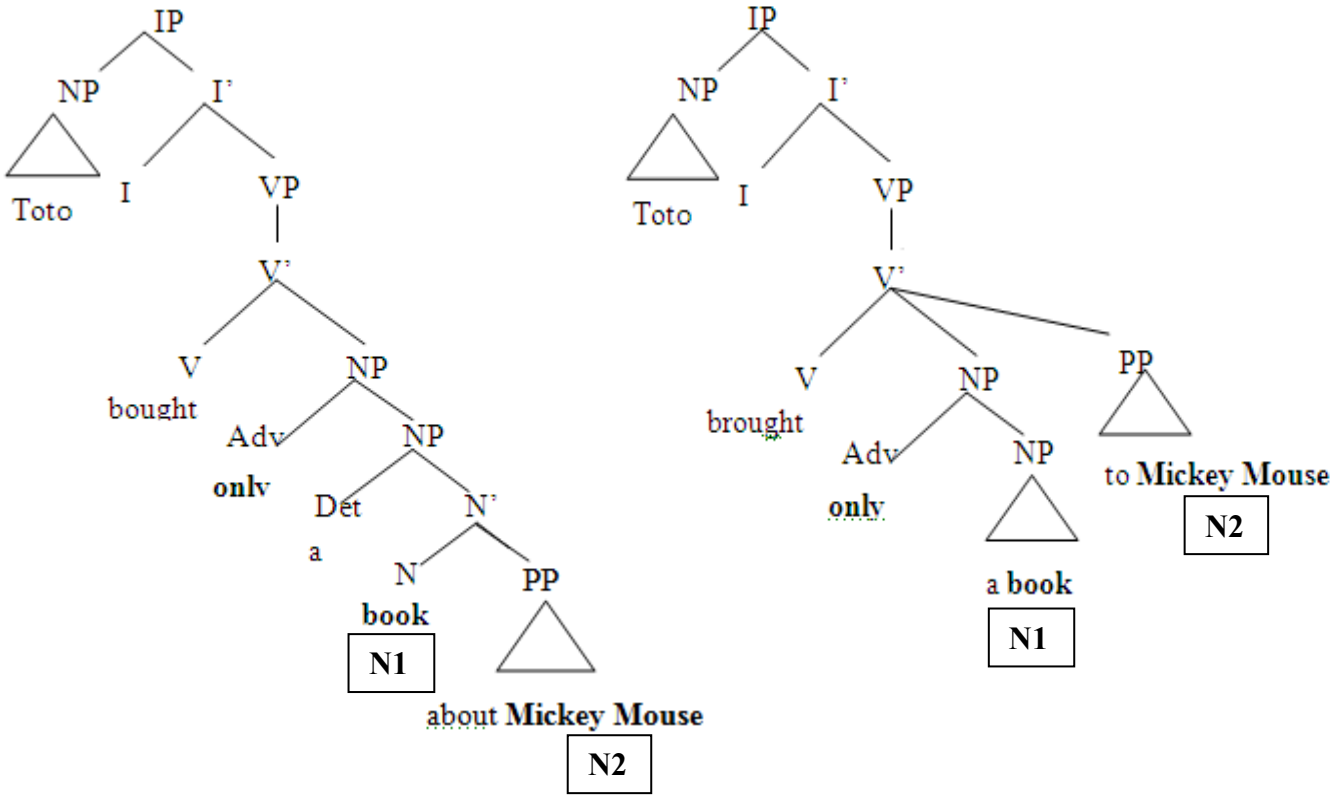
3.4 Research Questions for Experiment 2

Experiment 1 concerned two types of sentences with *only* in either a pre-subject or a pre-object position. In both sentence types, the NPs to which *only* applies are in its c-command domain. Children made scope-spreading errors by interpreting pre-subject *only* as pre-object *only*. This seemed to be evidence that they are able to associate *only* with constituents outside of its c-command domain. Before drawing a conclusion that children's scope spreading errors are accounted for by the violation of c-command constraint, it is necessary to test whether they are adult-like in restricting the focus of *only* to those constituents that are within its c-command domain and to exclude those elements that are not within its c-command domain. The direct experimental investigation can provide a more detailed picture of children's sensitivity to the grammatical restrictions on the scope of the focus particle *only*.

Experiment 2 used two experimental sentences involving *only* preceding two nouns connected by either the preposition *about* (e.g., *Toto bought <u>only a book about</u>*

Mickey Mouse) or the preposition *to* (e.g., *Toto brought only a book to Mickey Mouse*). As seen in figures 3.5a and 3.5b, these two sentences exhibit different structural configurations for the two nouns. In figure 3.5a, the second noun (henceforth N2) is embedded in the NP including the first noun (henceforth N1). By contrast, in figure 3.5b, the N2 is outside the domain of the NP including the N1. I will call the first case 'the embedded NP sentence' and the second case 'the parallel NP sentence'.

<Figure 3.5. Tree structures of test sentences>



a. Embedded NP sentence b. Parallel NP sentence

The structural difference between an embedded NP sentence and a parallel NP sentence results in a different manifestation of the c-command constraint. The first node

above *only* c-commands the complex NP including N1 and N2 in the embedded NP sentence, as in figure 3.5a. Not only the N1 *book* but also the N2 *Mickey Mouse* fall within the scope of *only* in this pattern. According to the c-command constraint, the focus particle *only* is allowed to be associated with either the N1 or the N2 in the embedded NP sentence. By contrast, *only* should be associated with the N1 alone in the parallel NP sentence in figure 3.5b because only the element in the NP is in the c-command domain of *only*.

Using these two types of sentences, Experiment 2 attempts to examine whether children are subject to the c-command constraints in focus identification. The specific research question is as follows:

- Are children subject to the c-command constraint so that they will associate *only* with either the first noun or the second noun in the embedded NP sentence, but exclusively with the first noun in parallel NP sentences?

3.5 Experiment 2

3.5.1 Participants

To investigate children's interpretation of *only*, 33 monolingual English-speaking children aged 6 and 7 years[1] (M age = 6;8) were recruited from after-school programs offered in the preschools in the Mānoa area of Honolulu. Thirty adult native speakers of English, who were undergraduate students at UHM, were also tested as a control group (M age = 23;6). All participants were reported to have normal or corrected-to-normal

[1] Because children aged 6 to 7 were easier to locate, this population was recruited first in this experiment. Data from children aged from 4 to 5 will be collected as a next step.

hearing and vision. Children were given a gift that cost around $4 in compensation for their participation. Adults who took part in the study received credit in an introductory course in psychology or linguistics, or a small bag of snacks that cost around $4.

3.5.2 Methodology

The task employed in Experiment 2 is identical to the one in Experiment 1. Each participant was asked to view a series of pictures (Microsoft Office PowerPoint slides) on the computer screen while listening to the story. As before, the story ended with a summary picture that helped participants access all the previous information about what had happened in the story. At the end of the story, a puppet was asked to describe what happened in the story. Participants were to judge whether the puppet's statement correctly described the situation of the summary picture. They were asked to answer 'yes' (=true) when what the puppet said was right and 'no' (=false) otherwise. They were also asked to justify their responses if they answered 'no'.

Participants were tested individually in a dedicated room at their school. The experiment was divided into two sessions, each of which lasted approximately 25 minutes. The second session took place one week after the first session. Both sessions were preceded by two practice sentences that elicited two different truth values to familiarize children with answering 'yes' and 'no'.

3.5.3 Material

As described above, I constructed two types of experimental sentences with post-verbal *only*: embedded NP sentences and parallel NP sentences:

(15) a. **embedded NP sentence (N1 *about* N2)**
Toto bought **[**only a book *about* Mickey Mouse**]**.
b. **parallel NP sentence (N1 *to* N2)**
Toto brought **[**only a book**] [***to* Mickey Mouse**]**.

Again, *only* in embedded NP sentences associates either with the first noun (N1=*book*) or the second noun (N2=*Mickey Mouse*) in (15a). For this sentence type, transitive verbs requiring only a direct object were employed, such as *buy*, *see*, and *write.* The parallel NP sentences, however, contain two independent phrasal constituents after the verb, and the scope of *only* is restricted to the N1. Thus, this type of sentence is constructed around a ditransitive verb—for instance, *bring*, *show*, and *give*—with a direct object involving N1 and an indirect object involving N2. In both types of experimental sentences, the first noun was consistently inanimate while the second was always animate.

I created four kinds of contexts for the target sentences. Participants judged sentences with post-verbal *only* to be either true (=yes) or false (=no) in these contexts. As shown in table 3.4, the first two contexts were presented to participants with an embedded NP sentence. The contexts were manipulated to produce different truth values, depending on which one of the two nouns is preferentially associated with *only* and is in focus. If children identify N1 as the focus in context 1, the target answer to the embedded sentence should be 'yes'; however, if they interpret N2 as focus, the answer should be 'no'. The true/false pattern of context 1 was reversed in context 2. Contexts 3 and 4 were combined with a parallel NP sentence. In context 3, if children have a narrow preference

for *only* to associate with N1 as the focus, the target answer to the parallel NP sentence should be 'yes'; however, if children interpret N2 as the focus, the answer should be 'no'. The target response pattern in context 3 was the reverse of the one in context 4.

Conditions	Sentence types	Contexts	Target answers
condition1	*embedded NP sentence* (N1 about N2)	Context1	If N1 is focused →Yes If N2 is focused → No
condition 2	*embedded NP sentence* (N1 about N2)	Context2	If N1 is focused → No If N2 is focused → Yes
condition 3	*parallel NP sentence* (N1 to N2)	Context3	If N1 is focused →Yes If N2 is focused → No
condition 4	*parallel NP sentence* (N1 to N2)	Context4	If N1 is focused → No If N2 is focused → Yes

<Table 3.4. Four conditions>

Each context was constructed based on three kinds of information, after the general background information about characters, places, and so forth was given to participants. The first piece of information always provided the proposition that the main character carried out the action mentioned in the sentence. However, the two following pieces of information are concerned with N1 and N2, respectively. Depending on which noun is associated with *only*, either an N1-based piece of information or an N2-based piece of information crucially affects participants' truth value judgments.

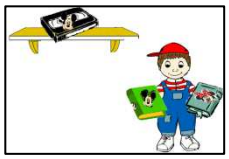
The four types of contexts are illustrated in the samples below. As shown in context 1, for the embedded NP sentence (e.g., *Toto bought only a book about Mickey Mouse*), the main character, Toto, initially performs the action denoted by the test sentence (buying a book about Mickey Mouse). He doesn't buy anything else about Mickey Mouse (e.g., a video about Mickey Mouse). However, he does buy a book about someone else (a book about Minnie). If participants understand the sentence with *only*

restricted to N1 (*a book*), an N1-based contrast is to be made between *a video about Mickey Mouse* and *a book about Mickey Mouse*. The response should be 'yes' since Toto didn't buy a video about Mickey Mouse, but just a book about Mickey Mouse. In contrast, if participants associate *only* with N2 (*Mickey Mouse*), they should make an N2-based contrast between *a book about Mickey Mouse* and *a book about Minnie Mouse*. The response consequently should be 'no' because Toto bought not only a book about Mickey Mouse but also a book about Minnie Mouse.

Example of Context 1

Toto went to Disneyland and saw a shop selling Disney toys. He decided to look inside.

He bought a book about Mickey Mouse. The store worker said to him, "How about a book about Minnie Mouse too? It is on sale!" Toto didn't need it but it was very cheap, so he also bought the book about Minnie Mouse.

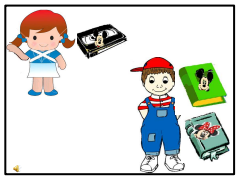


He wanted to buy a video about Mickey Mouse. There was one left in the store. But just when he was about to take it off the shelf, a girl came and wanted to buy it, too.

Toto felt like helping her so he didn't buy that video about Mickey Mouse.

- Hey Smurf, tell me something that happened at the shop.

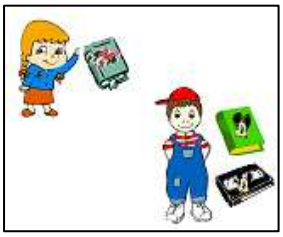
<Summary picture>



- puppet (Smurf): Okay, I can do that. ***Toto bought only a book about Mickey Mouse.***
- target answer: **Yes** if N1 'book' is focused or
  No if N2 'Mickey Mouse' is focused

In context 2, the main character, Toto, carries out the action in the sentence (buying a book about Mickey Mouse). However, unlike in context 1, Toto buys something else about Mickey Mouse (a video). But he doesn't buy a book about anyone other than Mickey (he doesn't buy a book about Minnie). In this context, if participants associate *only* with N1 (*a book*), they should answer 'no' in response to the test sentence because he bought not only a book but also a video. Conversely, if *only* is associated with N2 (*Mickey Mouse*), the target response should be 'yes' since he didn't buy anything else other than a book about Mickey Mouse.

Example of Context 2



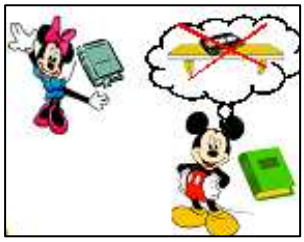
Story: Toto went to Disneyland and found a shop selling Disney toys. He decided to look inside. He wanted to buy a video about Mickey Mouse, but there were none left in the store. Just when he was about to look for something else, though, the store worker brought in a box filled with new videos about Mickey Mouse, so Toto bought one. Toto also bought a book about Mickey Mouse. The worker said to him, "How about a book about Minnie Mouse? It is very popular these days!" Toto would have loved to read the book, but a girl came and wanted to buy it, too. So, he didn't buy a book about Minnie Mouse.

- Hey Smurf, tell me something that happened at the store.

- puppet (Smurf): Okay, I can do that. ***Toto bought only a book about Mickey Mouse.***
- target answer: **No** if N1 'book' is focused
  Yes if N2 'Mickey Mouse' is focused

Contexts 3 and 4 were created in the same fashion as contexts 1 and 2. As illustrated in the example for context 3 (below), the situation described is that the main character, Toto, performs an action denoted by the sentence (bringing a book to Mickey Mouse). But Toto doesn't bring anything to Mickey other than the book. However, he also brings a book to Minnie Mouse. If participants understand the sentence with *only* restricted to N1 (*a book*), the response should be 'yes' because Toto didn't bring anything other than a book to Mickey Mouse. In contrast, if participants associate *only* with N2 (*Mickey Mouse*), they should consider the sentence 'no' since Toto brought a book not only to Mickey Mouse but also to Minnie Mouse.

Example of Context 3



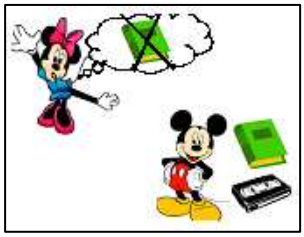
Story: Toto had a plan to meet his friends, Mickey Mouse and Minnie Mouse at the school. He decided to bring two books and a video to give to them. He was late for the meeting, so he hurried to pack the gifts into his bag. Toto met Mickey Mouse and wanted to give the video to him, so he checked his bag. However, there was no video in it. He felt very sorry that he hadn't brought the video for Mickey Mouse. There was a book in the bag, though. Toto was so glad that he was able to give the book to Mickey Mouse. Then Toto wanted to give the other book to Minnie Mouse. However, he couldn't find it in his bag. Toto checked the bag one more time and finally found the book. Toto was so glad that he was able to give the book to Minnie Mouse.

- Hey Smurf, tell me something that happened to Toto.
- puppet (Smurf): Okay, I can do that. ***Toto brought only a book to Mickey Mouse.***
- target answer: **Yes** if N1'book' is focused
  No if N2 'Mickey Mouse' is focused

In context 4, the main character, Toto brings a video to Mickey Mouse as well as a book to Mickey Mouse. However, he doesn't bring a book to anyone other than Mickey

Mouse. If participants associate *only* with N1 (*a book*), they should answer 'no' in response to the test sentence. Conversely, if N2 is in focus, the test sentence should be considered 'yes'.

Example of Context 4



Story: Toto had a plan to meet his friends, Mickey Mouse and Minnie Mouse in the school. He decided to bring two books and a video to give to them. He was late for the meeting, so he hurried to pack the gifts into his bag. Toto met Mickey Mouse and wanted to give the video to him, so he checked his bag. However, he couldn't find it in his bag. Toto checked the bag one more time and finally found the video. Toto also gave one of the books he'd brought from home to Mickey Mouse. Toto was so glad that he was able to give the book and the video to Mickey Mouse. Then Toto wanted to give the other book to Minnie Mouse. However, when he checked the bag, there was no book in it. Toto felt sorry that he had forgotten to bring the other book from home.

- Hey Smurf, tell me something that happened to Toto.
- puppet(Smurf): Okay, I can do that. ***Toto brought only a book to Mickey Mouse.***
- target answer: **No** if N1 'book' is focused
  Yes if N2 'Mickey Mouse' is focused

All four contexts involve 'plausible deniability'. Each context can be judged to be either true or false, depending on which noun is identified as the focus in the experimental sentences. In order for children to consider a statement with *only* to be true, the false version of the statement is considered in the story. For a false answer, the true version of the statement is also considered in the story. Each context consisted of a series of picture stories for each context. Participants were instructed to judge whether experimental sentences with *only* describe the last, summary picture of the story. The summary pictures depicted all the information involving N1 and N2 that had been mentioned in the story. To ensure that children's performance was not affected by the

complexity of the summary pictures, participants were asked to answer simple yes/no questions about what happened related to N1 and N2, such as *Whom did Toto bring a book to?* or *What did Toto bring to Mickey Mouse?*

As in Experiment 1, sentences without *only* (e.g., *Toto bought a book about Mickey Mouse*), for which the correct response was always "true" were included , served as control item. In addition, in order to investigate children's ability to answer 'false' when a sentence was false, filler items without *only* were created. Three tokens for each condition (see table 3.4) were created, resulting in 12 target trials that were interspersed among six control items plus six fillers. The final list of sentences with a total of 24 trials was divided into two sessions, each of which consisted of 12 trials (six experimental items, three control items, and three filler items). The sentences in each of the two sets were pseudo-randomized. All test sentences across conditions are listed in table 3.5.

Context types	**Sentence types**	**Test sentences**
context 1	embedded NP sentence	*Toto bought only a book about Mickey Mouse.*
context 2		
context 3	parallel NP sentence	*Toto brought only a book to Mickey Mouse.*
context 4		
context 1	embedded NP sentence	*Bear saw only a movie about Rabbit.*
context 2		
context 3	parallel NP sentence	*Bear showed only a movie to Rabbit.*
context 4		
context 1	embedded NP sentence	*Dora wrote only a song about Donald.*
context 2		
context 3	parallel NP sentence	*Dora gave only a song to Donald.*
context 4		

<Table 3.5. All test sentences in conditions>

All auditory materials were read by a female native speaker of English with phonetic training and prerecorded using Audacity. To minimize the potential effect of prosody on children's determination of focus between the two nouns, the reader was

instructed not to place a more prominent pitch accent on one noun than the other. There were two ways to control the prosody on the two nouns. First, the reader could avoid any prosodic prominence on both nouns. In this case, however, the target sentences sounded very awkward and unnatural to participants. Therefore, we chose the second alternative: all experimental sentences containing *only* had so-called broad focus on the two nouns. That is, the two potential nouns had almost the same degree of prosodic salience. To make sure that the two nouns were comparably prominent, the amplitudes of the two nouns were measured by Audacity.

Participants were allowed to listen to each sentence as many times as they wanted to before providing a truth value judgment for each sentence. To ensure that the participants paid attention to the task and understood the story correctly, all experimental sentences and half of the fillers were followed by a content-based question of the type *What did Bear buy?*, which was also presented auditorily.

3.5.4 Predictions

Table 3.6 shows children's predicted responses to the embedded NP sentences and the parallel NP sentences in light of the c-command constraint. If children's focus identification for *only* is subject to the c-command constraint, there will be a contrast in answer patterns between the two sentence types. For the embedded NP sentences, children will associate *only* with either N1 or N2 in contexts 1 and 2. Note, though, that the association of *only* with either noun does not provide crucial evidence as to whether or not children associate *only* with constituents outside of its c-command domain, since both nouns are within its c-command domain. This is why we need the parallel NP

sentences: the elicited responses to the parallel NP sentences in contexts 3 and 4 can help to determine whether the children's *only* interpretation is subject to the c-command constraint. Since only N1 is in the c-command domain of *only* in contexts 3 and 4, children with the c-command constraint will restrict the focus exclusively to the N1 in both contexts.

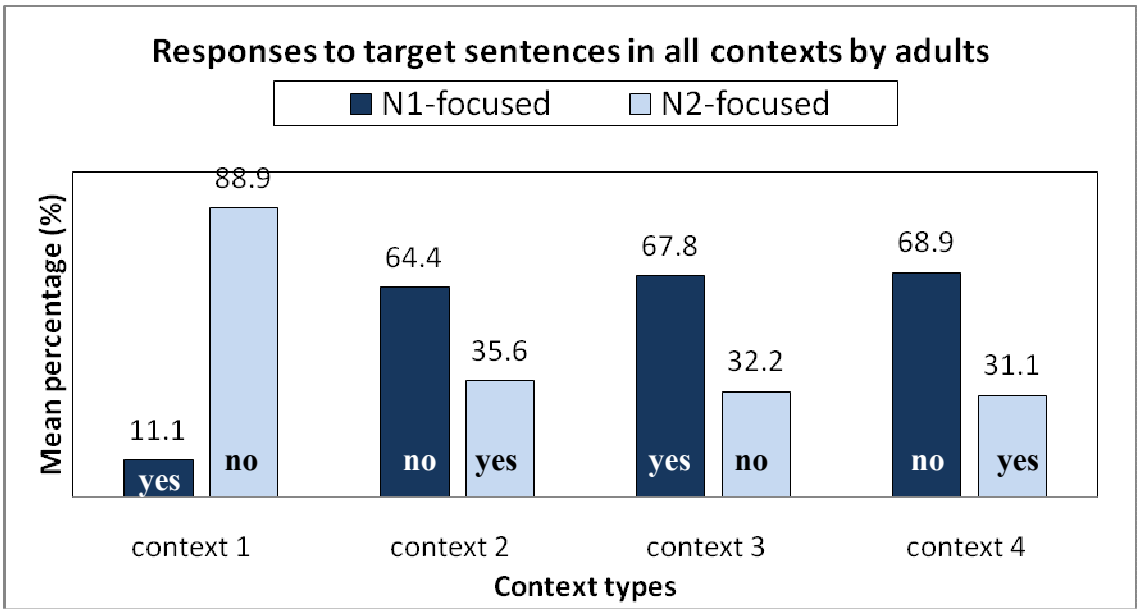
If children are not subject to the c-command constraint when identifying focus, they are more likely to treat the two sentence types identically. They will then willingly associate *only* with N2, a constituent outside of the c-command domain of *only*, in the parallel NP sentences.

Sentence types	**Context**	**Target answer**		**Predictions**	
				If N1 is focused	**If N2 is focused**
embedded NP condition (N1 about N2)	Context 1	If N1 is focused	Yes	Yes	No
		If N2 is focused	No		
	Context 2	If N1 is focused	No	No	Yes
		If N2 is focused	Yes		
parallel NP condition (N1 to N2)	Context 3	If N1 is focused	Yes	Yes	***No**
		If N2 is focused	No		
	Context 4	If N1 is focused	No	No	***Yes**
		If N2 is focused	Yes		

<Table 3.6. Predictions for four contexts>
(The symbol * indicates the violation of c-command)

3.5.5 Results

Figure 3.6 shows how the adults responded to the test sentences across all contexts. The adults showed different patterns in focus identification for the two types of sentences.



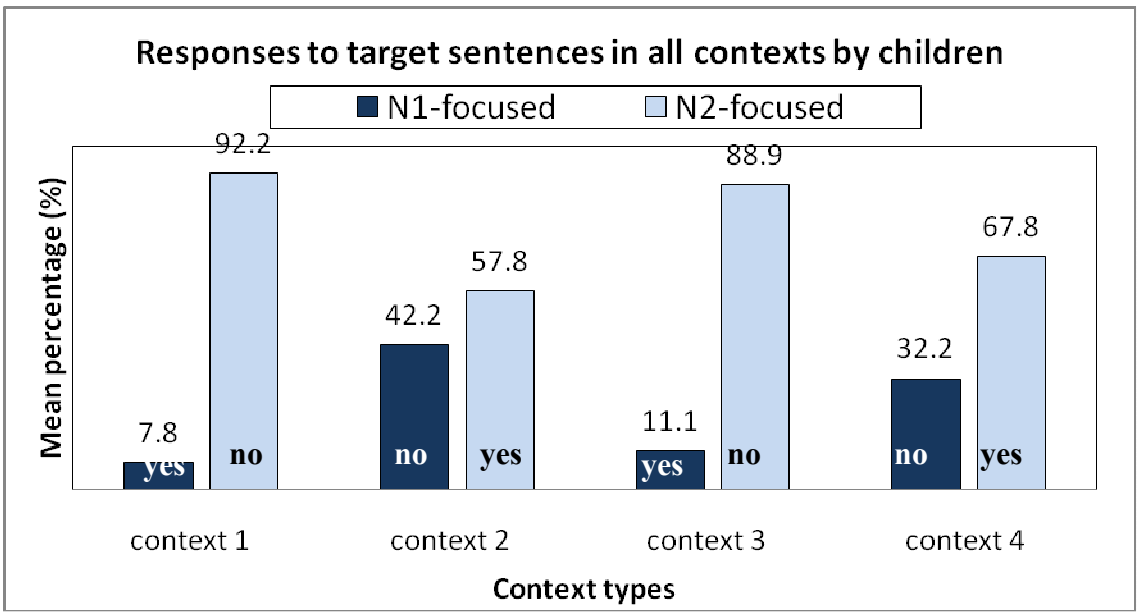
	context 1	context 2	context 3	context 4
N1-focused	11.1% (10/90)	64.4% (58/90)	67.8% (61/90)	68.9% (28/90)
N2-focused	88.9% (80/90)	35.6% (32/90)	32.2% (29/90)	31.1% (62/90)

<Figure 3.6. Adults' responses to test sentences>

For the embedded NP sentences, the adults adopted the N2-focused analysis 88.9 percent of the time in context 1, but opted for the N1-focused analysis 64.4 percent of the time in context 2. As predicted, since both the N1 and the N2 are in the c-command domain of *only*, the adults can access either as the focus. On the other hand, in the case of the parallel NP sentences, they usually adopted the N1-focused analysis in both contexts 3 and 4: they associated *only* with N1 67.8 percent of the time in context 3 and 68.9 percent of the time in context 4. The scope preference toward N1 in contexts 3 and 4 is also predicted in the adult group because N1 is the only constituent within the c-command domain of *only*. These results therefore show that adults, being subject to the c-command constraint, are sensitive to the difference in sentence types and determine the focus of experimental sentences accordingly. From the overall scope analysis across the

contexts, it is clear that the adults preferred to adopt the N1-focused analysis rather than the N2 interpretation, as shown in contexts 2, 3, and 4. A fairly strong preference for the N2-focused analysis in context 1 will be discussed in more detail in the discussion section.

As illustrated in figure 3.7, the children differed from the adults with regard to the choice of focus in the two sentence types.



	context 1	context 2	context 3	context 4
N1-focused	7.8% (7/90)	42.2% (38/90)	11.1% (10/90)	32.2% (29/90)
N2-focused	92.2% (83/90)	57.8% (52/90)	88.9% (80/90)	67.8% (61/90)

<Figure 3.7. Children's responses to test sentences >

Despite the structural difference between two sentence types in light of the c-command constraint (as shown in figures 3.5a and 3.5b above), the children showed a similar pattern in responding to them. For the embedded NP sentences, they adopted the N2-focused analysis in contexts 1 and 2 (92.9% and 57.6%, respectively). The same is true of the parallel NP sentences: they showed a strong preference for the N2-focused analysis in contexts 3 and 4 (89.9% and 67.7%, respectively). This high rate of the N2-

focused analysis in contexts 3 and 4 provides definite evidence of their apparent violation of the c-command constraint.

The consistently occurring pattern in the child group across all the conditions is that they were more likely to associate *only* with N2 than with N1, unlike the adults, who preferred to identify *only* with the linearly proximate noun. Of special interest is the contrast between responses for contexts 1 and 2: the rate of the N2-focused analysis in context 2 (57.6%) was considerably lower than in context 1 (92.9%). Put another way, the rate of N1-focused analysis was dramatically higher in context 2 than in context 1 (42.4% versus 7.1%). The same tendency was also witnessed in contexts 3 and 4: there was a higher rate of the N1-focused interpretation in context 4 than in context 3. The reason they reached for the N1-focused interpretation in contexts 2 and 4 will be discussed in relation with contextual effect in the next section.

3.5.6 Discussion of Experiment 2

Overall, adults differed from children in focus identification. They also exhibited different focus interpretations depending on sentence type (embedded NP sentences vs. parallel NP sentences). For the embedded NP sentence, they adopted the N2-focused analysis in context 1 but the N1-focused analysis in context 2. Given that both N1 and N2 are in the c-command domain of *only* in the embedded NP sentences, the adults' association of *only* with either of the NPs makes sense. The only thing that needs to be explained further is why they associated *only* with N2 in context 1 and with N1 in context 2, but not vice versa. In other words, why did adults generally not associate *only* with N1

in context 1 or with N2 in context 2? I propose that this tendency might derive from particular features of contexts, which influenced their choice of focus.

For embedded NP sentences, like *Toto bought only a book about Mickey Mouse*, context 1 depicted the situation where the main character, Toto, bought two objects, *a book about Mickey Mouse* and *a book about Minnie Mouse*. According to adults' justifications, they naturally paid attention to what objects the main character was involved with in carrying out the action denoted by the sentence. That is, the primary concern to participants was what Toto bought, and they were easily able to build a contrast set based on the two objects that Toto had bought. In context 1, the phrase *a book about Mickey Mouse* contains one referent that is also contained in the phrase *a book about Minnie Mouse*: both phrases refer to a book. So adults naturally made an N2-based contrast between *Mickey Mouse* and *Minnie Mouse*, with the N1-based information, *a book*, remaining constant. Under the assumption that the adult grammar allows the association of *only* with either of the nouns as the default setting, this N2-based contrast is likely explained by psychological salience, which led the adults to the N2-focused analysis. Meanwhile, in context 2, Toto bought not only *a book about Mickey Mouse* but also *a video about Mickey Mouse*. This helped the adults to make an N1-based contrast between *a book* and *a video* with the N2-based information, *Mickey Mouse*, remaining consistent. Prompted by the salient N1-based contrast, the adults were more likely to derive the N1-focused interpretation.

If such contextual effect on focus identification were the only factor at play in adults' comprehension of the parallel NP sentences, one would expect the N2-focused analysis to predominate in context 3 and the N1-focused analysis to predominate in

context 4. However, regardless of context types, adults identified N1 as the focus in both contexts 3 and 4. This suggests that adults are able to employ a different strategy for focus identification depending on sentence types, by obeying the c-command constraint.

In contrast to adults, children largely adopted the N2-focused analysis regardless of sentence type. This indicates that children might have a default scope preference toward N2 in determining the focus of test sentences. However, despite the general preference for the N2-focused analysis, the rate of N1-focus was higher in context 2 (42.4%) than in context 1 (7.1%) for the embedded NP sentences. A similar preference for the N1-focused analysis was also observed in context 4 (32.3%) when compared to context 3 (10.1%) for the parallel NP sentences. The cause of these preferences toward an N1 might be attributed to contexts, which may influence children in a similar way to adults and lead to the perception of an N1-based contrast in contexts 2 and 4. Clearly, though, contextual information couldn't override their default preference (N2-focused analysis). This indicates that children could integrate contextual information to adopt a focus interpretation other than the default one, but in a limited way.

There is another way for participants to be able to identify focus when interpreting experimental sentences. They might restrict the scope of *only* to the VP as a whole, including N1 and N2. In this case, *only* in a postverbal position is evaluated as if it were in a preverbal position, as in (16a), *Toto only bought a book about Mickey Mouse*, for the embedded NP sentences and (16b), *Toto only brought a book to Mickey Mouse*, for the parallel NP sentences.

(16) a. embedded NP sentence (N1 *about* N2)
Toto **only [**bought a book *about* Mickey Mouse**]**.

b. parallel NP sentence (N1 *to* N2)
Toto **only** [brought a book *to* Mickey Mouse**]**.

If children make this type of VP-oriented scope spreading errors, how will it be manifested in their answer pattern? The embedded NP sentences, as in (16a), will be interpreted as Toto didn't do anything other than buy a book about Mickey Mouse; the parallel NP sentences, as in (16b), will be interpreted as Toto didn't do anything other than bring a book to Mickey Mouse. Thus, if Toto carried out any action other than the action denoted by the test sentence, the experimental sentences should be judged to be 'no'. With this in mind, note that pictures employed in the task were always describing Toto carrying out not only the action denoted by the sentence but also another action not denoted by the sentence. Thus, children who interpreted a postverbal *only* as a preverbal *only* would have to produce the answer 'no' across all contexts. However, this was not what happened in all of the contexts. Children produced more 'yes' answers than 'no' ones in contexts 2 (56.6%) and 4 (67.7%).

Nevertheless, whenever children gave a 'no' answer, the possibility of this scope-spreading error remains one of the possible interpretive strategies. Consider contexts 1 and 3, for which the children produced a high rate of 'no' answers. It means that the same 'no' answers may have been produced for different reasons: either the scope of *only* was confined to N2 (henceforth NP scope analysis) or the scope of *only* was restricted to the VP as a whole (henceforth VP scope analysis). The reason why two scope analyses inevitably call for the same answer lies in their semantic relationship. As mentioned earlier, for the NP scope analysis, the sentence is true if the only book Toto bought was

the one about Mickey Mouse. Under the VP scope analysis, however, the sentence is true if the only thing Toto did was buy a book about Mickey Mouse. The main point in the semantic relation between the NP scope and the VP scope is that for Toto not to do anything other than buy a book about Mickey Mouse (VP scope) entails that he did not buy any book other than a book about Mickey Mouse whereas the reverse (for NP scope) does not hold (Paterson et al., 2006). Thus, the analysis with focus on the VP is possible in a subset of the circumstances in which the analysis with focus on the NP is possible. To carry this further, if 'no' answers produced by children in contexts 1 and 3 are consistent with the NP scope analysis, they should be consistent with the VP scope analysis as well. The fact that the 'no' answer is compatible with both scope analyses undermines my confidence in the conclusion that the 'no' answers across the four contexts are all due to the N2-focused analysis.

In sum, the children appeared to treat embedded NP sentences and parallel NP sentences in a similar fashion when it comes to identifying focus. Regardless of sentence types, they exhibited a default preference for N2.

3.6 General Discussion of Experiment 1 and Experiment 2

Previous studies on children's acquisition of *only* employed a variety of sentence constructions and reported different results. In general, children correctly analyzed the scope of *only* for intransitive constructions (e.g., *Only Tigger was under the tent*) (Notley et al., 2009) whereas they misanalyzed the scope of *only* for transitive constructions (Crain et al., 1992, 1994; Notley et al., 2009) and dative constructions (Gualmini et al., 2003). As demonstrated in the results of Experiment 1, children showed a strong

tendency toward the object scope interpretation for both pre-subject *only* and pre-object *only* sentences. The main finding of Experiment 2 was that children consistently associated *only* with N2 in both the embedded NP sentences and the parallel NP sentences. Although N2 was not in the c-command domain of *only* in the parallel NP sentences, children adopted the N2 interpretation to a high degree. Based on my results, together with the findings from previous studies, it seems that children have a default interpretive strategy that assigns scope in a way that associates *only* with the last noun in the utterance, even when this violates the c-command constraint. In (17), I provide examples of this strategy from the three studies mentioned above and from my two experiments:

(17)

Previous studies:

Crain et al. (1992)

Only the cat is holding a flag.

Gualmini et al. (2003)

The Troll *only* brought an onion ring to Superman.

Notley et al. (2009)

Only Mr. Pig got a silver coin.

My study:

Experiment 1:

Only Red Bear bought a balloon.

Red Bear bought *only* a balloon.

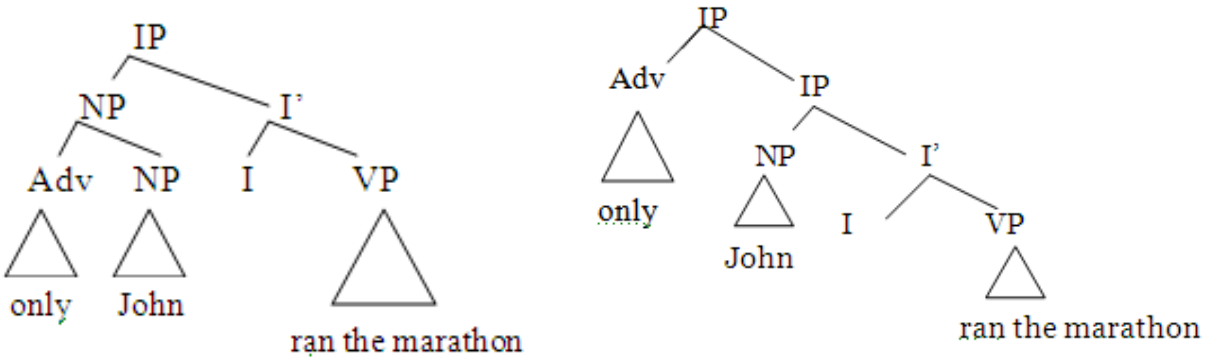
Experiment 2:

Toto bought *only* a book about Mickey Mouse.

Toto brought *only* a book to Mickey Mouse.

A possible explanation for this pattern of responses is that children adopt a non-orthodox structural analysis for the sentence types used as test items. Notley et al. (2009) was the first to propose a 'misattachment analysis' along these lines, suggesting that children initially analyze focus adverbs as having sentential scope, as illustrated in figure 3.8b.

<Figure 3.8. Tree structures of two syntactic analyses>



a. Traditional syntactic analysis b. Notley et al.'s (2009) analysis

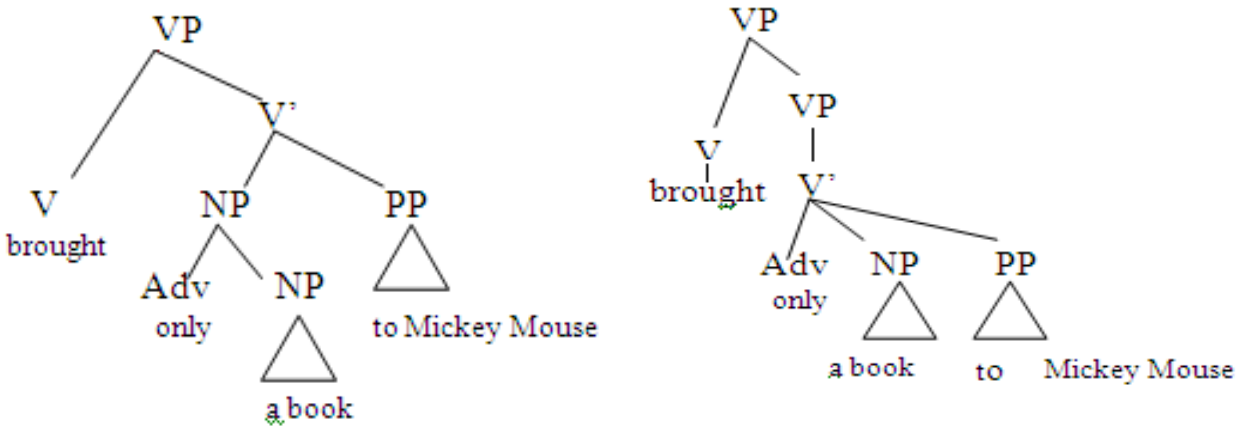
In the traditional syntactic analysis illustrated in figure 3.8a, *only* has scope over just the subject NP, which is the only constituent that it c-commands. On Notley et al.'s proposal, illustrated in figure 3.8b, however, *only* has scope over both the subject NP and the VP, since the VP is placed in the c-command domain of *only.*

Notley et al.'s suggestion offers a partial explanation for the results of Experiment 1: children are able to associate pre-subject *only* with the object constituent without violating the c-command constraint because they have adopted syntactic representations in which the entire VP is in the scope of *only*. Crucially, however, this does not explain

why children actually prefer the direct object interpretation (remember that the subject NP is also in the c-command domain of *only*), nor is there any proposal for how children eventually arrive at the correct syntactic structure.

These problems notwithstanding, Notley et al.'s suggestion is also potentially relevant to Experiment 2, in which children incorrectly allowed *only* to have scope over the second NP in parallel NP patterns such as *Toto brought only a book to Mickey Mouse*. The availability of this interpretation would follow automatically if *only* were 'misattached' in the manner illustrated in figure 3.9b, placing both complement NPs in its c-command domain.

<Figure 3.9. Tree structures of two attachment analyses>



a. Traditional attachment analysis for parallel NP sentence

b. Misattachment analysis for parallel NP sentence

The possibility of misattachment must be considered in tandem with the possibility of prosodic effects. According to Reinhart's (2006) interface theory (referenced above), the focused constituent of a sentence must bear the nuclear stress of the phrase, which is generally expressed by the intonation center (rising-fall). A sentence

typically contains a default prosodic structure, with the last noun phrase of the utterance bearing the nuclear stress of the sentence. The most prominent stress falls on the most deeply embedded constituent. In a VO language such as English, the direct object receives main stress. Not only an actual focus but also a set of constituents bearing this nuclear stress can serve as the focus. One member of the focus set is selected as the actual focus of the sentence when a context is given pointing to that member as the focus. In a sentence like *John only gave Superman a banana,* the rightmost NP, the secondary object, bears nuclear stress, so the focus set consisting of constituents containing the main stress are the secondary object NP and the full VP as shown in (18a).

(18) a. default prosodic structure:
John only [gave Superman [a **banana**]$_{NP}$]$_{VP}$
(focus set: secondary object NP and VP)

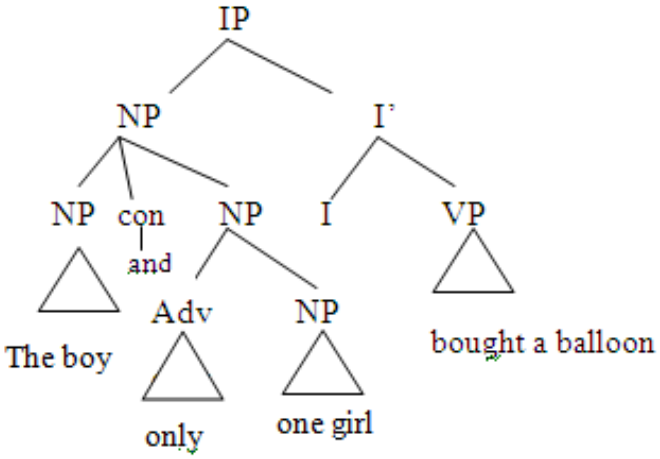
a. stress-shifted structure:
John only [gave [**Superman**]$_{NP}$ a banana]$_{VP}$
(focus set: primary object NP and VP)

However, if a constituent other than the last noun is focused, as in (18b), *John only gave **Superman** a banana*, a stress shift should occur. The sentence with the primary object prosodically stressed manifests a stress shift, which leads to the computing of a focus set for the primary object NP and VP as in (18b). When adults interpret sentences with *only* involving this stress-shift, they compare the focus set of the stress-shifted constituents (e.g., the primary object NP and VP) and the focus set of the neutral-stressed construction (e.g., the secondary object NP and VP). And then any constituents available as a focus with neutral stress should be filtered out to obtain the correct focus. So, in *John only gave **Superman** a banana*, the secondary object NP and VP are filtered out, leaving

the primary object NP. The deriving of the primary object as focus out of possible foci is called reference set computation. In contrast to adults, who have no difficulty identifying the focus of stress-shifted utterances, Reinhart (2006) argues that reference set computation is costly and difficult for children, who have limited memory resources to hold two focus sets in working memory. Unless context helps them override the default strategy, they tend to resort to the default interpretation: that is, direct object interpretation.

The prosodic analysis proposed by Reinhart (2006) is highly relevant to the results of Experiment 1 and Experiment 2 since it helps explain why children tended to associated *only* with the final NP in the sentence. Crucially, however, the prosodic analysis must assume either that children ignore the c-command constraint in some cases or that they misattach *only* in the ways suggested above, as prosodic factors are not supposed to override structural constraints.

One way to get at this issue more deeply suggested to me by William O'Grady might involve considering patterns such as those in figure 3.10, in which the possibility of a misattachment analysis is precluded by the inclusion of *only* in a coordinate subject NP.



<Figure 3.10. A proposed test structure>

If children respond to these sentences by allowing *only* to have scope over the direct object, it would suggest either an ignorance of the c-command constraint or a willingness to override it in response to prosodic considerations, such as the default assignment of focus to the final NP. On the other hand, if children correctly restrict the scope of *only* to one girl, we could conclude that when misattachment is impossible, children correctly apply the c-command constraint and give it priority over prosodic factors, just as adults do.

CHAPTER 4

DEVELOPMENTAL INVESTIGATION OF THE SCALAR PARTICLE *EVEN*

4.1 Previous research on scalar implicature

Despite extensive developmental investigation into the comprehension of *only*, to my knowledge, no study has been conducted to date on children's understanding of the semantic function of *even*. As noted earlier, unlike *only,* which simply evokes a contrast set, the introduction of *even* into a sentence causes speakers and addressees to construct a mental model in which alternative sets are ordered on a scale of likelihood or expectation in relation to the described event. The value of the *even* phrase is associated with the lowest ranked element on the likelihood scale. The fact that the scalar focus particle *even* requires such pragmatic sophistication gives rise to the prediction that children, with less pragmatic inferencing skill than adults, will be insensitive to such scalar implicature.

In order to investigate children's ability to understand the scaled meaning that *even* invokes, it is necessary to review the picture of development that emerges from previous studies concerning scalar words. The development of scalar implicature licensed by a variety of scalar terms has recently attracted experimental attention (Chierchia et al., 2001; Gualmini et al., 2001; Noveck, 2001; Papafragou & Musolino, 2003; Papafragou & Tantalou, 2004). A number of studies designed to test children's knowledge of scalar terms have discovered that computing scalar implicature is challenging.

The idea underlying scalar implicature in prior research is that the hearer evaluates what the speaker said against a set of ordered alternatives ranked in terms of information strength, given certain expectations about what the speaker intended to say

(Papafragou & Musolino, 2003). Grice (1989), who offered a comprehensive perspective of inferential communication, claims that communication is a cooperative enterprise governed by rational "expectations" (maxims) about how a conversational exchange should be conducted (Papafragou & Musolino, 2003). According to Grice's maxims, speakers are generally expected to make contributions that are informative and relevant to the goals of the conversation, and that appropriately phrase what they want to convey (Papafragou & Musolino, 2003). However, this expectation can be violated when the speaker uses a lower ranking term (weak term) from a range of items ordered with regard to informational strength. The use of the lower ranking word from the scale creates the implication that the speaker has no reason to employ the higher ranking one.

This well-known type of pragmatic inference is illustrated in the following example (19) containing *some*. The semantic meaning of *some* is *some and possibly all*. However, (20) can be derived on the basis of (19).

(19) Some top models are rich.

(20) Not all top models are rich.

This inferred meaning of *some* is *not all*. The hearer goes beyond what (19) encodes, with a spectrum of alternatives, that is, an informational scale <some, al> in his or her mind. Given that the speaker would have used the more informative term *all* (i.e., *All top models are rich*) if it were true, the use of the weaker term *some* indicates that this is not the case. Therefore, (19) implies that the speaker does not mean to refer to the whole of the group of models, but just to a subset (Monck, 1881:156).

Much work on scalar implicature uses a variety of expressions involving an informational scale defined in terms of entailment relations, such as quantifiers (*all*/*some*), numerals (*three*/*two*/*one*), modals (*necessarily*/*possibly*), connectives (*and*/*or*) and inchoative/completing verbs (*start*/*finish*) (Chierchia et al., 2001; Gualmini et al., 2001; Noveck, 2001; Papafragou & Musolino, 2003; Papafragou & Tantalou, 2004). These studies have primarily addressed two developmental questions: First, how are children able to derive the implicated meanings of these expressions? And, second, if children have limited awareness of scalar inferences, under what conditions can their ability to compute them be enhanced?

Chierchia et al. (2001) and Gualmini et al. (2001) tested preschoolers' interpretation of sentences with the disjunction operator *or* (e.g., *Every boy chose a skateboard or a bike*) in a context that made a statement containing *and* true (e.g., *Every boy chose a skateboard and a bike*). Since the two alternates in the scale < and, or > are licensed by an entailment relation, the stronger term *and* entails the weaker term *or*, but not vice versa. So the assertion with *A or B* is logically compatible with *A and B*; however, it is used to communicate *not A and B* pragmatically. While adults rejected the statement containing *A or B* in a context in which the statement with *A and B* was true, children accepted the statement containing *or* in such contexts. The results indicate that adults are sensitive to the implicature in contexts in which scalar implicature arises, but children show no sensitivity to it.

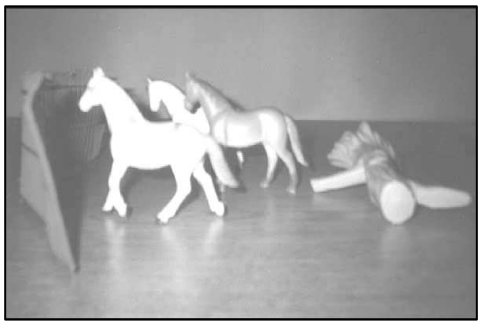
In a similar vein, children's difficulty with the computation of scalar implicature has been observed in research on the development of scalar implicature licensed by modal *have to/might*. Noveck (2001) examined how English-speaking children aged 7–9

interpret sentences containing these words, using a modal reasoning scenario. Children were asked to view three boxes, of which the first two were open while the last one was covered. The first open box had a toy parrot and a toy bear in it. The second open box had only a toy parrot in it. The children were informed that the third covered box would have the same content as either the parrot + bear box or the parrot-only box. A puppet presented statements containing *might* or *have to* about the covered box, and children were asked to say whether the puppet's claim was correct. When a statement containing *might* (i.e., *There might be a parrot* or *There might be a bear*) is true of either of the open boxes, it should be true of the covered box. However, when a statement with *have to* (i.e., *There has to be a parrot* or *There has to be a bear*) is false for either of the open boxes, it should be false for the covered box. The statement containing *might be* can be interpreted as being logically compatible with *have to* but pragmatically incompatible with it. The main finding was that the children treated *x might be y* as equivalent to *x has to be y* much more frequently than adults.

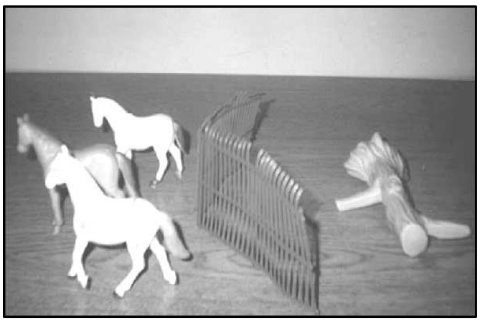
Considered together, the results of these studies offer support for the idea that children tend to attend to the semantic meaning before converging on the pragmatic meaning. Also, these studies leave open the question of whether children experience equal difficulty with the various scalar terms licensed by the entailment relation. Work by Papafragou & Musolino (2003) investigated the scope of 5-year-old Greek-speaking children's difficulty with a variety of scalar expressions such as quantifiers (*some*/*all*), numerals (*three*/*two*) and inchoative/completing verbs (*start*/*finish*), using a Truth Value Judgment Task. Children were presented with a statement containing the weaker terms in a context where the assertion with the stronger terms satisfied the truth conditions; for

example, *all* (e.g., *All of the horses jumped over the fence*), *three* (e.g., *Three of the horses jumped over the fence*) and *finish* (e.g., *The girl finished making the puzzle*). In the case of the *some*/*all* scale, the story described how three horses tried to jump over a fence, as shown in figure 4.1a, and noted that all three of them were successful in doing so, as in figure 4.1b. Because *some* gives rise to the implicature that not all horses jumped a fence, the statement containing *some* should be judged to be an infelicitous description of the story. While adults produced a high rejection rate to the sentence containing this infelicitous description, children didn't. A noteworthy observation emerging from these results is that children differed from adults in that their rejection rate on the numerical scale was reliably higher than on the two other scales. This result indicates that children are less attuned to implicature than adults but their apparent lack of sensitivity to scalar implicatures does not generalize to all scalar terms.

<Figure 4.1. Pictures of Papafragou & Musolino (2003)>



<Figure 4.1a>



<Figure 4.1b>

The conclusion that can be drawn from the results of these studies is that children are unable to deal with scalar inference. However, there remains the question of under what conditions children's performances with implicature can be improved. According to Papafragou & Musolino (2003), the reason for the low success rate of children's

computation of scalar implicature lies largely in two possibilities. One possibility is that children's difficulty in deriving scalar implicature is due to a genuine inability to deal with the phenomenon; the other is that the task design didn't get at what it was supposed to. In other words, the experimental tasks kept children from being able to compute scalar implicature. To adjudicate between the two possibilities, the first concern of the follow-up study by Papafragou & Musolino (2003) was to improve the task in order to enhance children's awareness of scalar implicature. They modified the task in two ways.

At the outset, children had not been aware of the goal of the task that required them to judge the "pragmatic felicity" of what the puppet said. Their performance might therefore reflect a misunderstanding about whether they should judge a statement made by a puppet as truth-conditionally right or wrong. To assist children in detecting pragmatic anomaly, the modified task included a training phase preceding the main task. For instance, children received a statement that was truth-conditionally right but pragmatically infelicitous, such as '*This is a little animal with four legs*' as the description of a dog. They were then asked whether they could say it better. This modified experiment worked under the principle that scalar inference can be produced when what the speaker said falls short of the hearer's communicative expectations. When only a reference to *all* satisfies the demands of the communicative situation, the presentation of a sentence with *some* causes the hearer to infer that the stronger term does not apply.

To illustrate, in a story where the main character, Mickey, tried to throw hoops around a pole, Minnie claims that Mickey is very good at throwing hoops around a pole. At the end of the story, Minnie made a statement like *Mickey put some hoops around the*

pole, after being asked "How did Mickey do?" This contextual help made children focus on Mickey's ability to throw "all" of the hoops around the pole. They were led to have communicative expectations about Mickey's ability to throw all of the hoops. However, what Minnie said was underinformative: the statement with *some* became the infelicitous description of this situation in which *all* should be used. The findings showed that children's rejection of the infelicitous description increased but still amounted to only about half, despite the contextual support. The results did not provide a conclusive answer regarding the locus of children's difficulty with the calculation of scalar implicature. Nevertheless, they point toward the possibility that the low success rate might be due to a flaw in the design of the experimental task rather than children's genuine inability to derive implicature.

In line with the finding of Papafragou & Musolino (2003), Papafragou & Tantalou (2004) explored another possible reason for failures in early implicature-calculation in children due to the specific characteristics of judgment tasks. Previous studies that documented children's limited awareness of SIs used an acceptability judgment of "weak" scalar expression (i.e., *some*) in contexts in which a stronger term (i.e., *all*) was warranted. Since this type of context can be compatible with the description of sentences containing weaker and stronger scalar term, children were not aware of what a speaker intended to communicate, thus failing to compute scalar implicature. Papafragou & Tantalou (2004) claimed that if a 'better task' were employed, children's ability to calculate scalar implicature could be enhanced. In order to motivate the computation of scalar implicature, Papafragou & Tantalou (2004) raised children's awareness of a speaker's communicative goal by constructing contexts in which stronger

scalar expressions would not be acceptable in an acceptability judgment of weaker scalar expressions.

To illustrate: a story described how an animal character, say, an elephant, needed to finish all the jobs that he had been assigned. This story line assisted children in building an expectation of informativeness, which requires the use of a more informative term *all.* The elephant then disappeared behind a screen and after a while reappeared. An experimenter asked the elephant whether he had finished the job (e.g., *Did you color the stars*?), and the elephant made a statement including a weak scalar expression like *some* (e.g., *I colored some*). Children were instructed to guess whether the animal characters had performed their jobs or not. The study reported that children produced a high rate of acceptance to sentences with *some* when contexts led them to notice that the animal character did not accomplish all the jobs. This result indicates that children show adult-like sensitivity to scalar implicatures if an appropriate task is used.

4.2 Previous studies on *even*

How children deal with scalar implicature in the comprehension of sentences with *even* has been underexplored to date. The first systematic investigation on how this device influences language comprehension in comparison with *only* was conducted by Filik et al. (2009). They were interested in how alternative information associated with focus particles is computed online in adults. The logic of the test is whether the information provided by the focus particles matches a reader's expectation as determined by the content of the text. As previously mentioned, *only* indicates that properties of a focus set are not shared by those of the alternative set, whereas *even* marks the focused

element as being low on a scale of alternatives ranked in terms of likelihood. Thus, *even* signals that what is being described is somewhat surprising. Whether the information triggered by the semantic properties of focus particles are congruent or incongruent with the event described by the sentence influences the felicitousness of the text. For example, consider the sentences in (21) and (22).

(21) a. Only students/ taught by the best teacher/ [passed examinations]$_{\text{critical region}}$ in the summer.

a. Only students/ taught by the worst teacher/ [passed examinations]$_{\text{critical region}}$ in the summer.

(22) a. Even students/ taught by the worst teacher/[passed examinations] $_{\text{critical region}}$ in the summer.

b. Even students/ taught by the best teacher/[passed examinations] $_{\text{critical region}}$ in the summer.

Passing the examination is considered to be more compatible with students taught by the best teacher than those taught by the worst teacher given our world knowledge. A teacher's quality determines whether students will pass the exam or not. When participants hear sentences as in (21), which contains *only*, a group of students who passed examinations is extracted from another group of students who did not in their mental representations. Student taught by the best teacher would be a highly likely set to pass the examinations. Since this focus set identified by *only* is congruent with the event described, sentence (21a) is judged to be felicitous whereas (21b) sounds awkward. However, with the minimal change of substituting *even* for *only*, the felicitousness of sentences in (22) is reversed. Since *even* signals an unexpected event, the students focused by *even* should be least likely to pass the exam. The information that the students

taught by the worst teacher passed the exam is surprising, which justifies the use of *even*. So, it becomes felicitous to state that students taught by the worst teacher passed the examination. On the other hand, sentence (22b) is perceived to be infelicitous.

To investigate how readers process sentence containing these two focus particles online, Filik et al. (2009) employed an eye-tracking paradigm. If there is incongruency between information provided and a participant's expectations, such disruptions can be reflected in the eye movements of adults. Experimental sentences were divided into analysis regions. The critical region contained a phrase (e.g., *passed the examination*) wherein it became apparent whether focus sets were a more or less likely set in relation to the event described by the sentence. When adults read the test sentences, the verb region *passed the examination* would be the first place where disruption occurs in *even* patterns.

The findings show that semantic information associated with focus particles is computed online but in a different way. For sentences with *only*, when the focus set was incongruent with events described, this incongruence appeared rapidly at the critical region. On the other hand, for sentences with *even*, this predicted effect was delayed until the postcritical region (e.g., *in the summer*), which shows that the semantic information associated with *even* had a later influence. This difference in time course reflects slower computation and evaluation of contrastive focus for *even* than for *only*.

The main finding of this study suggests that adults exhibit more processing costs in computing alternative sets online for sentences with *even* than for sentences with *only*. Although there has been no developmental research on how children understand the semantic interpretation of *even*, Filik et al. (2009) provides experimental evidence that the scalar particle *even* has a more complicated semantic function than *only*. Based on

this evidence, it is reasonable to predict that children might have more difficulty computing alternative sets for sentences with *even* than for sentences with *only*, as adults did. I conducted two experiments to investigate this matter.

4.3 *even* and methodology

As mentioned earlier, the use of the word *even* requires participants to employ pragmatic sophistication in order to compute scalar implicature. Based on prior studies that investigated children's understanding of focus particles, no absolute conclusions can yet be drawn as results varied depending on the type of task. Children's performance during the different experimental methods depended on whether the task provided contextual information that helped them make use of contrast information. In order to test children's ability to comprehend sentences containing *even,* the main concern for creating a task was to prevent the use of idiosyncratic pragmatic knowledge. Before introducing the logic of the newly created task for Experiment 4, I will explain how the semantic components of *even* can be relevant to the choice of experimental method. To begin, recall the three semantic components of *even* (see 2.2 (12) above).

(23) Even Bill likes Mary.

a. Bill likes Mary.

b. Other people besides Bill like Mary. (existential implicature)

c. Of the people under consideration, Bill is the least likely person to like Mary. (scalar implicature)

If people are given a sentence (23), the first semantic component, that Bill likes Mary, can easily be retrieved. Noticeably, this is equivalent to the proposition of the sentence without *even*. It demonstrates that the introduction of *even* into the sentence cannot influence the truth conditions of the sentence. Therefore, this semantic aspect of *even* cannot be isolated to examine children's knowledge about *even* when a task is solely manipulated on the basis of truth-false distinction.

The second semantic component of *even* in a sentence such as *Even Bill likes Mary* is that there are people other than Bill who like Mary. The word *even,* like additive focus particle *also*, indicates that a property of a focused expression is additive to the one of alternatives. As mentioned in the theoretical background section, the information in (23b) is not treated as a presupposition of (23) (Horn, 1969). So, (23b) doesn't have to be true. Put it another way, if someone utters (23) and is then informed that no one other than Bill likes Mary, (23) can be either true or false depending on the empirical evidence.

For example, given a context where there is no one other than Bill who likes Mary, parsers cannot accept the sentence *Even Bill likes Mary* as its correct description if they understand existential implicature. However, some parsers can build up their own discourse model in which there might be a person who likes Mary although he or she was not described in the context. This assumption can lead parsers to a 'true' answer, suggesting that *even* is context-dependent, vague and subjective in its meaning. Moreover, native speakers have no clear intuitions about or awareness of the relevant aspects of meaning. Thus, *even,* which allows speakers/hearers to construct a variety of discourse possibilities using their own pragmatic knowledge is not compatible with the methodology which fails to control participants' pragmatics in a more constrained way.

The last semantic component of *even* is the scalar meaning paraphrased in (23c), which evokes an order for the set of values under consideration. The value of the *even* phrase is associated with the lowest ranked element on the likelihood scale when it is used in a positive context. As illustrated in (23c), the sentence in question gives rise to the implicature that Bill is the least likely person to like Mary. Fauconnier (1976) supports this analysis, arguing that *even* evokes an end-of-scale. In other words, *even* indicates the existence of a pragmatic scale on which Bill is the lowest point (Fauconier, 1976:32). However, Kay (1990) provides a counterexample that does not necessarily produce end-of-scale expressions such as the following in (24).

(24) Not only did Mary win her first round match, she even made it to the semi-finals.

It seems clear that the focus marked by *even* is not end-of-scale. The acceptability of (24) depends on some special kind of context in which reaching the semi-finals, as against winning the tournament, is end-of-scale in a sense.

Fauconnier's analysis on end-of-scale can be applicable to (23c). Based on his observation, I can argue that if Bill in (23c) is the least likely to like Mary, the sentence would be perfectly fine. But if, however, Bill is the second least likely person to like Mary, the sentence would probably be fine as well in a certain discourse context. This example shows that scalar implicature of *even* can vary depending on a variety of discourse contexts that parsers construct in their own way. It suggests that owing to this pragmatic property of *even*, the experimental task has to create a well-constrained context in order to investigate children's scalar implicature.

4.4 Experiment 3

4.4.1 Participants

The participants in this experiment were a group of 30 English-speaking 4- to 5-year olds (mean age 4;47). Because previous studies on children's ability to derive scalar inferences have typically been concerned with this age group, preschoolers were chosen as an experimental group. Among the children, there were 16 4-years-olds and 14 5-year-olds.

The children who took part in this study were recruited from daycare centers located in Honolulu, Hawai'i. Parental consent for the children's participation was obtained prior to the tests. They were rewarded by a small snack box after the task. In addition, 30 adult English speakers who were undergraduate students at UHM served as a control group in the experiment. They participated in the study in exchange for a small bag of snacks or for credit in introductory courses in linguistics or psychology.

4.4.2 Methodology

Participants were tested individually using a task in the form of a "guess who game" whose basic architecture was suggested to me by William O'Grady. This research technique was newly created to investigate whether children are able to guess who performed an action using pragmatic knowledge derived from the story contexts. Participants were asked to listen to a prerecorded story while viewing a series of pictures presented as Microsoft Office PowerPoint slides on a computer screen. At the end of the story, a certain character that had appeared in the story made a statement containing *even*. The children were asked to guess who the referent denoted by the *even* phrase was,

choosing only one out of several characters depicted in the story. They were instructed either to point on the computer screen to the character that they guessed or to say who they guessed, and to explain why they made that choice.

It took about 30 minutes for a participant to finish the whole test, which was divided into two sessions, each of which lasted approximately 10 minutes, with a 10-minute interval between them. Before the main task began, in an initial training phase, children were presented with two warm-up stories designed to familiarize them with the guessing task.

4.4.3 Materials

Two types of target sentences were constructed with *even* in a pre-subject position: one type without negation, as in (25a) (henceforth affirmative pre-subject *even*), and the other type with negation, as in (25b) (henceforth negated pre-subject *even*).

(25) a. Even Larry was able to reach the cookie. (affirmative pre-subject *even*)

b. Even Larry was not able to reach the cookie. (negated pre-subject *even*)

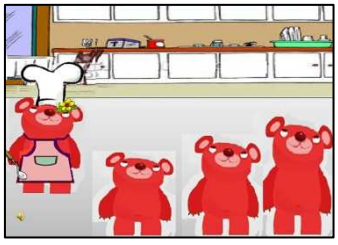
Participants were presented with contexts that provided a pragmatic feature relevant for the reasoning that they were supposed to be doing in interpreting sentences with *even.* As previously mentioned in section 4.3, it was necessary to control contexts in such a way that participants were led to use only explicit pragmatic features, such as the height or strength of the referent focused by *even*. The differences in such features were

closely associated with the likelihood of the agent being able to carry out the action denoted by the *even* sentences.

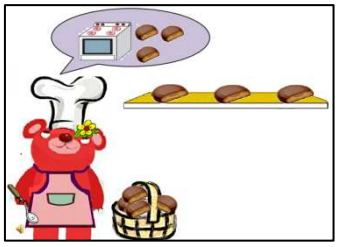
As shown in the sample contexts below, in the case of the cookie-reaching story, children were to use the height of the agent assigned to reach the cookie as a pragmatic feature to assist in their reasoning. The context depicted a situation in which three bears differed in height. Children's attention was drawn to the fact that the characters varied in height. In order to help children better notice the height difference of the characters, they were asked to point to the shortest bear and the tallest bear in the picture before the main story began. The purpose of this procedure was to enhance children's awareness of the fact that height determined the likelihood of any bear being able to reach the cookie. For an affirmative pre-subject *even,* Context 1 was created to depict a situation where three characters carried out an action even though one of them had not been expected to succeed in performing the action. The event in which the least likely referent performed the action was somewhat surprising, and therefore suitable with the use of *even*.

Sample material for Context 1

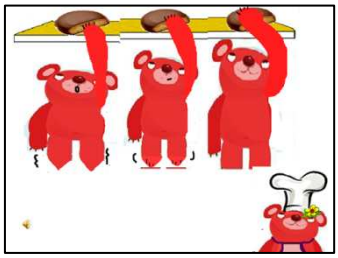
- **Sentence type:** pre-subject *even* **Target answer:** the shortest bear
- **Story**:



This story is about Mama Bear and her three sons. Look at the three sons. Each one has a different height. Who is the shortest one? Can you point to him? Who is the tallest one? Can you point to him?



Since Mama Bear wanted to know how high her sons could reach, she put three cookies on a shelf and then asked each of them to try to reach the cookies. Mama Bear said, "I made cookies for you guys. After all of you try to reach the cookies, let's have them together."



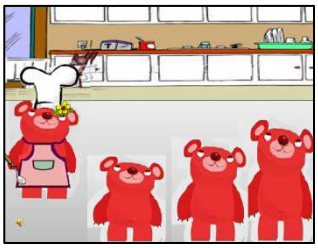
The three bears were very excited about eating the cookies. Each bear tried to reach the cookies on the shelf and managed to do so. Mama Bear said, "**Even Larry was able to reach the cookie**."

- experimenter: I don't know who Larry is. Can you point to Larry?

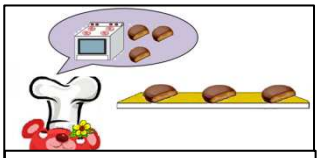
In the sample context shown above, reaching the cookie was considered more likely for the tallest bear than for the smallest bear. In other words, the shortest bear was the least likely to be able to reach the cookie and the tallest bear was the most likely to be able to reach the cookie. After hearing a target sentence like *Even Larry was able to reach the cookie*, adults would induce a set of alternatives; that is, a set of others who could reach the cookie along with the focused element, *Larry.* The alternatives are ranked on a scale of likelihood/expectation in relation to the reaching-cookie event. Since the focused element is ranked as being low on a scale of alternatives in terms of likelihood, the *even* phrase signals that the ability of the person to complete the described action is somewhat surprising. Therefore, adults should infer that Larry was the shortest bear and select a bear with such a feature in the picture.

Sample material for Context 2

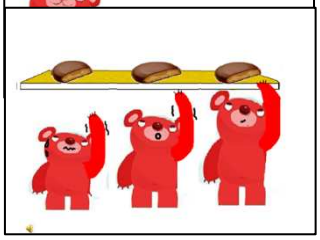
- **Sentence type:** pre-subject *even* + negation **Target answer:** the tallest bear
- **Story**:



This story is about Mama Bear and her three sons. Look at the three sons. Each one has a different height. Who is the shortest one? Can you point to him? Who is the tallest one? Can you point to him?



Since Mama Bear wanted to know how high her sons could reach, she put three cookies on a shelf and then asked each of them to try to reach the cookies. Mama Bear said, "I made cookies for you guys. After all of



Each bear tried to reach the cookies on the shelf, however, none of them could reach the cookies. Mama Bear said, "**Even Larry was not able to reach the cookie.**"

- experimenter: I don't know who Larry is. Can you point to Larry?

For negated pre-subject *even* sentences (e.g., *Even Larry was not able to reach the cookie*), contexts were constructed on the basis of a reverse logic in terms of the relation between the height of the agent and his/her likelihood of being able to perform the action mentioned in the sentence. Because the target sentence involved negation, the different heights of the agents could influence the likelihood of them being unable to perform the action. On encountering a negated pre-subject *even* sentence like *Even Larry was not able to reach the cookie*, adults should induce a set of alternatives who could not reach the cookie along with the focused element, *Larry*. As with the affirmative pre-subject *even* sentences, the alternatives are ranked on a likelihood scale in relation to the cookie-reaching event, but with the focused element *Larry* being ranked at the higher end of the scale. So *Larry* could be interpreted as being the one who had been most likely to be able

to reach the cookie, but unexpectedly was not able to perform the action. Context 2 was constructed based on this principle. It describes the situation in which none of the characters carried out the action, but one of them had been expected to succeed in performing the action. The event in which the most likely referent could not perform the action was unexpected, so it justifies the use of *even* in this context.

To ensure that children knew the function of *even,* sentences without *even* (e.g., *Larry was able to reach the cookie*) were interspersed with test sentences with *even*. They served as control sentences and were presented in the same contexts as were the test sentences with *even*. Due to the absence of *even* in control sentences, participants had no clue as to who performed the action, so they consequently had to rely on other grounds or to guess to decide on one character out of several. Fillers also did not contain *even*, so they looked the same as the control sentences in form. However, the fillers did not require children to engage in guessing in order to reach the intended interpretation. For instance, a filler sentence like *Larry was able to reach the cookie* was presented with a context providing a clear clue about who Larry was. For instance, as in the context used for test sentences*,* there were three bears differing in height. However, the filler context story depicted a situation in which only one bear could reach the cookie, whereas the other two bears couldn't reach it. The contexts combined with the filler sentences unambiguously led participants to select the right answer.

Three items for each condition (affirmative pre-subject *even* and negated pre-subject *even*) were created, resulting in six target trials. The test sentences were interspersed among six control sentences and six filler sentences. The task, consisting of a total of 18 trials, was divided into two sessions separated by a 10-minute interval. One

session tested affirmative pre-subject *even* sentences and the other session tested negated pre-subject *even* sentences. Each session was comprised of three test sentences, three control sentences, and three filler sentences. Participants were divided into two lists for the presentation order of the trials. For List 1, affirmative pre-subject *even* sentences were presented to participants first and negated *even* sentences followed. For List 2, negated pre-subject *even* sentences were presented to participants first and affirmative pre-subject *even* sentences followed.

Prior to the main experiment, children participated in a practice session to become familiar with how the task would proceed and what they had to do in the task. One type of item in the practice session was a sentence containing the exclusive focus particle *only*, in order to have a practice item similar in form to the experimental sentences with *even*. For instance, children heard a story about three men while viewing a series of pictures. At the end of the story, they heard a sentence containing *only,* such as *Only John ate an ice-cream.* Although the story did not provide any explicit clues about what John looked like, children were asked to guess who John was and to point to one of the three men. If children knew the function of *only* they would evoke the interpretation that no one other than John ate the ice-cream. Given a picture depicting three men, only one of whom had some ice-cream on his lips, they would draw an inference that the person with some ice-cream on his lips was more likely to be John than the others who had no ice-cream on their lips.

The other type of practice item in this training session involved sentences that did not contain any focus particles. Their purpose was to train participants in what to do when they encountered filler or control items that did not involve *even* in the main task.

The procedure was as follows: Children heard a story about three men, each of whom bought a box, while viewing a series of pictures. At the end of the story, children were presented with a picture depicting three men differing in height who were all successful in jumping to the ceiling, and then heard a sentence like *John jumped to the ceiling*. Though the story did not provide any identifying details about John, the children were asked to point to one of the three men in the picture. However, they were also informed that if they could not identify who the person in the sentence was, they did not have to choose anyone. The height difference among the three men could not invite any inference about which one was likely to be John, since all three men had successfully jumped to the ceiling. Nevertheless, if they made a choice, they would be instructed to justify their selection. Children were expected to provide a variety of justifications in accordance with subjective evaluations, such as *I don't know but I just feel like choosing this guy* or *Maybe the tallest one, because he might be stronger than the others*, and so forth.

Several aspects of the experimental design needed to be controlled in more detail. Contexts always depicting three characters allow the possibility that the presentation order of the three in the pictures could influence children's choices. To illustrate this possibility with the same cookie-reaching story, let us assume that the three characters were presented according to height, so that the shortest bear was always depicted on the far left of the picture, and the tallest bear on the far right, as in the sample picture on p. 91-92. In this case, the leftmost character in the picture would be discussed first and the rightmost one would be discussed last. With the assumption that the last-mentioned character (the tallest one) was likely to be cognitively more prominent than the first-mentioned character (the shortest one) this sequence might lead children to think that the

last character was pragmatically the most important of the three. This way of presenting the characters could increase the possibility of children choosing the rightmost character as the focused referent, despite the fact that their order in the picture was irrelevant to the guessing task. Therefore, the positions of the target characters in the pictures needed to be counterbalanced across the conditions. Target characters were therefore depicted either in the leftmost position or in the rightmost position of the pictures across the conditions.

Care was taken to ensure that different NPs occurred in matched control and test items. When asked to guess who Larry was for a test sentence such as *Even Larry was able to reach the cookie*, adults would find the smallest character able to reach the cookie to be Larry. On the other hand, control sentences without *even* such as *Larry was able to reach the cookie* allowed participants to select any of characters for Larry. Multiple characters could be identified as Larry in both test and control sentences, giving rise to confusion if participants perceived Larry to be the same person. Therefore, different names denoted by subject constituents were used in corresponding control and test items. The following table provides a list of the examples used in the real test.

Items	Conditions	Sentence type	Context type	Target answer
Item 1	condition1	affirmative pre-subject *even* i.e., *Even Larry was able to reach the cookie.*	Three characters reached cookies, but one character had been expected not to reach a cookie.	shortest character
	condition2	negated pre-subject *even* i.e., *Even Larry was not able to reach the cookie.*	Three characters didn't reach cookies, but one character had been expected to reach a cookie.	tallest character
Item 2	condition1	affirmative pre-subject *even* i.e., *Even Paul was able to grab an orange.*	Three characters grabbed oranges, but one character had been expected not to grab an orange.	monkey with shortest arms
	condition2	negated pre-subject *even* i.e., *Even Paul was not able to grab an orange.*	Three characters didn't grab oranges, but one character had been expected to grab an orange.	monkey with longest arms
Item 3	condition1	affirmative pre-subject *even* i.e., *Even Toto was able to lift a box.*	Three characters lifted boxes, but one character had been expected not to lift a box.	lion with weakest arms
	condition2	negated pre-subject *even* i.e., *Even Toto was not able to lift a box.*	Three characters didn't lift boxes, but one character had been expected to lift a box.	lion with strongest arms

<Table 4.1. All test conditions>

4.4.4 Predictions

As shown in Table 4.2, if children know the function of *even*, they should exhibit different choices for the affirmative pre-subject *even* sentences and for the negated pre-subject *even* sentences.

Sentence type	Target answer	If children cannot compute scalar implicature (sentence with *even* = sentence w/o *even*)
pre-subject *even*	shortest character	any character (or tallest character)
negated pre-subject *even*	tallest character	any character (or shortest character)

<Table 4.2. Predictions>

Let us assume that children hear affirmative pre-subject *even* sentences and negated pre-subject *even* sentences in the cookie-reaching story. If they know how to compute scalar implicature for the affirmative pre-subject *even* (e.g., *Even Larry was able to reach the cookie*), they should derive the interpretation in which the referent focused by *even* is the least likely one to be able to carry out an action. Thus, they should select the shortest person as Larry. If children know how to process the negated pre-subject *even*, noticing the polarity reversal, they should choose the tallest person as Larry because the tallest one is the most likely to be able to carry out the action mentioned in the sentence. Therefore they should choose different characters with opposite height features in the two different situations.

However, if children don't know the function of *even*, and so fail to calculate scalar implicature, they should make a choice based on idiosyncratic factors. In the case of the affirmative pre-subject *even*, if children are incapable of associating the referent of *even* with the least likely one to be able to carry out an action, their choice need not be the shortest person. For example, in the cookie-reaching task, children are presumably aware of the fact that the tallest character is most likely to be able to reach the cookie whereas the shortest character is least likely to be able to reach the cookie. Children who ignore the function of *even* might have difficulty ranking the referent in the *even* phrase as being

at the lower end of the scale of alternatives. Therefore, they can choose any character of any height, based on their own reasoning. Alternatively, given the children's ability to engage in practical reasoning, they will be likely to choose the tallest character as the target character because that one could easily perform the action denoted by the sentence. This would also hold true for the negated pre-subject *even*

4.4.5 Results

The proportion of accurate responses to the target sentences in the two groups is displayed in Table 4.3. In test trials, adult subjects selected the correct characters 100% of the time in the affirmative *even* sentences, and 98.6% of the time in the negated *even* sentences. In contrast, children exhibited significant difficulty with scalar implicature in both sentence types. They were successful just 45.6% of the time in selecting the target character in response to affirmative *even* sentences (the one who is the least likely to be able to carry out the described action). The accuracy rate for selecting the correct character in negated sentences (the one who is the most likely to be able to carry out the described action) amounted to 46.7%.

	affirmative pre-subject *even*				**negative pre-subject *even***			
	item1	item2	item3	**total**	item1	item2	item3	**total**
Adults (n=30)	30/30	30/30	30/30	90/90 **100%**	30/30	30/30	29/30	89/90 **98.6%**
Children (n=30)	13/30	12/30	16/30	41/90 **45.6%**	17/30	14/30	11/30	42/90 **46.7%**

<Table 4.3. Mean percentage of correct responses to test sentences in both groups>

Our analysis starts from the hypothesis that if children do not understand the function of *even* at all, they will select a target referent purely by guessing, with each referent having

a probability of 0.33 of being chosen. Putting it another way, the odds that a child will select a correct referent are one in three. Suppose that children avoid the middle referent in the array for some reason, preferring instead the perhaps more salient leftmost or rightmost characters. In this case, the chance that they will choose correctly amounts to 0.50. Taking these probabilities together, the success rates for both sentence types, as shown in Table 4.3, appear to be in the range of chance.

However, before drawing this conclusion, a close examination of what led to these choices was made through the analysis of the children's responses. Table 4.4 shows an in-depth analysis of how many correct answers children gave for each sentence type. The cases where children completely failed to compute scalar implicature across three items is marked as "none"; if they were successful on only one item, it is marked as "only 1 item" and so on. The number of correct answers across three items for affirmative pre-subject *even* sentences was combined with the number for negated pre-subject *even* sentences, which created a total of 16 combinations, as in Table 4.4.

negated sentence / affirmative sentence	none	only 1 item	2 items	3 items
none	5	1	2	1
only 1 item	5	3	2	0
2 items	2	0	0	0
3 items	0	0	1	8

G3 G2 G2 G1

<Table 4.4. Observed distribution of children's performance with both sentence types according to the number of correct items>

Based on their performance on the two sentence types, the children were broken into the three groups described below.

Groups	Descriptions	Number of correct items affirmative-negated
Group 1 (comprehension of both sentence types)	evidence of comprehending *even* in that: they succeeded on at least two items in both sentence types	**3 items-3 items** **2 items-3 items** **3 items-2 items** **2 items-2 items**
Group 2 (comprehension of only one sentence type)	weak evidence of comprehending *even* in that: a. they got at least two correct answers on affirmative *even* sentences, but fewer than two correct answers on negated *even* sentences b. they got fewer than two correct answers on affirmative *even* sentences but at least two correct answers on negated *even* sentences	**2 items-0 item** **2 items-1item** **3 items-0 item** **3 items-1 item** **0 item-2 items** **1 item-2 items** **0 item-3 items** **1 item-3 items**
Group 3 (no comprehension of both sentence types)	no evidence of comprehending *even* in that: they succeeded on at least one item in both sentence types	**0 item-0 item** **1 item-0 item** **0 item-1 item** **1 item-1 item**

<Table 4.5. Description of each group>

Table 4.6 summarizes how many children belong to each of these three categories.

	Group1	Group2	Group3
	evidence of understanding of *even*	weak evidence of understanding of *even*	no evidence of understanding of *even*
# of children	30% (9/30)	23.3% (7/30)	46.7% (14/30)

<Table 4.6. Three types of child participants with different ability to compute scalar implicature>

As shown in Table 4.6, the child participants were categorized into three contrasting groups. The members of group 1 (9 children out of 30) provided evidence of understanding of *even* because they consistently succeeded on at least two items in both

sentence types. In the group exhibiting weak evidence of *even,* two children out of seven showed an adult-like computation of scalar implicature only in response to the affirmative *even* sentences and five were successful in understanding only the negated *even* sentences. The 14 children in group 3 provided no evidence of comprehending the function of *even* since they succeeded on no more than one item in both sentence types.

Of interest in these results is an apparent close relationship between age and the ability to compute scalar implicature. All children in Group 1 were age 5, while the members of Group 3 were a mixture of age 4 and 5, but mainly age 4 (11 out of 14). This raises the possibility that age 5 may constitute important landmark for the knowledge of implicature.

The second analysis was driven by the question of what the reasoning was behind the children's choice of a character. An understanding of this would make it possible to speculate as to what type of pragmatics led them to the choices they made. Table 4.7 displays the variety of response patterns in children's choices of one out of three characters in the two sentence types.

The case where children selected target answers for both sentence types is dubbed as 'target characters'; the case where children chose characters opposite to the target ones for both sentence types is called 'opposite characters'; the remaining categories are for when children chose either always the rightmost character or always the leftmost character.

Selection pattern	target characters for both sentence types	opposite characters for both sentence types	always rightmost or leftmost character
rate of responses	33.3% (30/90)	38.9% (35/90)	27.8% (25/90) (22.2% for rightmost, 5.6% for leftmost)

<Table 4.7. Rate of responses out of different types of pragmatics for test sentences in children's group>

Overall, 33.3% of the responses for affirmative *even* sentences and negated *even* sentences were target characters. These responses were assumed to derive from correct pragmatic knowledge. The rest of the children's responses involved wrong choices. More specifically, in 38.9% of the responses, children chose the characters opposite to the target ones in both sentence types. For instance, in the reaching-cookie story where three bears all reached the cookie, children selected the tallest character as Larry for the affirmative *even* sentence (e.g., *Even Larry was able to reach the cookie*), because he is the best candidate for being able to reach the cookie. In contrast, in a situation where none of the bears could reach the cookie, the shortest character was chosen as Larry for the negated *even* sentences (e.g., *Even Larry was not able to reach the cookie*), because that one is the least able to reach the cookie. These children's behavior may have ignored *even*, and instead relied on practical reasoning to associate the main character's ability and the likelihood of that character being able to carry out the action.

Finally, a few children were biased toward either the rightmost character (22.2% of the time) or the leftmost character (5.6% of the time), regardless of where the target characters were.

The third analysis tested whether children are able to distinguish between test sentences with *even* and control sentences without *even*. Recall that the experimental

design contained control sentences without *even* that occurred in the same contexts as the test sentences. If children interpret the sentences with *even* as sentences without *even*, their response patterns should be the same.

Table 4.8 summarizes children's selection patterns for control sentences. As expected, children drew on a variety of factors to interpret control sentences without *even*.

	target characters for both sentence types	opposite characters for both sentence types	always rightmost or leftmost character	any characters
rate of responses	20% (18/90)	40% (36/90)	36.7% (33/90) (26.7% for rightmost, 10% for leftmost)	3.3% (3/90)

<Table 4.8. Rate of responses out of different types of pragmatics for control sentences in child group>

The overall picture of the response patterns for control sentences appears to be quite similar to that for test sentences for the children who did poorly on *even* sentences. For these control sentences, 40% of the responses selected characters opposite to the target characters in the test sentences, which suggests the children's frequent use of practical reasoning. Moreover, a majority of these responses for control sentences (33 out of 36) were produced by the same children who incorrectly performed when encountering test sentences. This consistency between the two data sets confirms that children who did not know the function of *even* tended to interpret sentences with *even* as sentences without *even*.

In Table 4.9, another interesting finding was manifested in the adult group, who differed from children in terms of the type of pragmatics they used.

	target characters for both sentence types	opposite characters for both sentence types	always rightmost or leftmost character	any characters
rate of responses	46.7% (42/90)	2.2% (2/90)	11.1% (10/90) (6.7% for rightmost, 4.4% for leftmost)	40% (36/90)

<Table 4.9. Rate of responses out of different types of pragmatics for control sentences in adult group>

First, adults selected any character as *Larry* 40% of the time, because in the absence of *even*, the sentence in question couldn't provide explicit cues to lead them to one interpretation. However, what was striking is the fact that despite the absence of a cue, adults sometimes interpreted sentences without *even* as sentences with *even*. Thus, they selected the same characters as they did when comprehending sentences containing *even* 46.7% of the time. This was clearly confirmed in their justifications. After providing their responses, the adults were asked to justify their selections. Recall that they were presented a context in which three bears all reached for the cookie with an affirmative control sentence (e.g., *Larry was able to reach the cookie*.). Because all of the bears were able to reach the cookies, there was no reason for only one character among the three to be described as the successful one. The adults basically assumed that Larry must be the worst candidate to be able to reach the cookie. Therefore, the situation where Larry managed to carry out the action was somewhat "surprising" to adults who made such an assumption. This reasoning led them to the same answer patterns as with the experimental sentences, which indicates that adults invoke implicit *even* in the interpretation of control sentences.

In summary, in contrast to adults, children had difficulty deriving scalar implicature for both affirmative and negated *even* sentences. However, as a result of closely investigating individual results, it could be seen that children in the age span from 4 to 5 exhibited a spectrum of abilities in their acquisition of the function of *even* from no knowledge about *even* to full mastery of *even*. Children who failed to understand *even* tended to interpret sentences with *even* as if *even* was not there. Unlike children, adults tended to evaluate sentences without *even* as sentences with *even* by invoking the unexpected meaning from their extralinguistic knowledge.

4.4.6 Discussion of Experiment 3

The results from Experiment 3 suggest that, unlike adults, preschoolers are unaware of the scalar implicature that the focus particle *even* induces. The failure of the children in my study is consistent with results from previous studies, which have reported children's difficulties with the scalar implicature that the words *some/all*, *might/must*, *and/but*, etc., give rise to (Noveck, 2001; Papafragou & Musolino, 2003).

Overall, the children succeeded in understanding affirmative *even* sentences (i.e., 45.6%) and negated *even* sentences (46.7%) only slightly less than half the time, which poses the possibility that they might perform as they did out of chance. However, by analyzing how often children correctly responded to all three items for both sentence types, a picture emerged of two child groups with different capabilities for computing scalar implicature; the first group with evidence of knowledge of *even* (i.e., 30%) and the second group with no evidence of knowledge about *even* (i.e., 46.7%). Taking into consideration that the probability for a child to either fail or succeed in giving a correct

answer on all three items is low, it seems clear that children who belong to one of these two opposite groups did not behave as they did out of chance. These findings therefore lend credence to the conclusion that children's success rate of less than 50% can mainly be attributed to the two largest groups, with their opposite abilities to derive scalar implicature.

Such a split between two groups of child participants offers a glimpse of the current state of children's knowledge about *even* during the age span from 4 to 5. The striking aspect of the results is the finding that there was a close link between the two groups' contrasting abilities to derive scalar implicature and their ages. Those who consistently failed to give correct answers for items were mainly aged 4, while those who consistently succeed to give correct answers were all age 5. The age between 4 and 5 appears to be the transitional period for mastering the function of *even*, and the age of 5 seems to be the starting point for children to converge on adult-like pragmatic inference. However, to address this issue more directly, it will be necessary to conduct a follow-up study that investigates whether older children aged from 6 to 7 are aware of the meaning of *even* and able to derive scalar implicature in an adult-like way.

Another finding that needs to be discussed in detail is that a middle character (e.g., the second tallest bear or the second shortest) was selected only 5% of the time during the trials. For the experimental sentences, almost all of the children avoided selecting the middle characters which were always placed between the other two characters in array. Instead, they picked only characters at one or the other end of the scale. Although all the trials were counterbalanced in terms of the position of the target characters, children preferred to choose either the leftmost character or the rightmost character. The reason

that they were biased toward either leftmost characters or rightmost characters might be a methodological artifact. Before the story started, children were instructed to pick who was shortest and who was tallest in the picture, for the purpose of leading them to use only this height difference to associate the likelihood of each character of being able to carry out the action. However, such introductory instruction might have influenced children to prefer to pay attention to the two sides in their selection strategy during the guessing task, so that either the leftmost or rightmost character might be most prominent to them as they made their choices in this task.

4.5 Experiment 4

The goal of this experiment was to explore how children comprehend sentences with *even* in pre-object position and whether there is any difference in sensitivity to scalar implicature in comparison with pre-subject *even*. The findings drawn from Experiments 3 and 4 together will provide comprehensive evidence concerning how the syntactic position of *even* can affect children's awareness of the scalar meaning that it conveys. As in Experiment 3, affirmative and negated sentences with pre-object *even* were used as test items in Experiment 4. This study addresses three research questions:

- Are children capable of interpreting the object constituent focused by *even* as the least likely one for the agent to be able to act upon in the pre-object *even* sentences? Conversely, in the case of negated pre-object *even* sentences, can children identify the object focused by *even* as the most likely one for the agent to be able to act upon?
- Is a negated pre-object *even* sentence more challenging to children than an affirmative pre-object *even* sentence in terms of the computation of scalar implicature?

- Do children show different levels of sensitivity to scalar implicature with pre-subject *even* sentences than with pre-object *even* sentences?

4.5.1 Participants

The participants from Experiment 3 also took part in Experiment 4, which took place almost one week later. From 30 children, half of them participated in Experiment 3 first and then Experiment 4 one week later. The other half took part in Experiment 4 first.

4.5.2 Methodology

The same methodology used in Experiment 3 was employed in Experiment 4. However, the current task differed from the one in the previous experiment in one respect. What participants were supposed to identify was not a referent denoted by a subject constituent but an entity denoted by an object constituent. Children were asked to listen to a pre-recorded story accompanied by a series of pictures presented via Microsoft Office PowerPoint slides on the computer screen. At the end of the story, a character in the story made a statement with *even* in a pre-object position. After hearing that target sentence, child participants were asked to identify the object denoted by the *even* phrase in the story. Then they were instructed either to point on the computer screen to the object they selected or simply to say what it was. Parental consent was obtained prior to the test. Participants were tested individually in a dedicated room at their school. The task lasted approximately 30 minutes in total. It was administered in two sessions, each of which took 10 minutes to complete, with a 10-minute interval between them.

4.5.3 Materials

Experimental materials were comprised of two types of sentences that always contained *even* in a pre-object position- one type without negation (henceforth affirmative pre-object *even* sentences) as in (26a) and the other type with negation (henceforth negated pre-object *even* sentences) as in (26b). The pre-object *even* sentence gives rise to the implicature that the object entity associated with *even*, in this case, a vanilla cookie, is the least likely object that the agent can act upon. The negation of the sentence reverses the implicature, so that the same object is the most likely object that the agent can act upon.

(26) a. Bear was able to reach even the vanilla cookie. (affirmative pre-object *even*)

b. Bear was not able to reach even the vanilla cookie. (negated pre-object *even*)

For target sentences, participants were presented with two types of contexts involving dimensions such as a height or weight. These features play a crucial role in participants' reasoning to arrive at the intended interpretation of *even*. The difference in a feature (dimension) was associated with the likelihood of the agent being able to act upon an object. For instance, in the cookie-reaching story, a bear attempted to reach a cookie placed on a shelf of three different heights. To make sure that children were aware of the visually distinct heights of the three shelves, they were asked to point to the lowest shelf and the highest shelf during the first part of the story.

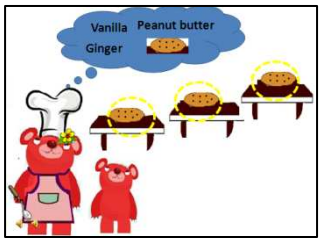
The cookie on the lowest shelf is the most likely one for a bear to be able to reach, while the cookie on the highest shelf is the least likely one for that bear to be able to

reach. The story goes on to inform the children that the three cookies, although looking exactly the same, differ from each other in flavor. So, figuring out which one is the vanilla cookie goes beyond the visually depicted information. Instead, the different heights of the shelves are used as the only tool to distinguish the three seemingly identical cookies. Due to the function of *even*, reaching the vanilla cookie should be an unexpected and surprising event. Therefore, the sentence in (26a) gives rise to the interpretation that the vanilla cookie is the least likely one for the bear to be able to reach. Because of this, the cookie on the highest shelf is the target answer.

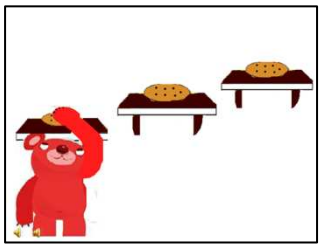
In Context 1 with a pre-object *even* (e.g., *Bear was able to reach even the vanilla cookie*), a character carried out an action involving three objects; however, an action involving one object was less likely than the others in light of the likelihood scale.

Sample material for Context 1

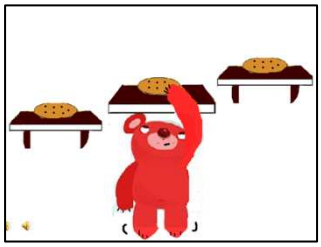
- **Sentence type:** pre-object *even* + negation **Target answer:** a cookie on the highest shelf
- **Story**:



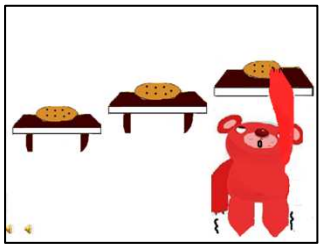
This story is about Mama Bear and her son. Since she wanted to know how high he could reach, she put cookies on three shelves of different heights. Look at the shelves. Each one has a different height. Which one is the lowest shelf? Can you point to it? Which one is the highest shelf? Can you point to it? The cookies on the shelves all look the same, but they have different flavors: vanilla, ginger, and peanut butter. Mama Bear said, "I made cookies for you. After you try to reach the cookies, let's have them together."



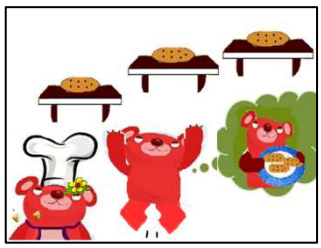
Her son was very excited about having the cookies. He tried to reach the cookie on the first shelf and managed to do so.



Then, he tried to reach the cookie on the second shelf and made it.



Lastly, he tried to reach the cookie on the third shelf and successfully did it.



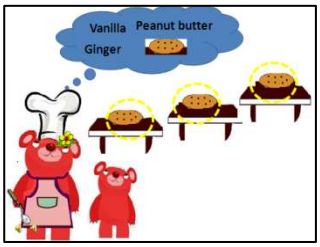
Mama Bear said, "**Bear was able to reach even the vanilla cookie**."

- experimenter: I don't know which is the vanilla cookie. Can you point to the vanilla cookie?

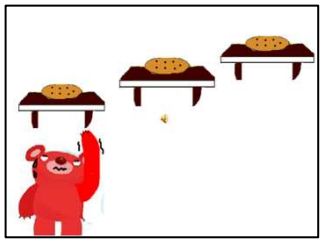
In Context 2 with a negated pre-object *even* (e.g., *Bear was not able to reach even the vanilla cookie*), though the character was not able to carry out the action at all, there was still an action involving one object that would have been most likely to receive the action..

Sample material for Context 2

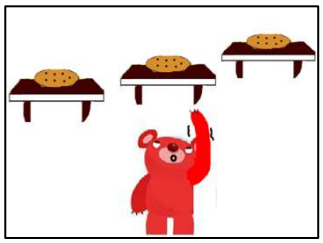
- **Sentence type:** pre-subject *even* + negation **Target answer:** the tallest bear
- **Story**:



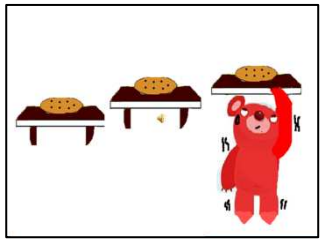
This story is about Mama Bear and her son. Since she wanted to know how high he could reach, she put cookies on three shelves of different heights. Look at the shelves. Each one has a different height. Which one is the lowest shelf? Can you point to it? Which one is the highest shelf? Can you point to it? The cookies on the shelves all look the same, but they have different flavors: vanilla, ginger, and peanut butter. Mama Bear said, "I made cookies for you. After you try to reach the cookies, let's have them together."



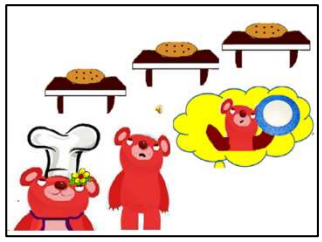
Her son was very excited about having the cookies. He tried to reach the cookie on the first shelf, however, he couldn't reach it.



Then he tried to reach the cookie on the second shelf, however, he also couldn't reach it.



Lastly, he tried to reach the cookie on the third shelf, however, he failed to reach it.



Mama Bear said, **"Bear was not able to reach even the vanilla cookie."**

- experimenter: I don't know which is the vanilla cookie. Can you point to the vanilla cookie?

Using a task identical to that in Experiment 3, three items for each condition (affirmative pre-object *even* sentences and negated pre-object *even* sentences) were created, resulting in six target trials that were interspersed among six control sentences and six filler sentences as shown in Table 4.10. A practice session that familiarized the children with the guessing task preceded the main task.

	Conditions	Sentence type	Context type	Target answer
Item1	condition1	affirmative pre-object *even* i.e., *Bear was able to reach even the vanilla cookie.*	A character reached three cookies, but an action involving one cookie had not been expected to happen.	a cookie on the highest shelf
	condition2	negated pre-object *even* i.e., *Bear was not able to reach even the vanilla cookie.*	A character didn't reach any of the cookies, but an action involving one cookie had been expected to happen.	a cookie on the lowest shelf
Item2	condition1	affirmative pre-object *even* i.e., *Monkey was able to grab even the juicy orange.*	A character grabbed three oranges, but an action involving one orange had not been expected to happen.	orange on the highest branch
	condition2	negated pre-object *even* i.e., *Monkey was not able to grab even the juicy orange.*	A character didn't grab any of the oranges, but an action involving one orange had been expected to happen.	orange on the lowest branch
Item3	condition1	affirmative pre-object *even* i.e., *Lion was able to lift even the WalMart box.*	A character lifted three boxes, but an action involving one box had not been expected to happen.	the heaviest box
	condition2	negated pre-object *even* i.e., *Lion was not able to lift even the WalMart box.*	A character didn't lift any of the boxes, but an action involving one box had been expected to happen.	the lightest box

<Table 4.10. All test sentences>

4.5.4 Predictions

As illustrated in Table 4.11, if children know the function of *even*, they make different choices for the affirmative pre-object *even* sentences and for the negated pre-object *even* sentences.

Sentence type	**Target answer**	**If children cannot compute scalar implicature (sentence with *even* = sentence w/o *even*)**
affirmative pre-object *even*	cookie on the highest shelf	cookie on any shelf or cookie on the lowest shelf
negated pre-object *even*	cookie on the lowest shelf	cookie on any shelf or cookie on the highest shelf

<Table 4.11. Predictions>

To illustrate with the cookie-reaching story, if children correctly compute scalar implicature for affirmative pre-object *even* sentences (e.g., *Bear was able to reach even the vanilla cookie*), they should derive the interpretation in which the object focused by *even* is the least likely one for the agent to be able to act upon. Consequently, they should point to the cookie located on the highest shelf. However, for the negated pre-object *even* sentences (e.g., *Bear was not able to reach even the vanilla cookie*), they should make the opposite choice, selecting the cookie that is the most likely one for the agent to be able to act upon, namely the cookie on the lowest shelf.

However, if children don't know the function of *even,* and so fail to calculate scalar implicature, the result should be similar to the one for the control sentences without *even*. In the case of the affirmative pre-object *even* sentences, if children are incapable of associating the object denoted by the *even* phrase with the least likely one for the agent to be able to act on, their choice does not have to be the cookie located on the highest shelf. In other words, they could choose a cookie on any shelf, based on their own reasoning. Alternatively, given the children's ability to engage in practical reasoning, they would be likely to choose the cookie on the lowest shelf as the target entity because that one is easy for a bear to be able to act upon. This also would also hold true for the negated pre-object *even* sentences.

4.5.5 Results

The adults gave correct responses to both affirmative pre-object *even* sentences and negated pre-object *even* sentences 100% of the time. On filler trials, they were also successful 100% of the time. However, understanding sentences with pre-object *even* was a challenge to children. They correctly answered only 46.7% of the time for affirmative pre-object *even* sentences and 46.7% of the time for negated pre-object *even* sentences, as summarized in Table 4.12.

	affirmative pre-object *even*				**negated pre-object *even***			
	item1	item2	item3	**total**	item1	item2	item3	**total**
adults	30/30	30/30	30/30	90/90 **100%**	30/30	30/30	30/30	90/90 **100%**
children	12/30	15/30	15/30	42/90 **46.7%**	12/30	10/30	10/30	42/90 **46.7%**

<Table 4.12. Mean percentage of target responses to test sentences in both groups>

As with Experiment 3, the analysis begins with the hypothesis that if children do not understand the function of *even* at all, they will select a target entity purely by guessing. So, they will randomly choose any object among the three possible objects in a context. Here, each object entity has a probability of 0.33 of being chosen as a target answer. Putting it another way, the odds that a child will select a correct entity are one in three, which is the chance level. Accordingly, the success rates for both sentence types, as shown in Table 4.13, appear to be in the range of chance.

In order to closely examine how these results were reached, an analysis parallel to the one proposed for Experiment 3 is summarized in Table 4.13, with the focus on children's performance with scalar implicature across three items in the interpretation of both target sentences. The number of correct answers across three items for affirmative

pre-subject *even* sentences was combined with the number for negated pre-subject *even* sentences.

negated sentence / affirmative sentence	none	only 1 item	2 items	3 items
none	4	2	2	1
only 1 item	5	3	1	0
2 items	1	0	2	1
3 items	2	0	1	5

G3 G2 G2 G1

<Table 4.13. observed distribution of children's performance with both sentence types according to the number of correct items>

Based on their performance on the two sentence types, the children were broken into the three groups described below.

Groups	Descriptions	Number of correct items affirmative-negated
Group 1 (comprehension of both sentence types)	evidence of comprehending *even* in that they succeeded on at least two items in both sentence types	**3 items-3 items** **2 items-3 items** **3 items-2 items** **2 items-2 items**
Group 2 (comprehension of only one sentence type)	weak evidence of comprehending *even* in that: c. they gave at least two correct answers on affirmative *even* sentences, but fewer than two on negated *even* sentences d. they gave fewer than two correct answers on affirmative *even* sentences, but at least two correct answers on negated *even* sentences	**4 items-0 item** **2 items-1item** **3 items-0 item** **5 items-1 item** **0 item-2 items** **1 item-2 items** **0 item-3 items** **1 item-3 items**
Group 3 (no comprehension of both sentence types)	no evidence of comprehending *even* in that: they succeeded on no more than one item in both sentence types	**0 item-0 item** **1 item-0 item** **0 item-1 item** **1 item-1 item**

<Table 4.14. Description of each group>

Table 4.15 summarizes how many children belong to each of these three categories.

	Group1	Group2	Group3
	evidence of understanding of *even*	weak evidence of understanding of *even*	no evidence of understanding of *even*
# of children	30% (9/30)	23.3% (7/30)	46.7% (14/30)

<Table 4.15. Three types of child participants based on their ability to compute scalar implicature>

As shown in Table 4.15, the child participants were categorized into three contrasting groups. As shown in Table 4.15, 30% of the children (9 children out of 30) computed scalar implicature for not only affirmative but also negated pre-object *even* sentences. The members of group 1 provided evidence of understanding of *even* because they consistently succeeded on at least two items in both sentence types. In the group exhibiting weak evidence of *even,* three children out of seven showed the adult-like computation of scalar implicature only in response to the affirmative *even* sentences and four out of seven children were successful in understanding only the negated *even* sentences. 46.7% of the children (14 children out of 30) provided no evidence of comprehending the function of *even* since they succeeded on no more than one item in both sentence types.

In sum, according to these results, the children who avoided chance performance appear to be divided into three main groups with extremely different levels of acquisition of *even*, from the stage of no understanding of *even* (Group 3), through a transitional stage (Group 2), and to the stage of knowledge of *even* (Group 1). What is more interesting in these results is that there is a close relationship between age and children's

different abilities to compute scalar implicature. The children in Group 1 were all age 5, while the members of Group 3 were all age 4. This points the possibility of a developmental advance around age 5.

The second analysis stemmed from the question of what type of pragmatics participants employed during the guessing task, which was directly reflected in their selection patterns. As shown in Table 4.16, there is a spectrum of response patterns. In the table, the case where children selected target answers for both sentence types is called 'target characters'; the case where children chose characters opposite to the target ones for both sentence types is referred to as 'opposite characters'; the remaining categories are for when children chose either always the rightmost character or always the leftmost character.

Selection pattern	target characters for both sentence types	opposite characters for both sentence types	always rightmost or leftmost character
rate of responses	24.5% (22/90)	37.8% (34/90)	37.8% (34/90) (22.2% for rightmost, 15.6% for leftmost)

<Table 4.16. Rate of responses out of different types of pragmatics for test sentences in children group>

Overall, 24.5% of the responses were from children who selected target characters for negated *even* sentences as well as affirmative *even* sentences. However, 37.8% of the children chose the characters opposite to the target ones in both sentence types. Recall the cookie-reaching story where a bear attempted to reach three cookies placed on different shelves. The cookie on the lowest shelf is the most likely one for the bear to be able to reach and the cookie on the highest shelf is the least likely. When this knowledge is what drives the children's responses, their response pattern is the opposite of the correct

pattern for *even* sentences. It shows that the children of this group do not know the function of *even* and performed out of practical reasoning. The rest of their responses (37.8%) were either always rightmost or leftmost characters.

The motivation for the third analysis is to test whether children are able to differently interpret test sentences with *even* and control sentences without *even*. Table 4.17 summarizes children's selection patterns for control sentences.

	target characters for both sentence types	opposite characters for both sentence types	always rightmost or leftmost character	any characters
rate of responses	23.3% (21/90)	38.9% (35/90)	35.6 % (32/90) (25.6% for rightmost, 10% for leftmost)	2.2% (2/90)

<Table 4.17. Rate of responses out of different types of pragmatics for control sentences in child group>

As expected, children relied on various kinds of pragmatic knowledge to interpret control sentences without *even*. The overall response pattern for control sentences was quite similar to the pattern for test sentences for the children who performed poorly. In the largest category, 38.9% of the responses selected characters opposite to the target ones for the test sentences, which suggests that practical reasoning led the children to perform in this way. Children who showed no evidence of understanding of *even* in response to the test sentences as in Table 4.15 were found to employ practical reasoning. This supports the claim that children who could not understand *even* evaluated sentences with *even* as if they were sentences without *even*.

As shown in Table 4.18, another interesting pattern was witnessed among the adult participants, who exhibited a clear split in response patterns.

	target characters for both sentence types	any characters
rate of responses	35.6% (32/90)	64.4% (58/90)

<Table 4.18. Rate of responses out of different types of pragmatics for control sentences in adult group>

More than half of responses (64.4%) came from adult participants who answered that any character could be the target answer. The control sentences, which lack *even* simply express the proposition that a character acted upon a certain object. Given the context, in which the character was equally involved with all three objects, there was no way for adults to select a particular object as the entity denoted by the object constituent. In line with this logic, they simply answered that the target answer could be any of the objects. However, the remaining responses, amounting to 35.6%, were identical with ones in the test sentences. When asked to justify their selections, the participants were found to have interpreted sentences without *even* as sentences as if they contained *even*. Despite the absence of *even* in the sentence, adults reasoned that that entity denoted by the object constituent must be the least likely one for the agent to be able to act upon. This logic fits perfectly with the use of *even*, and suggests that adults were able to use extralinguistic knowledge to recover *even* in the interpretation of control sentences.

In conclusion, similarly to the results of Experiment 3, children were challenged by computing scalar implicature for sentences with pre-object *even*. On the surface, it seems as if they simply performed as they did out of chance; however, by closely investigating individual results, it becomes clear that children from age 4 to 5 manifested different levels of acquisition of the function of *even*, from no knowledge about *even* to

the full mastery of *even*. Children who failed to understand *even* were found to select a character based on practical reasoning in a consistent way: they tended to interpret sentences with *even* as if *even* was not there. Unlike children, adults tended to evaluate sentences without *even* as sentences with *even*, by invoking implicit *even*.

4.5.6 Discussion of Experiment 4

The results from Experiment 4 were very similar to those from Experiment 3. For both target sentence types, children were successful only at levels to be expected from chance (affirmative pre-object *even* sentences: 46.7% and negated pre-object *even* sentences: 46.7%). However, after further examination of the number of correct answers across three items for both sentence types, children were divided into four main groups at different developmental levels. One group succeeded across all three items for both sentence types. The fact that they behaved in this way despite the very low probability of success on three consecutive items indicates their complete understanding of the function of *even*. The performance of the second group was adult-like only for one sentence type. Some children failed to compute scalar implicature on all the items for both sentence types, which provides evidence of a complete lack of knowledge about *even*. And the last group performed based on chance. These results make it possible to conclude that the success rate of about half was a result of the mixture of these groups with their different sensitivities to scalar inference.

An interesting feature of the results lies in the relationship between children who performed in an adult-like way and their age: children with apparent full knowledge of pre-object *even* were age 5, children with no knowledge of *even* were all age 4. This

suggests that the age from 4 to 5 is the period during which children start to acquire the function of *even* and to converge on adult-like comprehension of it.

According to the results, the syntactic position of *even* does not influence children's difficulty in the computation of scalar implicature. There was no significant difference in the success rate between pre-subject *even* sentences (i.e., 45.6% for affirmative and 46.7% for negative sentences) and pre-object *even* sentences (i.e., 46.7% for affirmative sentences and 46.7% for negative sentences). Since the same population took part in both experiments, the results from this comparison between pre-subject *even* and pre-object *even* suggest that the children's difficulty with scalar implicature is not due to their lack of syntactic knowledge of *even*.

4.6 General discussion of Experiments 3 and 4

The experiments presented here explore young children's ability to derive pragmatic inferences during utterance comprehension. I was interested in whether young children compute the scalar implicature associated with *even,* as adults routinely do. Using data from English speaking children aged between 4 and 5, my experiments tested affirmative sentences and negated sentences with *even* in a pre-subject or a pre-object position. To lead children to draw on the pragmatic knowledge required for the interpretation of *even*, the guessing task allowed them to employ contextual information in selecting which characters or objects were associated with the *even* phrase. Both Experiment 3 and Experiment 4 found that the child participants performed in non-adult-like ways, with no polarity-related difference.

One of the most interesting aspects of these experiments is the finding that the age span from 4 to 5 is a period of mixed ability, with some children falling short of full mastery of *even* but others clearly having already acquired it. In particular, the result that 5-year-old children exhibited an adult-like behavior while 4-year-old children did not, invites the inference that the year in which a child is 5 might be the transitional phase in which a child moves toward adult-like understanding of sentences containing *even*. Taken together with the results from previous studies by other scholars, the results of these experiments confirm that children have difficulty with pragmatic inference. There was no difference between affirmative *even* sentences and negated *even* sentences with respect to the success rate, which suggests that negation does not affect non-adult-like interpretation in child groups.

Also noteworthy is the fact that the syntactic position of *even* did not affect children's performance. The children were not better able to perform scalar implicature for either pre-subject *even* sentences or pre-object *even* sentences. This result suggests that children's difficulty with scalar implicature does not derive from the syntactic position of *even*.

The current Experiments 3 and 4 only focused on the investigation of children's pragmatic knowledge, more specifically on their ability to derive scalar implicature depending on polarity. The experimental designs of these experiments were limited to investigating whether children are sensitive to the scope of *even*. In Experiments 1 and 2, to examine whether children grasp the syntax of *only*, the same context was presented to children with pre-subject *only* sentences and pre-object *only* sentences. If children misanalyzed pre-subject *only* as if it were pre-object *only* or vice versa, this would be

indicated in their truth value judgment. However, in the experiments on *even*, although children may have misanalyzed the syntactic position of *even* by evaluating pre-subject *even* as being pre-object *even*, such errors would not be manifested in the selection pattern.

As mentioned earlier, in the two target sentences in (27), the *even* phrase should be associated with a person or an object that is unexpected or surprising in relation to the described event.

(27) a. Even Larry was able to reach the cookie. (Larry is the shortest)

b. Bear was able to reach even the vanilla cookie. (the cookie placed on the tallest shelf)

For the pre-subject *even* sentences, the context was manipulated in such a way that a feature of the three characters was varied, although the related feature of the object that they interacted with was constant. For example, in the cookie-reaching story, the three cookies were placed on a single shelf at one height, while three bears of different heights reached for the cookies. The height difference of the characters was the only information that could help children to access the likelihood of each character reaching a cookie. However, if the children misanalyzed pre-subject *even* as pre-object *even*, what should be unexpected or surprising in relation to the described action changed from a person to an object. Thus it evokes the interpretation that Larry was able to reach the cookie that is the least likely one to be reached. However, the context manipulation did not allow for any dimension related to the height of the cookies. There are thus no grounds to claim that

children's selection errors for pre-subject *even* can be attributed to their misassignment of the scope of *even*.

The same holds true for the opposite case of pre-object *even*. The context for this sentence type only manipulated a feature of the objects. For example, in the cookie-reaching context for pre-object *even*, the shelves' heights were different so that three cookies were placed from the lowest shelf to the highest one. If children were to misinterpret pre-object *even* as being pre-subject *even*, they would access the interpretation that, of the bears, one is the least likely to be able to reach the vanilla cookie. However, because only one bear with a fixed height appeared as an agent in this context, there is no opportunity to err in this regard.

In short, the design of Experiments 3 and 4 contained a methodological limitation that prevented them from directly testing children's syntactic knowledge of *even* in a way that could be compared with Experiment 1. Further research should investigate *even* sentences for the purpose of discovering the child participants' syntactic competence in terms of the scope assignment of *even*. A key element in the sentence or context manipulation in a future study designed to address the issue of scope assignment will be that two dimensions related to the agent denoted by the subject constituent and the entity denoted by the object constituent should be provided to children at the outset. This modified design will allow the children to entertain two scope interpretations. The following examples are appropriate to test whether this proposal works.

(28) a. Even Pooh solved Question 2. (not smart/easy question)

b. Pooh solved even Question 2. (smart/hard question)

These sentences manifest two dimensions, one involving Pooh's ability and one involving the level of difficulty of Question 2. For *even* in the pre-subject position, *Pooh* focused by *even* implies that he is not good at solving questions. The proposition that he solved Question 2 also gives the hearer the implication that Question 2 is easy. In contrast, with *even* in the pre-object position, the *even* phrase implies that Question 2 is a hard question for people to solve. This also yields implicature about the referent denoted by the subject constituent, which is that Pooh is smart. The implicated meanings are contrastive between the two sentences due to the different syntactic positions of *even.* Therefore, on encountering these sentences, children can be asked to judge either Pooh's ability or the difficulty of Question 2. Their answers will show what implicature the children have drawn from the sentences and so can contribute to examining whether children can analyze the syntactic position of *even*.

At this point, the locus of children's difficulty with the scalar implicature that *even* evokes is still matter for speculation. Several possibilities have been raised. One is that children often fail to understand sentences with *even* because they ignore *even* when hearing a sentence containing it, thus evaluating sentences with *even* as sentences without *even*. However, it is highly unlikely that children missed the word *even* during the task. To make sure that *even* was audible enough for children to notice, target sentences were always repeated twice and more than that if necessary. It is therefore hard to believe that a failure to hear *even* might explain children's low success rate.

Another possibility is that children's errors in response to sentences containing *even* might reflect either their genuine inability to derive scalar implicature or an inability to meet the task demands that the experiment imposed. Previous studies on scalar inference

have documented that children's awareness of scalar implicature can be enhanced with improved methodologies (Papafragou & Musolino, 2003; Papafragou & Tantalou, 2004). Children performed correctly more than 70% of the time with contexts that more readily invite the necessary kinds of pragmatic inference than when they were left without contextual help. Such results provide compelling evidence for children's early ability to compute scalar implicature.

The experiences of previous researchers strongly suggest that to decide between these possibilities, it will be necessary to revisit the locus of children's difficulty with understanding *even* with an improved methodology. The next question to focus on, then, is which aspect of the experimental design should be modified. To address this question, it will first be necessary to observe each step that a hearer goes through to reach the intended interpretation of *even* and then to consider how modifications in methodology can assist child participants in overcoming the possible difficulties that they might encounter during that process.

Before hearing a sentence containing *even* in the current experiments, participants were led to use contextual information to associate a difference among the characters with the likelihood of them being able to carry out the action. Given practical reasoning, carrying out an action is considered to be easy for a person with certain characteristics (e.g., height, strength, etc.,) or not easy for a person without those characteristics. More specifically, in the cookie-reaching story, all three bears were able to reach a cookie, with the tallest bear best suited to do it, and the smallest one least suited to be able to do it. The next crucial step for participants to take to compute scalar implicature is to realize that the word *even* describes an unexpected event. Upon hearing the *even* phrase, the fact

that the smallest character managed to reach the cookie should be perceived as being surprising and unexpected.

This may be difficult for children because they simply do not know the full meaning of *even.* They may thus have to perform out of practical reasoning, thereby selecting the tallest character as a target answer. Alternatively, it may be because, although they know the meaning of *even*, an unexpected outcome might be costly to compute. If this is the case, a better task that provides contextual assistance to ease the burden of computing unexpected outcomes could improve children's performances.

The current experimental design does not provide a way to test the possibilities put forth here. However, it is worth noticing that the children were found to have no problem employing practical reasoning to make an association between the height of characters and the likelihood of them carrying out the action. In the test sentences as well as the control sentences, children who apparently had not yet acquired *even* interpreted sentences with *even* as if they were sentences without *even*. In the future, contexts should be created to assist children to access the unexpected outcome associated with the use of *even*. I propose that a context which increases the unexpected outcome in which the smallest character successfully carries out a reaching action could well help children retrieve the full meaning of *even*, thus computing scalar implicature. If the success rate of computing scalar implicature increases due to such contextual help, it may be evidence that children's poor understanding of the scalar meaning of *even* derives from task demands.

CHAPTER 5

GENERAL DISCUSSION AND CONCLUSION

5.1 Summary

This dissertation has investigated how 4- to 5-year-old English-speaking children comprehend sentences containing focus particles with different semantic functions, including the exclusive focus particle *only* and the scalar focus particle *even*. In this final chapter, the first section briefly provides the purpose of each experiment and summarizes the main results reported in Chapters 3 and 4. The second section considers the implications of these results with respect to acquisition and highlights the contributions of this study. The third section identifies some limitations of this study and suggests further studies, and the last section provides a conclusion to the dissertation.

The first two experiments involved the comprehension by 4 and 5-year-olds of utterances including *only*. The purpose of Experiment 1 was to answer the following two research questions: (1) When interpreting sentences containing *only*, are children sensitive to the focus operator's syntactic scope? (2) Do children have the capacity to construct a contextually determined contrast set: a set of alternatives with respect to the focused expression? The findings were as follows.

- Children aged 4 to 5 were able to generate contrastive information for both pre-subject *only* and pre-object *only* sentences. This indicates that they are not deficient in pragmatic knowledge at this age. However, they made many scope spreading errors. They had a fairly strong tendency to assign the scope of *only* to the object constituents for both pre-subject *only* and pre-object *only* sentences.

As shown in Experiment 1, children's tendency to associate *only* with object constituents in pre-subject *only* sentences can be accounted for by their apparent violation of the c-command constraint on focus assignment. This occurs because the object NP is not the c-command domain of *only* in pre-subject *only* sentences. In order to chart a more detailed picture of children's grammatical constraints on focus assignment, there is a need to whether the same non-adult-like linguistic behaviors are observed in other types of constructions.

With this in mind, Experiment 2 investigated whether children's focus assignment for *only* violates the c-command constraint in constructions containing postverbal *only* preceding two NPs (the first NP will be referred to as N1 and the second NP is N2). Experiment 2 examined so-called embedded NP sentences and parallel NP sentences, which manifest different syntactic configurations in terms of the relation between *only* and two NPs. In the embedded NP sentences, both N1 and N2 are within the c-command domain of *only* and can therefore be able to be associated with *only* in order to be brought into focus (i.e., *Toto bought only a book about Mickey Mouse*). However, in the parallel NP sentences, only N1 is in the c-command domain of *only*, so the association of *only* with N2 is not acceptable (i.e., *Toto brought only a book to Mickey Mouse*).

The following research questions were pursued and answered : (1) Do children associate *only* with the same elements as adults in terms of focus assignment in embedded NP constructions and parallel NP constructions? (2) Do children obey the c-command constraint on focus assignment of *only*?

- Overall, adults differed from children in focus identification. Adults were able to adopt either the N2-focused analysis or the N1-focused analysis, depending on contexts for the embedded NP sentences. However, they identified only N1 as focus for the parallel NP sentences. In contrast, children showed a consistent preference toward the N2-focus interpretation, regardless of sentence types. This implies that they are insensitive to the type of sentence construction. More importantly, they were able to associate *only* with an element that it does not c-command. To account for children's identification of the last NP (i.e., direct object in Experiment 1 and N2 in Experiment 2) as focus, I propose that they adopted a misanalysis attachment in which *only* is attached to the verb phrase. According to this analysis, N2 and N1 would be placed in the c-command domain of *only*. Therefore, in terms of c-command constraint, children, unlike adults, have unorthodox syntactic representation in that they are subject to the c-command constraint.

The experiments regarding *only* were extended to investigate the focus particle *even*. Experiments 3 and 4 exclusively focused on children's pragmatic knowledge concerning constructing scalar alternatives in response to sentences with *even* in pre-subject position (as in Experiment 3) and pre-object position (as in Experiment 4). The specific goal of these experiments was to answer the following question: Are children able to derive scalar implicature when interpreting sentences containing *even*? The results from Experiments 3 and 4 can be summarized as follow.

- The results from Experiment 3 suggest that, unlike adults, preschoolers are unaware of the scalar implicature that the focus particle *even* induces. Overall, the children succeeded in understanding affirmative *even* sentences and negated *even* sentences only slightly less than half the time, which suggests the possibility that their performance might be due to chance. For the results of this experiment, a general picture emerged of two child groups with different capabilities for computing scalar implicature. The first group consistently failed for both sentence types with *even*; the second group consistently succeeded for both sentence types with *even*.

- The results from Experiment 4 were very similar to those from Experiment 3. It was found that children's success rate of less than 50% can mainly be attributed to the two largest groups, with their opposite abilities to derive scalar implicature. Some children failed to compute scalar implicature on all the items for both sentence types, which provides evidence of a lack of knowledge about *even*. Another group succeeded across all items for both sentence types. Taken together, the results from Experiments 3 and 4 suggest that there was no difference in the difficulty of the two sentence types.

5.2 Implications and contributions

The findings reported in Chapters 3 and 4 suggest that the developmental paths for children's acquisition of the focus particles *only* and *even* are different. As mentioned before, understanding sentences containing focus particles requires the establishment and

integration of specific knowledge in different domains. A thorough comparison of *only* and e*ven* must take into account three domains that language users must cope with in order to arrive at the correct interpretation of focus particles. The learner has to cope with: (a) a ***lexical*** problem—the exclusive meaning of *only* and scalar meaning of *even* must be learned. (b) a ***structural*** problem—s/he has to figure out where syntactic positions are available for a given particle has to be established. (3) a ***discourse*** problem—pragmatic inferencing through which contextually determined alternatives are computed with respect to a focused constituent have to be acquired.

While the orientation of my study is to a large extent a comparison between the acquisition of *only* and *even,* the current dissertation falls short of providing parallel evidence of children's response to sentences containing *only* and *even* from all of these three aspects. Experiments 1 and 2 regarding *only* dealt with children's syntactic and pragmatic knowledge whereas experiments 3 and 4 on *even* touched only on children's pragmatic knowledge. My study can thus provide a comparison between *only* and *even* in terms of children's pragmatic knowledge. However, owing to the absence of the corresponding data for children's syntactic knowledge of *even,* it was limited to exploring the similarities and differences in children's sensitivity to the syntactic constraints on focus assignment for *only* and *even*. Nevertheless, evidence from this series of experiments and previous studies firmly implies that the two focus particles are acquired differently by children.

In previous studies, there seems to be no doubt that children have already acquired the lexical meaning of *only* by age 4 or 5 (Crain et al., 1992, 1994; Paterson et al., 2003; Notley et al., 2009; Gualmini et al., 2003). The first piece of evidence for this

conviction can be found in corpus studies investigating the onset of exclusive focus particles in German and Chinese (Höhle et al., 2009; Lee, 2003). Since these languages are typologically similar to English, we can obtain an idea about the onset of English-speaking children's production of *only* from them.

According to Gentner (1982:328), nouns that have a transparent semantic mapping onto their perceptual-conceptual world appear early in child language. For instance, a concrete noun like *dog* allows children to directly map between the word and their experience of a living creature with a head, a tail, and four legs that makes barking noises (Gruyter, 2003). For this reason, children readily learn and produce concrete nouns in the early stages of language development. On the other hand, words that denote abstract concepts such as determiners, complementizers, tense and agreement affixes, and so on, are harder to learn and tend to occur later than concrete nouns because they lack a correlate in the perceptual world of the child. Focus particles also lack a direct correlate in the perceptual-cognitive world due to their abstract relation with entities. Furthermore, function words are known to emerge relatively late (Radford, 1995; Buβmann, 1990:286).[1] In light of their similarities to abstract nouns and function words, one might also expect focus particles to be acquired late. Surprisingly, however, focus particles have been observed in early multi-word utterances produced by children during their second year of life (Gruyter, 2003; Höhle et al., 2009; Nederstigt, 2003; Penner, Tracy & Weissenborn, 2000). This calls raises the question of whether children have adult-like competence in using focus particles from a very early age.

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[1] Radford (1995) argued in his 'small-clause hypothesis' that children do not use function categories in the early stages (from 20 to 24 months) of language development.

The finding that young children aged 2-3 are able to compute contrastive information constitutes evidence that the relevant lexical knowledge is present from this early age. Notley et al. (2009) collected longitudinal data from two English-speaking children with a starting test age of 2;02 up to 3;01 by conducting a wh-question task and a yes-no question task involving *only*. The very young children had the ability to compute contrastive information, which is relevant to the semantic function of *only*.

In contrast to this positive evidence for early mastery of *only* from this early age, to my knowledge there has been no data that makes it possible to speculate about children's lexical knowledge of the function of *even*. Corpus studies on German or Chinese focus particles (Höhle et al., 2009; Lee, 2003) reported that additive focus particles appeared from a very early age, but they did not provide any data on the relative onset of scalar focus particles compared to exclusive or additive focus particles. In addition, no attempts have been made to experimentally examine how very young children under 3 years of age behave when comprehending sentences containing *even*. However, based on the empirical evidence for Experiments 3 and 4, I assume that children might not know the semantics of *even* at age 4. Recall that 30% of child participants show no evidence of understanding positive *even*, in that they were incapable of deriving scalar implicature for both affirmative and negated *even* sentences across all the trials. More importantly, they did not respond to the test sentences with *even* differently from the control sentences without *even*. I presented children with contexts in which the use of *even* would be natural and reasonable. Such contextual help was to mitigate their deficiency in pragmatic knowledge, thus aiding their calculation of scalar implicature. However, I found from Experiments 3 and 4 that children aged 4 did not

have the ability to compute scalar alternatives at all, which indicates that their understanding of the function of *even* is nonexistent at this developmental stage.

As for structural factor; a comprehensive picture of children's grammatical knowledge of constraints on *only* and *even* on focus assignment is elusive. Experiments 1 and 2 reported that children favored associating *only* with the last NPs when identifying focus. However, as noted before, there is a lack of data concerning *even* in terms of syntactic constraints in my dissertation. Recently, Ito (2007) provided empirical evidence about whether Japanese children aged 4 to 5 are sensitive to the syntactic scope of *sae* 'even'. Ito (2007) conducted an acceptability judgment task in which children were asked to judge whether sentences with *sae* attached to subject constituents and object constituents were felicitous for particular pictures. No significant differences in the frequency of correct responses were observed between the subject *sae* and object *sae* sentences. The finding that children have the same level of difficulty with the object *sae* sentences as with the subject *sae* sentences was not congruent with Notley et al.'s (2009) finding and with my finding that children produced more errors when *only* was in a pre-subject position than in a pre-object position. However, whether English-speaking children's focus assignment in sentences with *even* resembles their performance on sentences with *only* should be investigated in future studies.

With respect to the discourse, there was clear evidence that children experience a different developmental path in acquiring the focus particles *only* and *even* in terms of pragmatic inferencing. English-speaking children showed an adult-like capacity to generate contrastive information in responding to *only* sentences between ages 4 and 5 while only 30% of child participants were able to do so for sentences containing *even*.

This discrepancy in children's performance on the two focus particles is in accordance with the evidence that adults also comprehend these two particles differently. Filik et al. (2009) reported that the processing of *even* is relatively delayed compared to *only*, which reflects the more complicated semantic function of *even* than *only*. In other words, the derivation of scalar implicature is more costly than that of contrastive information even to presumably sophisticated adults. Based on psycholinguistic evidence from Filik et al. (2009) and developmental evidence from my study, I claim that children develop differently in their pragmatic inferencing of *only* and *even.*

The methodological contribution of this dissertation was in capturing the crucial characteristics of the use of focus particles in daily conversation and reflecting it in the design of the experiments. Focus particles require shared information between the speaker and listener, which can be provided by the verbal context, the situational context, or shared world-knowledge. In previous studies which neglect this important factor in the creation of experimental tasks, results tend to report a high rate of errors in child language. In order to prevent children's performance from being unnecessarily influenced by task demands, the experiments in this study presented test sentences alongside natural contexts in which the appearance of the particles is expected and reasonable. With such discourse contexts, participants can access contextually determined alternative information. For this reason, the experimental tasks of this dissertation were better able to assess children's competence in understanding focus particles. The results from this dissertation therefore provide more convincing and definite answers about children's knowledge of focus particles.

This dissertation also plays an important role in resolving a controversial issue concerning the origin of children's non-adult-like responses in understanding sentences with *only*. One side proposed that children make errors due to a deficiency in their pragmatic knowledge while the other proposed that errors come from a lack of syntactic competence. However, Experiment 1 adjudicated between these two prevailing accounts by using a well-controlled methodology that confirmed the account of Notley et al. (2009) and Crain et al. (1992, 1994).

This dissertation also makes an empirical contribution to children's development of the comprehension of *even*. There has been limits in the theoretical literature about the semantic, syntactic and pragmatic intricacy of *even,* apprehension empirical experimental approach to substantiate these claims. Although the investigation into *even* needs to be further implemented from various angles with different types of tasks, the finding from this dissertation was important because it plays a pioneering role in proving empirically the features of *even*, going beyond theoretical discussion and parsers' intuition.

5.3 Limitations and future studies

This study attempted to shed light on the development of syntactic and pragmatic constraints on children's interpretation of *only* and *even*. Nevertheless, a number of questions still remain unanswered, suggesting promising avenues for future research.

First, throughout the experiments on *even*, children had difficulty in the calculation of scalar implicature. As previous studies on scalar terms such as *some*, connectives and other elements etc., (Papafragou & Musolino, 2003; Papafragou & Tantalou, 2004) pointed out, low success rate in children's calculation of scalar

implicature might be due either to their genuine inability to compute scalar alternatives or to the task constraints. Further research is needed to create other types of tasks to investigate the precise nature of children's poor performance on *even* sentences and to present contexts that assist them to induce scalar implicature. If contextual help leads children to compute scalar implicature as in previous studies (Papafragou & Musolino, 2003; Papafragou & Tantalou, 2004.), the errors found in Experiment 3 and 4 can be attributed to task constraints rather than their deficiencies in pragmatic knowledge.

Future studies can also make use of on-line tasks. Previous studies simply uncovered the result of children's interpretation processes, which as discussed, might be influenced by different kinds of linguistic or non-linguistic factors. In order to provide information about the processing of these sentences, there is a need to employ the visual world- eye-tracking paradigm (Cooper, 1974; Tanenhaus, Spivey-Knowlton, Eberhard & Sedivy, 1995). This online paradigm allows us to collect data from unconscious gaze movements on a picture, while the child is listening to a sentence that describes aspects of the scene. Due to the excellent time resolution of this technique, children's eye gaze behavior can be linked closely to the appearance of single elements in the sentence. This on-line method will contribute a deeper insight into the issue of whether children process information given by the focus particles and how the different semantic functions of *only* and *even* reflect children's linguistic behavior.

Third, other types of focus particles such as additive focus particle *also* need to be examined in future studies. In German, very young children were found to comprehend sentences containing *auch* 'also' in adult-like ways. They were found to compute an alternative set whose property is inclusive with that of a focus set. The fact that these

particles appear early in German corpus data suggests that this should be an area of relatively early acquisition compared to scalar focus particles. Through the experimental investigation of the English additive focus particle *also,* this analysis can be confirmed or disconfirmed. Furthermore, it should be possible to discuss how the different semantic functions of *only*, *also* and *even* influence children's comprehension of sentences containing these particles in course of acquisition. These comparative studies will shed light on children's comprehension mechanisms of focus at semantic, syntactic and pragmatic interfaces.

Lastly, current studies do not provide a cross-linguistic comparison of children's sensitivity to focus particles. Previous studies on *only* have been limited to SVO languages such as English, German, Chinese, etc. As noted in Chapter 3, the finding that children favored associating *only* with the direct object NP regardless of sentence type was commonly obtained in these studies. However, it is important to investigate whether this phenomenon is limited to English or is found across languages. Once this question is answered, we should take up the question of whether children's non-adult responses could be indicative of a universal stage of language development.

5.4 Concluding remarks

To conclude, I have presented new data from studies of children's acquisition of *only* and *even*. I have offered an account of how children's grammars initially differ from those of adults. Until further research on children's understanding of *even* or *also* is conducted, I cannot determine whether the pattern I have uncovered hold for all focus particles. Children are able to compute a contrastive set for *only* without difficulty,

whereas they failed to compute a scalar implicature. This indicates that children have a different capacity to use discourse information to reach the intended interpretation of two focus particles. Based on these findings, I conclude that children aged 4 to 5 travel a different developmental path in acquiring *only* and *even*.

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