CHILDREN SEEM TO KNOW RAISING:
RAISING AND INTERVENTION IN CHILD LANGUAGE

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ABSTRACT

English-speaking children exhibit difficulty in their comprehension of raising patterns, such as (1), in which the NP *the boy* is semantically linked to the VP in the embedded clause, but is syntactically realized as the subject of the matrix clause.

- (1) Raising pattern: [s The boy seems to the girl [s _ to be happy]].
-

This dissertation attributes this difficulty to an intervention effect stemming from the disruption of the association between the matrix and embedded subject positions by an overt intervening NP. A parallel effect has been widely discussed in relation to other patterns, in both adult and child language comprehension.

A corpus study and a set of comprehension experiments reveal several key results. First, children very rarely hear or produce raising patterns with an experiencer. Second, children have difficulty comprehending raising sentences like (2) that contain an intervening experiencer, but this difficulty disappears when the experiencer is fronted to the beginning of the sentence, as in (3).

- (2) Donald seems to Mickey _ to be short. [Experiment 1]

- (3) To Mickey, Donald seems _ to be short. [Experiment 2]

Third, children's comprehension also improves when there is an intervening pronominal experiencer as in (4), but no such effect is observed in the reverse situation, with a raised pronominal and a lexical NP experiencer, as in (5).

(4) Donald seems to him _ to be short. [Experiment 3]

(5) He seems to Mickey _ to be short. [Experiment 4]

Finally, children have difficulty comprehending copy-raising patterns such as (6) when there is no gender cue available to help them correctly interpret the referent of the pronominal copy.

(6) Donald seems to Mickey like he is short. [Experiment 5]

These results show that the difficulty associated with raising patterns cannot be attributed to children's grammatical deficits, as previously suggested (Borer & Wexler, 1987; Hyams & Snyder, 2005; Orfitelli, 2012; Wexler, 2004). Rather, it leads to a theory of Performance-based Intervention Effects (PIE) that attributes the difficulty to the disruption of the semantic link between the matrix and embedded subject positions by an overt intervening NP.

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CHAPTER 1

INTRODUCTION

Children are fast language learners. However, not all structures are acquired immediately and without difficulty in the course of normal language acquisition. One particularly notorious structure is exemplified in (1), in which the NP *the boy* is semantically linked to the verb phrase *to be happy* in the embedded clause, but is syntactically realized as the subject of the matrix clause.

- (1) Raising pattern: [_S The boy seems to the girl [_S _ to be happy]].
-

This structure is often referred to as a “raising” pattern, reflecting the fact that some syntactic analyses posit movement of the NP from the subject position in the lower clause to the higher subject position, leaving a gap in the original position (e.g., Postal, 1974). (For expository purposes, the movement analysis of raising will be assumed henceforth.)

The set of predicates that license this operation, called “raising predicates,” include *seem*, *appear*, *happen*, *be likely*, and *be apt*. Two types of evidence suggest that their subjects are thematically associated with the embedded VP. First, the acceptability of these patterns is sensitive to whether the subject of the raising predicate is semantically compatible with the VP in the embedded clause. Thus, (2a) is unacceptable for the same reason that (2b) is – an NP with a singular referent is not a possible subject for a verb that denotes a collective activity.

- (2) a. *The resident seems to be gathering in the town square.
(cf. The residents seem to be gathering in the town square.)
b. *The resident is gathering in the town square.
(cf. The residents are gathering in the town square.)

Second, most raising patterns have an unraised counterpart such as (3), in which the raised NP appears in the embedded clause and a non-referring expletive NP serves as the subject of the matrix clause.

- (3) Unraised: It seems that John is working hard.

In syntactic frameworks that adopt the raising analysis, patterns such as (4a) are seen as a classic example of “A(rgument)-movement,” since the NP *John* appears to move from one argument position (in this case, the subject of the embedded clause) to another argument position (the subject of the matrix clause). Other types of A-movement structures include passives (4b) and unaccusatives (4c).

- (4) a. Raising: John seems _ to be happy.
b. Passive: John was kicked _ by Mary.
c. Unaccusative: John arrived _.

Although the majority of raising predicates (e.g., *tend*, *used to*, *be about*, *be going*) do not permit an experiencer argument, a subset of raising predicates, including *seem* and

appear, do allow such an argument (*Mary* in (5a)) to occur between the raising predicate and the embedded clause ([5a], with [5b] its unraised counterpart).

- (5) a. Raised: John seems to Mary [_ to be happy].
 b. Unraised: It seems to Mary [that John is happy].

While there is no clear syntactic evidence for or against the idea that the experiencer argument is obligatory or optional, Orfitelli (2012) posits the existence of an implicit experiencer argument even when it is unpronounced – based on “the native speaker intuition that a proposition cannot ‘*seem*’ without there being a ‘*seem-ee*’ to experience it” (p. 111). I will proceed on this assumption without making any commitment, as the issue is not directly relevant to this dissertation. It should be noted, however, that patterns like (5a), where raising takes place across the experiencer, are cross-linguistically rare. In some languages, such as Icelandic, Italian, and Spanish, raising across an experiencer NP is simply forbidden (e.g., Boeckx, 1999, 2008).

In addition to the canonical raising patterns discussed so far, there is a less common pattern – known as “copy-raising” (noted earlier by Postal, 1974; Rogers, 1971) – in which the matrix subject NP is associated with a pronoun inside the embedded clause, as in (6).

- (6) $Mary_i$ seems like she_i is happy.

While copy-raising is perhaps considered uncommon in English (Potsdam & Runner, 2001), it has been attested in a number of different languages, including Modern Greek (Joseph, 1976; Perlmutter & Soames, 1979), Samoan (Chung, 1978), Hebrew (Lappin, 1984), Irish (McCloskey & Sells, 1988), Haitian Creole (Deprez, 1992), Igbo (Ura, 1998), Turkish (Moore, 1998), and Swedish (Asudeh & Toivonen, 2006).

The copy-raising pattern manifests two signature properties of canonical raising patterns. First, the acceptability of the matrix subject is determined by its compatibility with the embedded VP.

- (7) a. *The resident seems like he is gathering in the town square.
(cf. The residents seem like they are gathering in the town square.)
b. *The resident is gathering in the town square.
(cf. The residents are gathering in the town square.)

Second, copy-raising patterns have a non-raising counterpart such as (8), in which the copy-raised NP appears in the embedded clause and an expletive NP serves as the subject of the matrix clause.

- (8) It seems like Mary is happy.

However, unlike an infinitival raising construction, the copy-raising verb takes a finite complement clause headed by *like*, *as if*, or *as though*:

- (9) Mary seems like/as if/as though she is happy.

As it is generally assumed that A-movement cannot move an argument out of a finite clause, the status of the copy-raising patterns has been debated in the literature, and questions remain over whether to assimilate the syntax of copy-raising to the standard syntax of raising from infinitival complement (Asudeh & Toivonen, 2012; Fujii, 2005; Landau, 2009, 2011; Potsdam & Runner, 2001). For example, Potsdam and Runner (2001) propose that copy-raising involves a non-movement A-chain, in which the NP in the matrix subject position originates there. Yet, even the presence of A-chain is controversial as there are cases where the pronominal copy is not the subject of the embedded clause, as in (10) and (11), and where there is no copy in the embedded clause, as in (12) and (13).

- (10) Mary appears as if her job is going well. (Lappin, 1983, p. 122)
- (11) The corpse seemed like the coroner had done an exceptionally bad job of dissecting it. (Asudeh & Toivonen, 2006, p. 6)
- (12) He seemed like there was no longer any turmoil or emotion over doing the tough things. (Landau, 2011, p. 785)
- (13) In fact, even the sky appeared as though the clouds themselves had been stripped of life. (Landau, 2011, p. 785)

As we will see in due course, the copy-raising pattern provides a particularly interesting case for our understanding of why raising patterns present difficulties to language learners.

1.1 Motivation and objectives

Several studies have investigated children's acquisition of raising patterns. By and large, these studies can be divided into two groups: (i) those that tested simple raising sentences *without* an experiencer, as in (14a), and (ii) those that tested raising sentences *with* an experiencer, as in (14b).

- (14) a. John seems [to be happy].
 b. John seems to Mary [to be happy].

For the first group of studies – on raising without an experiencer – the results have been conflicting in that some studies report difficulty, while other do not. The results are summarized in Table 1.1. (All the studies listed in the tables tested the raising verb *seem*, unless otherwise noted.)

Table 1.1. Results of the studies on raising *without* an experiencer

No Difficulty	Difficulty
Becker (2004) Becker (2006) Becker (2007) Orfitelli (2012; with raising verbs such as <i>be about</i> , <i>be going</i> , and <i>tend</i>)	Hirsch, Orfitelli, & Wexler (2007) Hirsch, Orfitelli, & Wexler (2008) Orfitelli (2012)

Yet, there is a general consensus for the second group, shown in Table 1.2, that children have problems comprehending raising patterns containing an experiencer phrase like in (14b).

Table 1.2. Results of the studies on raising *with* an experiencer

No Difficulty	Difficulty
	Hirsch & Wexler (2007) Hirsch, Orfitelli, & Wexler (2007) Hirsch (2011)

The current dissertation aims to provide an explanation for this pattern of findings. I argue that previous studies suffer from either methodological flaws or incorrect analyses, thus obscuring the real picture of how acquisition unfolds in the case of raising. In particular, the conflicting results in the first group are due to the use of poor methodology, and the results of the second group – those that tested raising sentences containing an experiencer – are better explained through a performance factor shown to operate in a number of other sentence types. That is, I propose an explanation that has not been considered before, namely that the source of the difficulty in such raising patterns stems not from a grammatical deficit (e.g., Borer & Wexler, 1987; Hyams & Snyder, 2005; Orfitelli, 2012; Wexler, 2004), but from the performance limitations responsible for *intervention effects* in a variety of other constructions. In other words, I argue that the difficulty children experience with raising patterns plays a role in adult sentence processing as well.

Children (and adults) have been shown to have difficulty with structures in which an NP intervenes between a filler and the associated gap, including object relatives (15a), object topicalizations (15b), object *wh*-questions (15c), coordination (15d), and subject control with *promise* (15e) (e.g., Avrutin, 2000; Chomsky, 1969; de Vincenzi, Arduino, Ciccarelli, & Job, 1999; Friedmann, Belletti, & Rizzi, 2009; Friedmann & Costa, 2010; Friedmann & Lavi, 2006; Friedmann & Novogrodsky, 2004).

- (15) a. Object relative: The boy who the girl kissed _
 b. Object topicalization: The boy, the girl kissed _.
 c. Object *wh*-question: Which boy did the girl kiss _?
 d. Coordination: The boy tickled the girl and _ smiled.
 e. Subject control: The boy promised the girl _ to leave.

The raising pattern in (16) resembles constructions in (15) in that the NP *the girl* intervenes between the dislocated NP *the boy/which boy* and its original position.

- (16) Raising: The boy seems to the girl [_ to be happy].

Thus, intervention effects can be informally defined as follows:

- (17) *Intervention effects*: Children (and adults) have difficulty computing an interpretive dependency between an overt NP and the position with which it is associated, when an overt NP intervenes between them.

Intriguing recent research reveals that intervention effects are sensitive to the type of noun phrase that is the intervener (e.g., Friedmann et al., 2009). In particular, Arnon (2010) has found that children's comprehension of object relatives improves significantly when the intervening NP is a pronoun rather than a lexical NP, as in (18).

(18) The nurse that I am drawing _

This pronoun-lexical NP difference is a signature property of this kind of performance-based intervention effects. Thus, if children's difficulty with raising is indeed due to the same sort of limitation, manipulation of the type of the intervening experiencer should have a similar effect on children's comprehension. That is, by considering what effect the different NP types of intervening experiencers have on children's comprehension, we have a new way of exploring the source of the difficulty associated with the raising pattern.

The goals of this dissertation are twofold: First, it critically addresses and corrects previously unnoticed flaws in the methodologies of existing studies testing the acquisition of raising (see Chapter 2 for more details), thus providing a more reliable picture of children's abilities with respect to raising. Second, it offers an explanation for children's difficulty with raising that draws on a phenomenon (intervention) that generalizes across multiple constructions, thereby reducing the observed difficulties with raising to a performance-based limitation.

The dissertation includes a corpus study of the raising verb *seem* and a series of comprehension experiments that investigate (i) how children's comprehension is affected

by the presence of an intervening NP in raising patterns, (ii) how it is affected by manipulation of the type of intervening NP (lexical versus pronominal) and (iii) how it is affected by the position of the semantic subject (raised versus unraised). Not only do the results of this work provide an accurate and comprehensive assessment of children's acquisition of raising, they are helpful in evaluating and comparing three different theories that have been proposed to explain intervention effects in the fields of language acquisition and adult sentence processing. Thus, in a narrow sense, the dissertation focuses on how children acquire a particular pattern, while in a broader sense, it aims to advance our general understanding of intervention effects and of factors that influence children's sentence comprehension.

1.2 Organization of the dissertation

The dissertation is organized as follows: Chapter 2 reviews previous studies on the acquisition of raising patterns – both without and with an experiencer, and identifies several potential concerns about the methodologies used in this work. Chapter 3 explains the phenomenon of intervention effects, presents three different theories of intervention, and suggests a way to tease apart those theories via the use of the raising pattern with an experiencer. Chapter 4 reports on a corpus study of the raising verb *seem*, drawing on the CHILDES database. Chapters 5, 6, and 7 present a total of six comprehension experiments with English-speaking children on various types of raising patterns with an experiencer. Lastly, Chapter 8 concludes the dissertation by providing a summary of the results and discussing the implications of our findings as well as remaining issues for future study.

CHAPTER 2

ACQUISITION OF RAISING

2.1 Raising without an experiencer

As noted in Chapter 1, the majority of raising predicates (e.g., *tend*, *used to*, *be about*, *be going*) do not permit an experiencer argument. Orfitelli (2012) investigated children's comprehension of this group of raising predicates via a series of experiments using a Truth-Value Judgment Task (TVJT). The four-to six-year-old English-speaking children who were tested on the raising sentences exemplified in (1), manifested adult comprehension from as young as four years old.

- (1)
- a. The pig *is about* to be playing in the mud.
 - b. The ball *is about* to be rolling down the hill.
 - c. The ball *is going* to be rolling down the hill.
 - d. The flower *tends* to be flying through the air.

These finding led Orfitelli to conclude that children are not delayed in acquiring raising predicates that do not select an optional experiencer argument.

However, matters are complicated once we consider the previous studies of the raising predicate *seem* (and *appear*) without an experiencer. Recall that *seem* can occur either with an experiencer (2a) or without one (2b).

- (2) a. John seems to Mary to be happy.
b. John seems to be happy.

Previous research on sentences like (2b) has shown conflicting results so far, some claiming children's good comprehension (e.g., Becker, 2006), while others arguing for the opposite (e.g., Hirsch, Orfitelli, & Wexler, 2008). Let us first consider the studies that claim to have found good comprehension of *seem* sentences without an experiencer.

Becker (2004) used a sentence judgment task to investigate whether 3- to 5-year-old children (mean age 4;3, $n = 43$) can comprehend raising sentences. The children were asked to judge whether a puppet's comment about a cartoon picture was "okay" or "silly." The results showed that the children had little difficulty with raising sentences. They correctly accepted raising sentences with a compatible lower predicate, such as (3a) (3-year-olds: 77%, 4-year-olds: 91%, and 5-year-olds: 79%) and correctly rejected those with an incompatible lower predicate, such as (3b) (3-year-olds: 73%, 4-year-olds: 88%, 5-year-olds: 100%).

- (3) a. The hay seems to be on the ground. [Raising-Compatible]
b. #The hay seems to be excited. [Raising-Incompatible]

Furthermore, in another sentence judgment task with children ages 3–4 years ($n = 48$), Becker (2007) found that both age groups were quite good at accepting raising sentences with a non-referential subject, such as (4) (3-year-olds: 82.98%, 4-year-olds: 91.67%).

- (4) It seems to be raining. [Raising-Expletive]

It should be noted that both studies also tested control verbs (e.g., *want*, *try*) as well as raising verbs. Becker argues that her participants analyze the control verb as a raising verb by (i) accepting it with a compatible lower predicate (5a), (ii) rejecting it with an incompatible lower predicate (5b), and (iii) accepting it with an expletive (5c).

- (5) a. #The flower wants to be pink. [Control-Compatible]
b. #The flower wants to fly away. [Control-Incompatible]
c. #It wants to be raining. [Control-Expletive]

Therefore, although Becker does not make an explicit claim about children's knowledge of raising verbs, she appears to imply that children have no difficulty with them, since her claim is that children are incorrectly over-applying a raising analysis to the control verbs.

However, a closer look at her experiments makes one doubt whether children have the correct raising analysis to begin with. The fact that children pay attention to the relationship between the matrix subject and the embedded predicate, and the fact that they accept the raising verb with expletives do not necessarily mean that they apply an adult-like raising analysis. Becker's results are compatible with other explanations. One possibility is that the children may simply be ignoring the main raising verb and interpreting the sentence as a copular structure – hence *John seems to be happy* might be interpreted as 'John is happy'. Note that this strategy would result in the same responses as if they correctly understood raising.

In fact, this possible confound was noted in Becker (2006), where a TVJT was conducted that respected the distinction between appearance and reality. One story described a white dog appearing purple under a purple light. Given the test sentence *The dog seemed to be purple*, a child using a raising analysis should respond *true* since the dog seems to be purple, while a child using a copula analysis should response *false* since the dog is actually white. She found that most children (3–4 years, $n = 52$) provided appropriate responses, suggesting that they correctly interpreted the main raising verb. However, one of the concerns raised by Hirsch, Orfitelli, and Wexler (2008) is that copular sentences like *The dog was purple* were not actually tested in her experiment. Therefore, one is not sure whether the child was really sensitive to the distinction between appearance and reality. In other words, there is a possibility that children may have responded *true* to the test sentence *The dog seemed to be purple*, by relying on the copular strategy, because the dog *was* indeed purple under the light. If this is the case, then this study also suffers from the same potential confound as with the other two studies mentioned above, and thus does not constitute evidence for children’s good comprehension of raising.

To address their criticism of Becker’s (2006) study, Hirsch, Orfitelli, and Wexler (2008)¹ conducted a modified version of Becker’s original task, in which one of the major changes was the addition of the word *really* in each test sentence, serving the role of emphasizing the difference between appearance and reality. A total of 50 children (3.21–7.92 years, mean age = 5.51) were tested with the following conditions in (6), and the results showed children’s poor comprehension only on the raised condition (6d).

¹ This study is also presented in Hirsch (2011) as Study 5, with further analyses and expanded discussion.

(6)	a. The dog is really white.	[<i>Copula</i>]
	b. The dog really likes to be white.	[<i>Subject control</i>]
	c. It really seems that the dog is purple.	[<i>Unraised</i>]
	d. The dog really seems to be purple.	[<i>Raised</i>]

However, this study suffers from several methodological shortcomings. The first has to do with the word *really*, which serves different functions for each condition. When it occurs with the copula in (6a), *really* is ambiguous in that it may link the sentence to reality, or function as an intensifier. As such, the paraphrase of this sentence would be either ‘*In reality, the dog is white*’ or ‘*The dog is truly white*’. However, in both the unraised and raised conditions, *really* is most likely to function as an intensifier which highlights the illusion denoted by *seem*. Thus, these sentences, both unraised and raised, can be roughly paraphrased as ‘*It truly seems that the dog is purple*’. In fact, in her review of the study by Hirsch, Orfitelli, and Wexler (2008), Orfitelli (2012) acknowledges the ambiguity of *really*. Yet, she dismisses the relevance of this fact on the grounds that children performed poorly only on the raised conditions, even though *really* was also present in the unraised patterns. However, there is no reason to assume that children should apply the same meaning of *really* to both unraised and raised conditions. It is actually quite plausible to hypothesize children interpreting *really* as something like ‘in reality’ for the copula condition and extend this analysis only to the raised condition, given the similarity of the surface word order where *really* occurs right after the word *the dog* in both the copula (6a) and raised (6d) conditions, but not in the unraised condition (6c), where the word *the dog* appears far later in the embedded clause. That is, children

may have interpreted the raised sentence as ‘*In reality, the dog seems to be purple,*’ and then incorrectly gave a false response, showing non-adult performance on the condition. On the other hand, they may have applied the adult-like interpretation of *really* to the unraised sentence, roughly interpreting it as ‘*It truly seems that the dog is purple.*’ This analysis suggests that it is the ambiguity of *really*, rather than the raising operation, that posed difficulties for children and led them to respond incorrectly only on the raised sentences. As such, Hirsch, Orfitelli, and Wexler’s (2008) claim about children’s delayed acquisition of raising without an experiencer cannot be warranted until one finds empirical evidence showing that children have adult-like interpretations of *really* in all of those sentences that were used in their study.

In addition, Hirsch et al.’s (2008) research design raises some concerns about their results. According to Hirsch’s (2011) detailed description of Hirsch et al.’s (2008) study, there were *four* different scenarios, each consisting of a dialogue and two pictures (reflecting a difference in reality versus appearance), and *four* conditions, which are repeated from above, as (7):

(7)	a. The dog is really white.	[<i>Copula</i>]
	b. The dog really likes to be white.	[<i>Subject control</i>]
	c. It really seems that the dog is purple.	[<i>Unraised</i>]
	d. The dog really seems to be purple.	[<i>Raised</i>]

Yet, it is later mentioned that “[e]ach condition is to be tested eight times, with four each of true and false items, for a total of 32 test sentences” (Hirsch, 2011, p. 281). It thus

seems that each child saw the same scenario *eight* times – each of the four structures occurred in (7), one true and one false.² While this design offers a way to increase the number of test items and allows for an examination of within-subject contrasts, there is a risk that children’s performance was affected by repeated exposure to the same scenario.

In summary, the attempts by Becker (2004, 2006, 2007) and Hirsch et al. (2008) to test comprehension of the raising sentences without an experiencer phrase are marred by a number of methodological concerns, that call into question their validity.

2.2 Raising with an experiencer

Only a few studies have investigated English-speaking children’s acquisition of raising patterns containing an experiencer phrase: Hirsch and Wexler (2007),³ Hirsch (2011), and Hirsch, Orfitelli, and Wexler (2007),⁴ all of which are comprehension studies.

Hirsch and Wexler (2007) conducted a two-choice sentence-picture matching task with 70 children (3.04–9.96 years, mean age = 6.49) to assess comprehension of non-raising (8a) and raising (8b) sentences with an intervening experiencer.

- (8) a. It seems to Homer that Marge is pushing a cart.
 b. Homer seems to Maggie to be bowling a ball.

² Or it may be the case that each child saw the same scenario only once, and then were asked to judge eight different test sentences, based on that scenario. Either way, it still brings up the same concern that the same child was presented with *all* of the sentences in (7).

³ This research also appears in Hirsch (2011) as Study 1, with new individual subject analyses and more discussion.

⁴ This study is also presented in Hirsch (2011) as Study 4, with further analyses and expanded discussion.

The children were shown two pictures and were asked to choose the picture that best matches the test sentence they heard. There were three different foil types. (i) *Matrix-reversal* (MR) foils involved switching the character who does the thinking. For example, the MR foil of sentence (8a) would have Marge pushing a cart, thinking about Homer. (ii) *Embedded-reversal* (ER) foils involved switching the character who performs the action denoted by the embedded predicate. The ER foil of sentence (8a) would depict Homer pushing a cart, thinking about Marge. (iii) *Double-reversal* (DR) foils involved switching both who is doing the thinking and who is performing the relevant action. Thus, the DR foil of sentence (8a) would have Marge thinking about Homer pushing a cart.

The results showed that while the majority of children performed quite well on the *unraised* condition (93.3%), they had great difficulty with the *raised* condition (60.6%) until around the age of seven. In particular, most children consistently chose the wrong picture when a raised sentence was presented with a choice between the correct picture and the DR foil. For example, the DR foil for the sentence *Bart seems to Lisa to be playing an instrument* had Bart thinking about Lisa playing an instrument. Based on these results, Hirsch and Wexler (2007) initially proposed the *think*-analysis where children treat the raising verb *seem* as if it were *think*. For example, the sentence *Bart seems to Lisa to be kicking the ball* would be incorrectly interpreted by children as meaning *Bart thinks Lisa is kicking the ball*. Yet, this literal *seem-as-think* analysis is later dismissed in Hirsch (2011), since it entails that children are not paying attention to the non-finiteness of the embedded clause in the raised sentences, despite previous findings that suggest sensitivity to the finite/non-finite distinction from around 18 months of age (Pierce, 1992; Poeppel & Wexler, 1993). Instead, Hirsch (2011) proposes an

imagine-analysis where children interpret the raising sentences (9a) as (9b), by analyzing the verb *seem* as a raising-to-object verb, like *imagine*.

- (9) a. John *seems* to Mary to go to the store every Saturday.
 b. John *imagines* Mary to go to the store every Saturday.

As with the *think*-analysis, the *imagine*-analysis should lead to below-chance performance on the *raised* condition with DR foils, since the DR foil matches this incorrect interpretation.

Using the same methodology and the same pictures, Hirsch (2011) also tested children's comprehension of raising sentences containing an experiencer (4.25–7.98 years, mean age = 6.02, $n = 60$), but this time the experiencer phrase was dislocated to the beginning of the sentence, as in (10):

- (10) To Lisa, Homer seems to be petting a dog.

The results revealed that children generally did well on comprehending raising sentences with a fronted experiencer (4-year-olds: 74.4%, 5-year-olds: 78.1%, 6-year-olds: 80.7%, 7-year-olds: 91.8%). However, Hirsch notes that children's performance on one particular foil type did not differ from chance until the age of seven years: that was the MR foil which involved switching the character who does the thinking. For example, for the test sentence (10), the picture A in Figure 2.1 is the correct response, while an MR foil is the picture B.

Figure 2.1. A sample set of pictures used in Hirsch (2011)

Given this chance performance on the MR foil, Hirsch argues that the children are ignoring the fronted experiencer in raised sentences, and using a copula-analysis, in which they interpret the raising verb *seem* as the copula – thereby taking the raised sentence (10) to mean *Homer is petting a dog*. This analysis explains their chance performance with the MR foil, since both pictures (correct and incorrect) presented to a child would then match the test sentence once the experiencer is ignored. Overall, Hirsch (2011) concludes that raising is problematic for young children irrespective of the position of the experiencer phrase.

However, factors involving the experimental stimuli used in these two studies ultimately cast serious doubt on the results just reported. The first concern involves the use of “thought-bubbles” to depict sentences containing the verbs *think* or *seem*, in order to convey the notion of thinking. Consider the picture shown below (Figure 2.2), which is the correct picture for the five sentences in (11).

Figure 2.2. A sample picture used in Hirsch & Wexler (2007) and Hirsch (2011)

- (11)
a. Lisa thinks that Bart is playing an instrument.	[<i>think</i>]
b. It seems to Lisa that Bart is playing an instrument.	[<i>unraised</i>]
c. To Lisa, it seems that Bart is playing an instrument.	[<i>unraised</i>]
d. Bart seems to Lisa to be playing an instrument.	[<i>raised</i>]
e. To Lisa, Bart seems to be playing an instrument.	[<i>raised</i>]

As the term itself suggests, “thought-bubbles” are perfectly appropriate for the *think*-condition. However, the children in Hirsch and Wexler’s may have incorrectly treated the raising verb *seem* as *think* (or *imagine*) because of the thought-bubbles: Since the picture portrays a person thinking about something, it would be natural for children to assume that whatever verb they hear has the same meaning as the verb *think* solely based on the picture, leading them to use either the *seem-as-think*- or *imagine*-analysis.

Secondly, the two characters portrayed in the picture seem to differ in their relative salience in that the one who is doing the thinking is given more emphasis than the one who is performing the relevant action. While sentences (11d) and (11e) actually match the picture in Figure 2.2, it may sound awkward to describe this picture with Bart

as the subject of the sentence since Lisa, who is doing the thinking, looks more prominent in the picture than Bart, who is carrying out the action depicted inside the thought-bubble.

The third concern involves the infelicitous use of the experiencer phrase when there are only two characters in the stimuli, whether it be a picture or a story (Hamburger & Crain, 1982). In Hirsch and Wexler (2007) and Hirsch (2011), there are always only two characters depicted in the picture – Bart and Lisa, for example. Notice that the use of the experiencer phrase *to Lisa* in this case is arguably redundant, since there is nobody else to whom Bart seems to be playing an instrument except Lisa. In fact, this may be the very reason why those children in Hirsch’s (2011) study seemed to ignore the fronted experiencer.⁵ In other words, it is quite reasonable for children to ignore the fronted experiencer, since the picture contains no alternative experiencer that contrasts with the “real” experiencer, and thus it maybe infelicitous to topicalize the experiencer phrase to begin with.

There is also a potential concern about Hirsch’s (2011) interpretation of the results. Recall that he argues for children’s use of a copula-analysis for raised sentences with a fronted experiencer. That is, he posits that children analyze the raised sentence (12a) as (12b), whereby they ignore the experiencer phrase and treat the raising verb *seem* as a copula.

- (12) a. To Lisa, Bart *seems* to be waving a flag.
b. Bart *is* waving a flag.

⁵ However, this may not be the only explanation as to why children were ignoring the fronted experiencer in raised sentences, since those same children had no problems interpreting the fronted experiencer with unraised sentences. Hirsch (2011) does not provide an explanation for this unexpected pattern of results.

While this analysis successfully captures the pattern of the results that he found (see above), there is an alternative explanation, namely, that children are ignoring the experiencer, but grammatically interpreting the remainder of the raised sentence. This strategy would also be compatible with his experimental findings, since it would lead to chance performance with MR foil type, in which the foil picture for the sentence (12a) would be Bart waving a flag, thinking about Lisa. Crucially, however, this analysis would be incompatible with his claim for the delayed acquisition of raising with a fronted experiencer. Hirsch, in fact, considers this possibility that children may successfully parse the raising sentence once the experiencer is ignored. But he dismisses the idea, with the reasoning that children are not ignoring the experiencer phrase in Hirsch and Wexler (2007), which tested the raised sentences with an intervening experiencer. Specifically, he notes that “... an analysis that suggests children are ignoring the experiencer, and grammatically interpreting the raised sentence that remains, fails to unify the results of Study 1 [which tested raising with an intervening experiencer] and Study 2 [which tested raising with a fronted experiencer]” (Hirsch, 2011, p. 158). However, Hirsch’s own conclusion that children are using a copula-analysis also inevitably rests on the assumption that they are ignoring the fronted experiencer in raised sentences, thereby also failing to unify the results from his two studies. In sum, Hirsch’s (2011) experimental findings are compatible with both accounts: one in which children ignore the fronted experiencer and *cannot* comprehend raising sentences, thus using the copula-analysis, and one in which children ignore the fronted experiencer but *can* interpret raising sentences. Therefore, the data do not fully support his claim that children cannot comprehend raising sentences where the experiencer is fronted.

Turning to a different methodology, let us review a study conducted by Hirsch, Orfitelli, and Wexler (2007), who employ a Truth-Value Judgment Task to examine children's comprehension of raising with an intervening experiencer (4.35–7.95 years, mean age = 5.97, $n = 40$). Sample test sentences are shown below:

- (13) a. It seems to Ken that Barbie is wearing a hat.
b. Barbie seems to Ken to be wearing a hat.

The results demonstrated that while children were successful comprehending unraised sentences (97.8%), they showed poor comprehension of raised sentences (30.0%). From this finding, Hirsch et al. conclude that children are unable to comprehend raising over an experiencer until around age seven.

Yet, there are several methodological concerns that need to be addressed. First, their results may have been due to the infelicitous use of the raising verb *seem*. Note that the verb *seem* is frequently used to project illusion or uncertainty. However, in the contexts used by Hirsch et al. (2007) for the raised condition, it is always the case that what is described in the raising sentence actually matches what happens in the story. For example, in one story, Barbie is wearing a hat, but she does not realize it. Then, Ken sees that Barbie is wearing a hat. The test sentence used in the matching condition is *Barbie seems to Ken to be wearing a hat*. But children might be puzzled by use of the verb *seem* in a situation where Barbie is actually wearing a hat, so that there is no illusion for Ken, the experiencer.

The second concern has to do with the same issue raised above: namely, the infelicitous use of the experiencer phrase when there are only two characters in the story (Hamburger & Crain, 1982). With only two characters, Barbie and Ken, use of the experiencer phrase *to Ken* is unmotivated. Hence, another potential experiencer may be necessary to make it felicitous to include the experiencer phrase. (See O'Brien, Grolla, and Lillo-Martin, 2006, who found an improvement in children's performance on long passives when the task satisfied a felicity condition by having an extra character in the story.)

Overall, while the three studies reviewed thus far claim to have found evidence for children's delay in the acquisition of raising with an (intervening and fronted) experiencer until the age of seven, each of the studies seems to suffer from its own methodological problems. Thus, one goal of the following three experimental chapters (Chapter 4–7) is to address these concerns and seek to provide a better assessment of children's comprehension of raising sentences with an experiencer.

2.3 Explanations for the difficulty

This section reviews several grammar-based accounts that have been put forward to account for children's difficulty with raising, and discusses the predictions they make with respect to the different patterns of raising sentences. The section ends with a novel account which reduces the source of this difficulty to a performance-based limitation.

2.3.1 Universal Phase Requirement

Children's difficulty with raising has been interpreted as evidence for maturational theories of language acquisition (Borer & Wexler, 1987; Wexler, 2004), which posit that certain syntactic representations are impossible for young children because of their immature grammatical system. In particular, Borer and Wexler (1987) attribute this difficulty to young children's inability to form A-chains (A-Chain Deficit Hypothesis (ACDH)), predicting that structures involving A-chains – such as raising, passives, and unaccusatives – are delayed in acquisition. However, one difficulty faced by the ACDH is that not all A-chains have been found to be difficult for children. Since the formulation of the ACDH, it has been argued that subjects are base-generated inside the VP and only later move up to Spec, IP (VP-internal subject hypothesis; Contreras, 1987; Kitagawa, 1986; Koopman & Sportiche, 1991; Kuroda, 1988; Speas, 1986; Zagana, 1988). This is illustrated in (14), which shows that the subject NP originated in the Spec of the VP.

Since the subject moves from an A(argument)-position to another A-position, it creates an A-chain. Yet, acquisition data show that children are able to correctly raise the subject out of the VP (Stromswold, 1996), contra the prediction of ACDH. Furthermore, Kirby (2009) found that even four-year-old children have adult-like comprehension of raising-to-object sentences (15), in which the embedded subject is assumed to raise to the matrix object position. Note that since these sentences also involve an A-chain, they should be ungrammatical for young children according to ACDH.

- (15) Raising-to-Object: Suki needed Neil [_{NP} to kiss Louise]
-
- The diagram consists of a horizontal line segment below the text 'Neil [_{NP} to kiss Louise]'. An upward-pointing arrow starts from the left end of this line and points to the space between 'Neil' and the bracketed phrase, indicating movement from the embedded subject position to the matrix object position.

Recognizing these weaknesses in the ACDH, Wexler (2004) proposes that children have no constraint against A-chains *per se*, but rather (until around age 5) they are subject to the Universal Phase Requirement (UPR): all *v*P_s are phases. The UPR is couched in the Minimalist framework (Chomsky, 2000, 2001), which includes the Phase Impenetrability Condition (PIC):

- (16) The Phase Impenetrability Condition: An item can be extracted from a phase⁶ only if it is in the ‘edge’ position (roughly, if it is in the Specifier position of the phase, but not if it is in a lower position).

⁶ A phase is a sub-domain of the syntactic derivations that proceed incrementally. Both *v*P and CP are identified as phases (Chomsky, 2001).

However, constructions such as passives, unaccusatives, and raising pose a problem, since they require movement across a phase boundary from a non-edge position, as illustrated in (17).

(17)

To address this problem, Chomsky proposed that the *v* of those constructions (passive, unaccusative and raising) is ‘defective’, in that it lacks an external argument and that it therefore does not count as a phase. This in turn allows the embedded subject to move to the matrix subject position without violating the PIC.

Drawing on this idea, the UPR claims that there is no defective phase in young children’s grammar. Thus, children take all *v*Ps to be strong phases and therefore cannot carry out subject-to-subject raising. The presence of the experiencer phrase is irrelevant for UPR, since it is the grammatical operation (i.e. movement) itself that is problematic for children. The UPR thus predicts that raising sentences should always be ungrammatical for young children, regardless of whether there is an experiencer phrase.

2.3.2 Universal Freezing Hypothesis

Hyams and Snyder (2005) seek another explanation to account for delays in raising acquisition by adopting Collins' (2005a) "smuggling" account of raising, and proposing the Universal Freezing Hypothesis (UFH).

Under Collins' analysis of raising, the experiencer phrase is generated in the specifier position of an applicative phrase, which structurally intervenes between the base position (indicated by $_$) of the raised argument and its final position in the matrix Spec of the IP:

As such, simple raising of the embedded subject at this point seems to violate locality restrictions on syntactic movement, such as Relativized Minimality⁷ (Rizzi, 1990), or the Minimal Link Condition⁸ (Chomsky, 1995), since the experiencer DP *Mary* c-commands the embedded subject. The issue is the following: why doesn't the DP *Mary* block movement of the DP *John* from the embedded clause to the matrix Spec of the IP? As noted in Chapter 1, English is exceptional in that it allows sentences like (18). In fact, this problem, which Boeckx (1999) calls the 'experiencer paradox', has been a long-standing puzzle for formal syntax, for which various solutions have been proposed (e.g., Boeckx, 1999, 2008; Chomsky, 2000; Epstein et al., 1998; Kitahara, 1997; McGinnis, 1998).

⁷ Relativized Minimality (RM): In the configuration ... X ... Z ... Y ..., Y cannot be related to X if Z intervenes and Z has certain characteristics in common with X (Rizzi, 1990).

⁸ Minimal Link Condition (MLC): K attracts α only if there is no β , β closer to K than α , such that K attracts β (Chomsky, 1995, p. 311).

Collins' smuggling approach is also designed to solve this problem, as can be seen by considering the derivation of the sentence in (18). Here, the subject DP *John* undergoes a series of movements: starting from its original position in the Spec of AP (*happy*), it moves first to the Spec of the infinitival IP and then to the Spec of the VP headed by the verb *seem*. It is at this point that “smuggling” takes place in the manner illustrated in (19), from Collins (2005a):⁹

(19)

⁹ Before the smuggling operation, the embedded IP undergoes extraposition, where it moves to the specifier position of a functional projection XP, which is lower than the applicative phrase (see Collins 2005a for more details).

That is, the entire VP containing the subject DP moves higher to the Spec of the ν P above the applicative phrase (with the experiencer in its Spec), thereby smuggling the subject DP past the experiencer and allowing it to raise to the matrix subject position. Given that the VP containing the subject DP has already moved past the intervening experiencer, the subsequent movement of the subject DP to matrix Spec of IP is no longer a problem. Importantly, as the subject DP is raised from the VP that itself has already undergone movement, the smuggling process is considered an exception to the Freezing Principle (Müller, 1998), which rules out movement from an already moved phrase.

Appealing to these processes of smuggling and freezing, Hyams and Snyder's Universal Freezing Hypothesis (UFH) claims that children over-apply the Freezing Principle to all cases of movement:

- (20) UFH: For the immature child (at least until age four), the Freezing Principle always applies – No subpart of a moved phrase can ever be extracted.

As a consequence, children have difficulty with structures involving the smuggling process – such as raising sentences and verbal passives (Collins, 2005a, b). Note, however, that the UFH predicts that children's comprehension of raising becomes problematic only when an experiencer is present. That is, it predicts no trouble for raising sentences without an experiencer, since it is only when the embedded subject needs to raise across the intervening experiencer that the smuggling is required.

2.3.3 Argument Intervention Hypothesis

Orfitelli (2012) puts forward the Argument Intervention Hypothesis (AIH) to account for children's delay in raising as well as verbal passives:

- (21) AIH: Children are delayed in acquiring those structures which require A-movement across a structurally intervening argument.

For example, raising sentences like (22) are ungrammatical for children, since it involves movement of the embedded subject *John* past the experiencer argument *Mary*.

- (22) John seems *to Mary* to be happy.
 ↑ |

The AIH is similar to the UFH in that the crucial component of the theory has to do with the presence of an intervening argument, and it therefore claims that children have difficulty with subject-to-subject raising when it operates across an experiencer. Thus, it is only the *seem*-type raising predicates that select an experiencer argument (e.g., *seem*, *appear*) that pose special difficulty for children, while non-experiencer raising predicates (e.g., *tend*, *be about*) should be unproblematic. However, the AIH makes a prediction different from the UFH with respect to the *seem*-type raising sentences *without* an experiencer. According to the AIH, it is assumed that even when there is no overt experiencer argument in *seem*-type raising sentences, it is syntactically projected (Orfitelli, 2012; 109–111), leading to the prediction that children's difficulty should persist even in patterns such as (23), in which the experiencer phrase is unpronounced.

(23) Karl seems to be upset.

However, Orfitelli notes that there is a way to avoid triggering the intervention violation under Rizzi's (2004) Relativized Minimality, even when one argument is moved across another. Specifically, she predicts that children's difficulty with raising sentences (22) should disappear, "if the experiencer argument can be sufficiently focused in the discourse" (Orfitelli, 2012, p. 118). Such a prediction was not tested in Orfitelli (2012), but it was invoked as an attempt to explain the results of O'Brien et al.'s (2006) study, which found children's improved performance with verbal passives when their Truth-Value Judgment Task scenarios satisfied the felicity condition of the long passive by introducing a third character to act as a potential referent of a *by*-phrase. Note that these results go against the prediction of Orfitelli's AIH: Under the AIH, verbal passives should be problematic for children, since the structure, just like raising, involves movement of one argument (thematic object) over another (*by*-phrase) (Collins, 2005b). Thus, to account for this seemingly contradictory finding, Orfitelli adopts the idea of Snyder and Hyams (2008), who suggest that the discourse feature of the intervening argument can prevent an intervention violation:

- (24) “The passive becomes unproblematic in OGL’s [O’Brien, Grolla, & Lillo-Martin’s] felicity condition because the surface subject bears a [+Topic] feature, and/or because the demoted subject (whether pronounced or not) bears a [+Focus] feature”
[from Snyder & Hyams’ (2008) handout for UConn Psycholinguistics
Brownbag]

In other words, Snyder and Hyams argue that O’Brien et al.’s addition of a third character has served to give the *by*-phrase a [+Focus] feature, which then assisted children to comprehend the verbal passives.

Since the AIH aims to capture the delayed acquisition of both verbal passives and raising by relying on their shared syntactic trait (i.e., A-movement across an intervening argument), it is naturally assumed that what this theory predicts for passive acquisition should also apply to the acquisition of raising. Therefore, by adopting Snyder and Hyams’ approach regarding the acquisition of passives, the AIH makes a clear prediction for the case of raising as well: if children were tested on raising sentences in a Truth-Value Judgment Task which introduced a third character that contrasts the actual referent of the experiencer, the movement of one argument over another should not be problematic. (Recall that the failure to meet the felicity condition of raising sentences was mentioned in the previous section as a potential concern for the past studies.) Experiment 1 (and subsequent ones) satisfy this felicity condition by having three characters in the TVJT stories. This provides a suitable testing ground for AIH’s specific prediction – namely that children’s difficulties with raising should cease, as was the case with the passive

(O'Brien et al., 2006), when there is a third character, giving rise to the [+Focus] feature to the experiencer phrase.

2.3.4 Performance-based Intervention Effects

All of the three accounts mentioned – Universal Phase Requirement (UPR), Universal Freezing Hypothesis (UFH), and Argument Intervention Hypothesis (AIH) – have in common that a grammatical deficit underlies children's delayed acquisition of raising. Furthermore, these accounts are often referred to as competing theories explaining the acquisition path of A-movement structures, such as passives, unaccusatives, and raising, since their claims and predictions are not specific to raising sentences, but can be generalized across other types of A-movement structures.

However, there is another way to explain the seemingly grammatical deficit, which does not make recourse to non-adult-like linguistic systems but instead points to performance-based limitations which impinge on the proper functioning of an adult-like grammar system (Bloom, 1990; Valian, 1991). I propose that the difficulty associated with raising patterns in (25) is not unique to children, but is merely a reflection of the processing difficulty imposed on both adults and children in a variety of other structures, as in (26) (e.g., Avrutin, 2000; Chomsky, 1969; de Vincenzi et al., 1999; Friedmann & Costa, 2010; Friedmann & Lavi, 2006; Friedmann & Novogrodsky, 2004; McKee et al., 1998; Tavakolian, 1981).

(25) Raising: The boy seems to the girl to be happy.

The diagram illustrates a movement path. A horizontal line starts from the right side of the boxed phrase 'the girl' and extends to the left. From the left end of this line, an arrow points vertically upwards to the space between the word 'to' and the phrase 'the girl'.

- (26)
- a. Object relative: The boy who the girl kissed _
 - b. Object topicalization: The boy, the girl kissed _.
 - c. Object *wh*-question: Which boy did the girl kiss _?
 - d. Coordination: The boy tickled the girl and _ smiled.
 - e. Subject control: The boy promised the girl _ to leave.

These structures all manifest what I will henceforth call an “intervention effect.”

- (27) *Intervention effect*: Children (and adults) have difficulty computing an interpretive dependency between an overt NP and the position with which it is associated, when an overt NP intervenes between them.

Specifically, I propose the Performance-based Intervention Effects (PIE) in raising – that the delay in the acquisition of raising should be attributed to the increased processing cost associated with the presence of the NP (*the girl* in (25)) between the raised NP (*the boy*) and the gap in its original position.

At this point, it is worth mentioning that while both the AIH and the PIE make use of the term “intervention,” the underlying notion is fundamentally different in a grammatical deficit theory compared to a performance-based theory. Consequently, as we will see in due course, the two accounts diverge on their predictions regarding raising patterns containing different types of noun phrases. Furthermore, for the AIH, intervention comes from a structurally intervening argument, and crucially, this intervening argument can be either overt or covert, as long as it is syntactically projected.

But for the PIE, the only requirement is that there be an overt NP within an interpretive dependency.

Also noteworthy is that of all four accounts considered, only the PIE links the difficulty associated with raising to another well-known difficulty that both adults and children encounter and that is observed in multiple construction types. The other three accounts (UPR, UFH, and AIH) limit themselves to the structures involving classic A-movement. Thus, in order to evaluate the PIE with respect to the other accounts, it is important to closely examine the phenomenon of the intervention effect itself. The next chapter summarizes previous findings on intervention effects in children and adults and compares different explanations put forward in acquisition and processing studies.

CHAPTER 3

INTERVENTION EFFECTS

3.1 Description of the phenomenon

Numerous studies, conducted on many different languages, have shown that children do not comprehend relative clauses until age 5 to 6 (e.g., Córrea, 1995; Kidd & Bavin, 2002). Yet, not all kinds of relative clauses are equally problematic for children. It is well-established that children find object relatives such as (1b) more difficult than subject relatives such as (1a) (e.g., Diessel & Tomasello, 2005; Friedmann et al., 2009; McKee, McDaniel, & Snedeker, 1998, among others). There are several differences between the two kinds of relatives, but one key difference is that in object relatives, the embedded subject NP intervenes between the relativized NP and its original position, while there is no intervening noun phrase in subject relatives.

- (1) a. Subject relative: the boy that _ kissed the girl
 b. Object relative: the boy that the girl kissed _

This phenomenon has been referred to as an intervention effect (Belletti & Rizzi, forthcoming; Friedmann et al., 2009) because the difficulty associated with it is thought to arise from the presence of a noun phrase that interrupts the filler-gap dependency. This effect has also been found in other structures involving this sort of dependency, including object topicalizations (2a) and *wh*-questions (2b) (Avrutin, 2000; de Vincenzi et al., 1999; Friedmann & Lavi, 2006).

- (2) a. Object topicalization: The boy, the girl kissed _.
 b. Object *wh*-question: Which boy did the girl kiss _?

Friedmann and Costa (2010) report a similar finding in a structure that does not involve *wh*-movement. Specifically, Hebrew-speaking children have difficulty even with coordinate structures such as (3a), in which a subject-verb dependency (*grandma* and *smiled*) is interrupted by the intervening NP *the girl*. In contrast, the children show good comprehension of coordinate structures without such a dependency, as in (3b), and of those with a dependency that does not involve an intervening argument, as in (3c).

- (3) a. Grandma tickled the girl and _ smiled.
 b. Grandma smiled and the girl sang.
 c. Near grandma, the girl sang and _ smiled.

Moreover, strong correlations were found between children's comprehension of coordinate structures such as (3a) and of object relatives such as (4), both of which have filler-gap dependencies that are interrupted by an intervener.

- (4) Here is the grandma that the girl kissed _.

Thus, the authors conclude that intervention effects are not limited to *wh*-movement dependencies, and that the presence of an intervening argument within any dependency creates comprehension difficulties for children.

The intervention effect is made even more intriguing by the finding that its difficulty can be modulated by manipulating the type of noun phrases in a sentence (Arnon, 2010; Friedmann et al., 2009; Kidd, Brandt, Lieven, & Tomasello, 2007). For example, Arnon (2010) tested Hebrew-speaking children on subject and object relatives which varied in whether the relative clause contained a lexical NP or a pronoun. In line with previous findings, children comprehended subject relatives better than object relatives, but they were better at comprehending object relatives with pronouns (5b), than ones with lexical NPs (5a).

- (5) a. the nurse that the girl is drawing _
 b. the nurse that I am drawing _

This advantage will, henceforth, be referred to as the “pronoun advantage.”

- (6) Pronoun advantage: Pronominal interveners cause less difficulty than lexical NP interveners.

Surprisingly, the same contrast has been found in studies of adult processing: object relatives have longer reading times and higher error rates in comprehension than do subject relatives (e.g., Caplan & Waters, 2002; Carpenter et al., 1994; Gibson, 1998; Wanner & Maratsos, 1978, among others), but the difficulty associated with object relatives disappears when the subject inside the relative clause is pronominal as in (7)

(e.g., Gordon, Hendrick, & Johnson, 2001; Real & Christiansen, 2007).

(7) the barber that you admired _

Based on these observations, different theories have been put forward to explain the selective intervention effects. The following section reviews three accounts that draw to varying degrees from the literature on adult processing and child language acquisition.

3.2 Explanations for the difficulty

3.2.1 Relativized Minimality account

Some scholars (Belletti & Rizzi, 2010; Friedmann et al., 2009) suggest that the observed intervention effects can be explained in terms of a syntactic principle called Relativized Minimality (RM). This locality constraint, proposed by Rizzi (1990), states that in the configuration:

(8) ... X ... Z ... Y ...

Y cannot be related to X if Z intervenes and Z bears a certain similarity to X. Specifically, the dependency between X (the moved element) and Y (the gap) is blocked if Z (the intervener) is a potential antecedent of Y. For example, in (9a), the *wh*-word *how* (marked with a +Q feature) cannot be extracted from its original position _, since there is the intervening element *who*, which is also a *wh*-word, marked with a +Q feature. In

contrast, extraction in (9b) is permitted despite the presence of an intervener (*John*), since the intervener is not a possible antecedent to the gap (i.e., it does not have a +Q feature).

- (9) a. *How do you wonder [who behaved _]?
 b. How do you think [John behaved _]?

Schematically speaking, the sentence (9a) violates RM because it exhibits a configuration like (10a), where the intervener Z is similar to the moved element X by having the identical feature (+Q feature in the example above). However, the sentence (9b) is well formed because it involves a configuration like (10b), in which X and Z do not share any feature, and thus, the intervener does not have a blocking effect.

(10)	X ...	Z (Intervener) ...	Y	RM
a.	+A ...	+A ...	+A	* (Identity)
b.	+A ...	+B ...	+A	ok (Disjunction)
c.	+A, +B ...	+A ...	+A, +B	ok (Inclusion)

Another possible extraction is exemplified by the pattern in (10c), where X and Z share a feature, but the feature of the X is more richly specified than that of the intervener. Since their features are globally distinct, the intervener Z is no longer a potential antecedent of Y, and thus, makes such extraction possible. Such a pattern is illustrated in (11):

(11) ?Which problem do you wonder how to solve _?

+Q, +NP	+Q	+Q, +NP
X	Z	Y

This so-called inclusion configuration is marginally acceptable, since the feature of the intervener *how* (+Q) is included in the feature specification of the target *which problem* (both +Q and +NP).

Extending this idea to language acquisition, Friedmann, Belletti, and Rizzi (2009) argue that children apply a stricter version of RM than adults, requiring the features of X and Z to be entirely distinct in order to move an element over an intervening element. That is, the child allows only patterns like (10b: Disjunction), in which there is no overlapping feature between the moved element and the intervener, while banning the grammatical one (10c: Inclusion) due to a partial overlap of features. Thus, they rule out object relatives such as (12), another inclusion pattern, in which *the girl* intervenes between the gap and the relative head *the boy*.

(12) Object relative: the boy that the girl kissed _

[+R, +NP] [+NP] +R, +NP

(where “+R” designates a relative feature, and “+NP” designates a full lexical noun phrase.)

The feature of the relative head is more richly specified than the intervener, since it has an additional +R feature, but importantly, they share the same feature +NP. Thus, this

extraction is disallowed in the child system, while it is permitted with adults. Hence, the child's more restrictive version of RM explains children's difficulty in comprehending object relatives, when the relative head and the intervening subject are both of the same type.

In addition, the RM approach makes a clear prediction: If the relative head and the intervener are made sufficiently different, so that the two do not share relevant features, as in (10b: Disjunction), then extraction should be possible even in the child system. This prediction is borne out in a series of experiments in Friedmann et al. (2009), which showed children's improved comprehension of object relatives by manipulating the NP type of the relative head or the intervening subject. For example, children had difficulties understanding object relatives such as (13a), where both the relative head *ha-pil* 'the elephant' and the intervening subject *ha-arie* 'the lion' were full lexical noun phrases. However, no such difficulty was found with sentences like (13b) and (13c), where the two were of different NP types: in (13b), the relative head *mi* 'who' is a bare *wh*-word, while the intervening subject *ha-yeled* 'the boy' is a lexical NP. And in (13c), the relative head *ha-sus* 'the horse' is a lexical NP, but the intervener is an impersonal arbitrary *pro*.

- (13) a. Tare li et ha-pil she-ha-arie martiv.
 show to-me ACC the-elephant that-the-lion wets
 ‘Show me the elephant that the lion is wetting.’
- b. Tare li et mi she-ha-yeled menadned.
 show to-me ACC who that-the-boy swings
 ‘Show me the one that the boy is swinging.’
- c. Tare li et ha-sus [e] she-mesarkim oto.
 show to-me ACC the-horse that-brush-pl him
 ‘Show me the horse that someone is brushing.’

Thus, Friedmann et al. conclude that it is only when both the relative head and the intervener are of the same type (e.g., when both are full lexical noun phrases) that children have difficulty understanding structures like object relatives. The difficulty disappears when the relative head and the intervening NP are of different NP types, as in the pronoun advantage cases.

While the RM approach was proposed to explain the observed intervention effects in children, a similar line of argumentation exists in studies of adult sentence processing. Known as the similarity-based interference approach,¹⁰ this account attributes adults’ processing difficulty of object relatives to the similarity of the two noun phrases

¹⁰ While this processing approach is similar to the RM account in terms of the predictions they make, it is worth noting that the nature of the two approaches are quite different: According to the RM approach, the difficulty stems from the child’s grammar being different from the adult-like grammar. For the similarity-based interference approach, however, the difficulty relates to memory interference during retrieval.

appearing in the sentence (Gordon et al., 2001, 2004; Gordon, Hendrick, & Levine, 2002; Lewis, 1996). That is, object relatives like (14b) are difficult to process, because both *the banker* (the head modified by the relative clause) and *the barber* (the subject of the relative clause) are of the same type – both are definite NPs with a human referent. This similarity is claimed to cause interference in working memory, making it hard to retrieve the correct NP at the embedded verb. Note that the same problem does not arise in subject relatives like (14a), since it does not involve two similar NPs before the embedded verb.

- (14) a. Subject relative: The banker that _ praised the barber climbed ...
b. Object relative: The banker that the barber praised _ climbed ...

Thus, like the RM approach, this approach also explains why processing difficulty is mitigated in object relatives with a pronominal subject as in (15): because the filler and the intervener are now dissimilar, the intervention effect is reduced or even eliminated entirely (Gordon et al., 2001).

- (15) The banker that you admired _ climbed ...

Furthermore, Gordon, Hendrick, and Johnson (2001) provide another piece of evidence for the similarity-based interference. Using a self-paced reading task with adults, they examined the processing of subject- and object-extracted clefts which contained two

NPs that are either matching (both descriptions or both names) or mismatching (a name and a description), as in (16).

(16) a. Subject-extracted cleft:

It was the barber/John that _ saw the lawyer/Bill in the parking lot.

b. Object-extracted cleft:

It was the barber/John that the lawyer/Bill saw _ in the parking lot.

As expected, object-extracted clefts were found to be more difficult to process than subject-extracted clefts. However, this subject-object difference was greater when the two NPs were matched (i.e., name-name or description-description) than when they were mismatched, indicating that the similarity between NPs is a crucial factor affecting processing difficulty.

3.2.2 Experience-based account

An alternative experience-based approach to explaining intervention effects is proposed by Kidd, Brandt, Lieven, and Tomasello (2007) and Arnon (2010). The key claim of this approach is that children have difficulty with patterns whose properties differ from those most frequently instantiated in the input. On this view, children's difficulty with object relatives in previous studies is due to the fact that test sentences failed to satisfy the distributional properties of object relatives. To confirm this claim, Kidd et al. (2007) conducted a corpus study and a sentence repetition task with 3- and 4-year-olds, and found that children were indeed more likely to accurately repeat the type

of object relatives that they hear and produce most often – those with an inanimate head noun and a pronominal embedded subject (e.g., *the book that you read* _). A similar finding was observed by Arnon (2010), who examined the distributional pattern of relative clauses in child and child-directed Hebrew. Subsequent tests of children's comprehension and production of relative clauses showed that children have no difficulty with pronominal object relatives – the kind of relative clause that they hear and produce most frequently (e.g., *the nurse that I am drawing* _).

The experience-based account is also supported by results from adult sentence processing studies, which appeal to the distributional and discourse regularities of the input to explain the difference in processing difficulty between subject and object relatives (e.g., MacDonald & Christiansen, 2002; Reali & Christiansen, 2007). For example, Reali and Christiansen (2007) conducted a large-scale corpus study, which revealed that object relatives such as (17b), with a pronominal subject, overwhelmingly outnumber subject relatives such as (17a) with a pronominal direct object. However, this asymmetry is reversed when the pronoun is inanimate (*it*): subject relatives such as (17c) are more frequent than object relatives such as (17d).

- (17) a. Subject relative with a personal pronoun:

The consultant that _ called you emphasized...

- b. Object relative with a personal pronoun:

The consultant that you called _ emphasized...

- c. Subject relative with an impersonal *it*:

The studies that _ motivated it converged...

- d. Object relative with an impersonal *it*:

The studies that it motivated _ converged...

Emphasizing the role of statistical information, they predicted that the processing difficulty of relative clauses should mirror this distributional pattern. That is, object relatives with embedded personal pronouns (17b) should be easier than subject relatives (17a), while subject relatives with embedded impersonal pronouns (17c) should be easier than object relatives (17d). These predictions were borne out in a series of self-paced reading tasks, which revealed shorter reading times across the relative clause region for (17b) over (17a), and for (17c) over (17d).

3.2.3 Dependency Locality Theory-based account

Yet another possibility, not tested in the acquisition literature, focuses on the referential accessibility of the intervening NP in movement patterns. The Dependency

Locality Theory (DLT), proposed by Gibson (1998, 2000), states that sentence processing involves integrating a new word into the existing syntactic and discourse structure (which incurs an integration cost) and keeping the structure in memory (memory cost).

Importantly, the integration cost is said to increase with the number of new discourse referents that intervene between the elements being integrated within a dependency. Thus, object relatives (18b) are harder to process than subject relatives (18a) because two new discourse elements (*the girl* and *kissed*) intervene between the relative head and the gap in object relatives, while the dependency in subject relatives is resolved immediately without any new discourse element intervening.

- (18) a. Subject relative: the boy that _ kissed the girl
b. Object relative: the boy that the girl kissed _

Furthermore, this theory also explains why the subject-object difference in processing difficulty is reduced when the intervening NP in object relatives is a pronoun (19b), compared to when it is a definite NP (19a) (e.g., Gordon et al., 2001): Since the referent of the pronoun is already present in the discourse, it is not considered a new discourse referent, and thus, incurs less integration cost.

- (19) a. The banker that the barber praised _ climbed the mountain.
b. The banker that you admired _ climbed the mountain.

Additional support for the role of the discourse status of the intervening NP comes from Warren and Gibson (2002), who demonstrate the effects of referential processing on sentence complexity. Using both complexity ratings and self-paced reading tasks, they show that the processing difficulty is sensitive to gradations of status between new and old, of the sort proposed in the Givenness Hierarchy (Gundel, Hedberg, & Zacharski, 1993) in (20), which correlates NP types with the accessibility of their referents.

(20) The Gundel et al. (1993) Givenness Hierarchy:

Central	Peripheral
in focus	< activated
	< familiar
	< uniquely identifiable
	< referential
<i>I, we, you</i>	<i>he, she, they</i>
<i>Donald Trump</i>	<i>the chairman</i>
	<i>a chairman</i>

For example, in object relatives like (21), the reading time at the main verb was fastest when the subject was a pronoun [*we*] or a famous name [*Donald Trump*], slower for the definite NP [*the chairman*], and the slowest for the indefinite NP [*a chairman*].

(21) The consultant who we/Donald Trump/the chairman/a chairman called advised wealthy companies about tax laws.

Overall, the results suggested that sentences with an NP that is central on the hierarchy and thus highly accessible was associated with lower processing cost than those with an NP that is peripheral on the hierarchy.

3.3 Intervention in raising

The three approaches summarized above offer different explanations as to what the source of the intervention effect is and how it is influenced by the types of NPs in a sentence. It is important to note that these accounts are not necessarily incompatible with each other. Rather, intervention effects may involve multiple factors, including memory interference, distributional information, and referential accessibility of the intervening NP. However, there are three major gaps in our understanding of these facts: First of all, there are far fewer acquisition studies on intervention effects than adult sentence processing studies, and it is thus not clear whether the same factors that influence adult processing also hold for children. Second, since the existing studies rely primarily on data involving object relatives, we do not know if these facts are a property of a particular construction or of human language more broadly. Finally, in the previous studies with object relatives, frequency information plays a confounding role, potentially masking the effect of having different NP types in the test sentence.

This dissertation seeks to address these problems by investigating intervention effects in raising sentences with an experiencer phrase such as (22).

(22) Donald seems to Mickey _ to be short.

As noted in Section 2.3.4, such patterns resemble constructions inducing intervention effects in that there is an intervening NP (the experiencer *Mickey* in (22)) within the

(23) Bart seems to her to be studying.

The RM account makes this prediction because the NPs *Bart* and *her* are of different types (one being a lexical noun, the other a pronoun). The DLT-based account makes the same prediction because the intervening NP has an old, and therefore more accessible, discourse referent, which is less likely to place burden on working memory. However, the two accounts make divergent predictions when a pronoun is raised across a lexical NP experiencer, as in (24).

(24) He seems to Lisa to be studying.

Because the RM account focuses on the (dis)similarity of the two NPs, it predicts improved comprehension of raising sentences like (24), while the DLT-based account predicts the opposite because the intervening NP introduces a new discourse referent.

The following chapters present a corpus study drawing on data from CHILDES and a series of six comprehension experiments with English-speaking children to address these research questions: (1) Are children's difficulties with raising patterns similar to intervention effects found in object relatives? (2) What effect does the type (lexical versus pronominal) of noun phrases (the moved NP and intervening NP) have on children's comprehension of raising sentences? (3) Of the different theories of intervention effects, which one is most compatible with the findings of this research?

For each comprehension experiment, a Truth-Value Judgment Task (TVJT) (Crain & McKee, 1985; Crain & Thornton, 1998) is employed: In Chapter 5,

Experiments 1 and 2 test the comprehension of raising sentences with and without an intervener, by manipulating the position of the experiencer phrase. In Chapter 6, Experiments 3 and 4 (and 4b) manipulate the type of intervening NP and the raised NP, respectively. Lastly, in Chapter 7, Experiment 5 tests a non-standard raising pattern – known as a copy-raising sentence – which contains a pronominal copy in the position of the gap in the standard infinitival raising patterns. A summary of the experimental design is presented in Table 3.1.

Table 3.1. Overview of experiments

Exp.	Raised NP	Intervening NP	Origin NP	Sample stimuli
1	Lexical NP	Lexical NP	Gap	Donald seems to Mickey _ to be short.
2	Lexical NP	No Intervener	Gap	To Mickey, Donald seems _ to be short.
3	Lexical NP	Pronoun	Gap	Donald seems to him _ to be short.
4	Pronoun	Lexical NP	Gap	He seems to Mickey _ to be short.
5	Lexical NP	Lexical NP	Pronominal copy	Donald seems to Mickey like he is short.

But before I begin the investigation of how children comprehend raising sentences, let us first turn to Chapter 4, which presents a corpus study of the raising verb *seem*.

CHAPTER 4

CORPUS STUDY OF *SEEM*

In this chapter, I use the Child Language Data Exchange System (CHILDES) database (MacWhinney, 2000) to investigate use of the raising verb *seem* by children and their interlocutors.

4.1 Previous research

The corpus studies conducted by Hirsch (2011) and Orfitelli (2012) both report the rarity of sentences containing the raising verb *seem* with an overt experiencer. Hirsch (2011) reports that only 6.3% (28 out of 448) of the child-directed *seem* sentences in the CHILDES database¹² occur with an overt experiencer. Out of 28 utterances, 27 experiencers occur in sentence-final position, one in sentence-medial position, and none in sentence-initial position. Furthermore, 9.1% (3 out of 33) of children's use of *seem* sentences involve an experiencer phrase. Similarly, Orfitelli (2012), who also drew on the CHILDES database,¹³ finds adults using the experiencer in only 14 instances of over 500 utterances with *seem* or *appear* that are directed to children, and in the children's production, in only 3 out of 33 utterances.

4.2 CHILDES corpus

Utterances containing the raising verb *seem* were extracted from all the English (USA) corpora available in the CHILDES database (MacWhinney, 2000) as of October

¹² Hirsch's (2011) searches included all the files in the CHILDES database, available as of May 2004.

¹³ Orfitelli's (2012) searches included only the data of four to six years old, available as of September 2011.

2011 and classified into two groups – child-directed speech and child-produced speech.¹⁴ Each utterance was then coded for (i) whether it was unraised or raised; (ii) the presence and the position of an experiencer; (iii) the type of experiencer NP; and (iv) for each raising utterance, whether it involved copy-raising as in (1a) or raising from an infinitival as in (1b) or non-verbal complement as in (1c).

- (1) a. John seems like he is happy.
- b. John seems to be happy.
- c. John seems happy.

4.2.1 Child-directed speech

There were, in total, 628 child-directed utterances containing the raising verb *seem*, of which 606 analyzable, non-repetitive utterances were considered for further investigation. Figure 4.1 presents adults' use of *seem* sentences (i) with a medial experiencer, (ii) with a non-medial experiencer, and (iii) without an experiencer. Only 6.3% (38/606) of *seem* sentences have an experiencer; the vast majority, 93.7% (568/606), do not.

¹⁴ Initially, two searches for the verb *seem* were conducted, using the CLAN program – one that pulled utterances appearing on the non-child tiers (–t*CHI) for the child-directed speech, and the other that pulled utterances appearing on the child tier (+t*CHI) for the child-produced speech. However, as some children's utterances were found to be on tiers other than the child tier (CHI), the utterances from the non-child tiers were individually looked at and sorted into the appropriate groups. This procedure resulted in the identification of twenty additional utterances in child-produced speech.

Figure 4.1. *Seem* sentences in child-directed speech

Of these 606 utterances, only 88 (14.5%) were unraised sentences, and 518 (85.5%) involved raising (Figure 4.2), showing that adults are more likely to use raising sentences than unraised sentences.

Figure 4.2. Unraised vs. Raised in child-directed speech

When the adults' 518 raised sentences were examined more closely, it was observed that 321 (62%) of them involved raising from infinitival complements (2a), while 175 (33.8%) had non-verbal complements (2b). The remaining 22 (4.2%) were copy-raising sentences (2c).

(2) a. Raising from infinitival complements:

Michel can't seem to get through lunch without spilling his milk.

(Gathercole, 03.cha, line 1186)

b. Raising from non-verbal complements:

You seem very tired, did you not take a good nap?

(Soderstrom, joe05.cha, line 621)

c. Copy-raising:

But when you fell you didn't seem like you were okay.

(MacWhinney, 69a2.cha, line 642)

Let us now consider how frequently the experiencer phrase appears in sentences with and without raising. Out of 88 unraised sentences, 19 (21.6%) contained the experiencer phrase— all in sentence-medial position. The experiencer was almost always the first person pronoun, *me* (18/19) – only one utterance had the third person pronoun, *her*. Some examples are presented in (3) (see Appendix A for a complete list of sentences):

(3) Unraised with a sentence-medial experiencer:

a. *Seems to me that those were twenty nine or thirty two dollars.*¹⁵

(Valian, 10b.cha, line 936)

b. *Seems to me that is th(e) dinosaur book.*

(Peters, 820314b.cha, line 144)

c. *It seems to me that you tire of your games very easily.*

(Brown, adam20.cha, line 3643)

d. *It seems to me you place these long ones on top of one another.*

(Brown, adam53.cha, line 2099)

e. *It seemed to her that roots and branches of trees reached out ...*

(HSLLD, vicbr1.cha, line 183)

As for the raised sentences with an experiencer, there were 19 utterances out of all 518 raised sentences (3.7%) – 2 in sentence-medial position and 17 in sentence-final position. The experiencer phrase was mostly the first person pronoun *me* (15/19) – other instances included the second and third person pronouns, *you*, *him*, and *her*. Examples appear in (4) and (5) (see Appendix B for a complete list of sentences):

¹⁵ Note that some of the example sentences begin right away with the verb *seem*, without any subject. Nonetheless, the dropped subject is thought to be an expletive, since the thematic subject appears in the subject position of the embedded clause. Thus, these utterances were categorized as unraised.

- (4) Raised with a sentence-medial experiencer:

a. *And a hum came suddenly into his head which seemed to him a good hum such as is a hum hopefully to others.*

(Providence, nai63.cha, line 116)

b. *Seem to me like you wouldn't be trying to use the water.*

(Brent, w3-1107.cha, line 1516)

- (5) Raised with a sentence-final experiencer:

a. *That seems acceptable to me.*

(MacWhinney, 74b1.cha, line 2776)

b. *It seems barbaric to me.*

(MacWhinney, 84a1.cha, line 1094)

c. *It'll seem like a new toy to her.*

(Providence, lil22.cha, line 653)

It is interesting that all but one of these 19 utterances involved raising from non-verbal complements. The exception was the copy-raising sentence in (4b), repeated here as (6), in which the dropped subject is thought to be the second person pronoun *you*, as evidenced by the form of the verb.

- (6) *Seem to me like you wouldn't be trying to use the water.*

In sum, the data from the child-directed speech demonstrate that adults rarely use the experiencer with *seem* sentences, and even when it is used, it is far more likely to appear in unraised sentences than in raised sentences. Moreover, it is only slightly more likely to be in medial position than in final position.

4.2.2 Child-produced speech

There were a total of 72 child-produced utterances containing the raising verb *seem*, of which 64 analyzable, non-repetitive examples were considered for subsequent analysis. As shown in Figure 4.3, the vast majority (93.8%, 60/64) of *seem* sentences appeared without an experiencer. That is, of the 64 *seem* sentences, only 4 contained the experiencer phrase: 2 (3.1%) in a sentence-medial position, and the other 2 (3.1%) in a non-medial position.

Figure 4.3. *Seem* sentences in child-produced speech

Comparing the use of unraised versus raised utterances, Figure 4.4 shows that of these 64 utterances, 20 (31.25%) took the form of unraised sentences, whereas 44 (68.75%) involved raising.

Figure 4.4. Unraised vs. Raised in child-produced speech

A closer examination of the 44 raised sentences produced by children showed that 25 (56.8%) involved raising from infinitival complements, while 19 (43.2%) had non-verbal complements. There was no instance of copy-raising sentences.

Let us now consider how frequently the experiencer phrase appears with either unraised or raised sentences. Out of 20 unraised sentences, there were 2 utterances that appeared with the overt experiencer (10%) – both in sentence-medial position:

- (7) a. *It seemed to me there was something I ...*

(Gleason, wanda.cha, line 1830, age = 4;0.20)

- b. *It seems to me that's all Graeme is taping today.*

(Hall, jub.cha, line 16397, age = 4;6-5;0)

As for the raised sentences, 2 out of 44 utterances (4.5%) contained an experiencer – both in sentence-final position. Notice that both are instances of raising out of non-verbal complements:

- (8) a. *That doe(s)n't seem Chinese to me.*

(Gathercole, 06.cha, line 1560, age = 5;2)

- b. *This seems so special to me today.*

(MacWhinney, 61a2.cha, line 695, age = 5;5.20)

4.3 Discussion

Overall, the data of both the child-directed speech and the child-produced speech confirmed the rarity of *seem* sentences containing an experiencer – 38 out of 606 (6.27%) utterances by adults, and 4 out of 64 (6.25%) utterances by children. But perhaps what is most telling is that despite the preference for raised sentences over unraised sentences in child-directed speech (85.5% vs.14.5%), the use of the experiencer in raised sentences was much rarer than in unraised sentences. That is, adults used the experiencer with raised sentences only 3.67% (19/518) of the time, while they used it with unraised sentence 21.6% (19/88) of the time. Notably, the same pattern was also found in child-

produced speech: Children were more likely to use raised sentences than unraised sentences (68.75% vs. 31.25%), but their raised sentences contained the experiencer 4.5% (2/44) of the time, whereas their unraised sentences had the experiencer 10% (2/20) of the time. Thus, not only are instances of *seem* sentences with an experiencer rare, but it is also much rarer to have the experiencer in a raised sentence.

Crucially, even when raised sentences occurred with an experiencer, in most cases the experiencer was in a sentence-final position. There were only two utterances in the child-directed speech (and none in the child-produced speech) where the experiencer appeared in a sentence-medial position, shown in (4). These utterances are repeated here in (9).

- (9) a. *And a hum came suddenly into his head which seemed to him a good hum such as is a hum hopefully to others.*
 b. *Seem to me like you wouldn't be trying to use the water.*

As already mentioned, (9a) is an instance of raising from a non-verbal complement, while (9b) is a copy-raising sentence. Thus, in both the child-directed and child-produced speech, there were no instances of sentences in which an experiencer appears between *seem* and an infinitival complement. That is, there were no sentences of the type *Donald seems to Mickey to be short* that have been tested in previous studies on the acquisition of raising.

Also noteworthy is the fact that when there was an experiencer, it was a first person pronoun *me* in most cases (86.8% (33/38) for the child-directed speech and 100% (4/4) for the child-produced speech).

Summing up, the data presented in this chapter show that adults' use of the raising verb *seem* is quite similar to that of children, and that children rarely hear or produce raising sentences with an experiencer, let alone sentences where the experiencer intervenes between the raised NP and the gap in its original position.

4.4 Key findings of Chapter 4

- Out of 606 *seem* utterances in the child-directed speech, only 19 (3.1%) had both raising and an experiencer (2 experiencers in sentence-medial position and 17 in sentence-final position).
- Out of 64 *seem* utterances in the child-produced speech, only 2 (3.1%) had both raising and an experiencer (both in sentence-final position).
- Out of the entire corpus (both in the child-directed and in the child-produced speech), there were no instances of *seem* utterances in which an experiencer intervenes between the verb *seem* and an infinitival complement.

CHAPTER 5

INTERVENTION EFFECTS IN THE ACQUISITION OF RAISING

5.1 Experiment 1: Raising across the experiencer¹⁶

The aim of Experiment 1 is to better assess children's comprehension of raising sentences with an experiencer; it also serves as a baseline for the subsequent experiments. As noted in Sections 2.1 and 2.2, previous studies of children's acquisition of raising have been undermined by several methodological issues. For this reason, the experiments presented in this chapter, as well as the subsequent experiments described in this dissertation, were designed with the following modifications.

First, an illusion is created to properly motivate the raising verb *seem*. For example, in the story illustrated in Figure 5.1, Mickey thinks Donald is short while Donald is in fact not short. The reason for Mickey's misconception is that Mickey is looking down at Donald who is standing inside a hole. From Mickey's relatively high vantage point, Donald looks short – hence the appropriateness of the test sentence in (1).

¹⁶ While an earlier version of this section appears as Choe (2011), this section includes additional data and analyses.

Figure 5.1. An illusion for the experiencer (example 1)

- (1) Donald seems to Mickey to be short.

Another example, illustrated in Figure 5.2, is of Bart doodling in his room. Lisa walks into the room, sees Bart sitting at his desk, and wrongly assumes that he must be studying; hence the test sentence in (2).

Figure 5.2. An illusion for the experiencer (example 2)

- (2) Bart seems to Lisa to be studying.

The second modification involves the presentation of an alternative experiencer needed to create a contextual contrast. For example, if the test sentence is *Donald seems to Mickey to be short*, not only do Donald and Mickey appear in the story, but so does a third character, Daisy, acting as an alternative experiencer, as shown in Figure 5.3.

Figure 5.3. An alternative experiencer

This serves two purposes. First, it allows for the felicitous use of the experiencer phrase (e.g., *to Mickey*), because without the alternative experiencer in the context, the experiencer phrase would be superfluous, and therefore infelicitous. Second, this third character serves to remind the child to consider the distinction between what is real and what is illusory. For example, in the story, the third character tries to explain to the character under the illusion why s/he is mistaken (although the character who hears this is not convinced).

As reviewed in Section 2.3, several different proposals have been put forward to account for the acquisition of raising: the Universal Phase Requirement (UPR; Wexler, 2004), the Universal Freezing Hypothesis (UFH; Hyams & Snyder, 2005), the Argument

Intervention Hypothesis (AIH; Orfitelli, 2012), and Performance-based Intervention Effects (PIE). All of these accounts except the AIH predict that children should be delayed in comprehending raising sentences like *Donald seems to Mickey to be short* – the pattern that is tested in Experiment 1. For the UPR, children’s difficulties should come from the raising operation itself, which involves movement across a defective phase boundary, while both the UFH and PIE attribute the delay to the presence of an intervening experiencer, albeit for a different reason.¹⁷ In contrast, the AIH predicts the opposite, namely that children should not have difficulty comprehending raising sentences containing an intervening experiencer under the manipulation in Experiment 1. Although the raising pattern in question involves A-movement over an argument, triggering a seeming violation of the AIH, Experiment 1 was designed with the same manipulation that was used in O’Brien et al.’s (2006) study with verbal passives. That is, all the TVJT stories included a third character who acts as a potential experiencer, so as to satisfy a felicity condition. Given that the AIH attributes children’s ease with verbal passives to the addition of a third character (see Section 2.3.3 for more details), and that the AIH is formulated to account for the acquisition of both passives and raising, it predicts that under that same manipulation, children should not have difficulty comprehending raising sentences containing an intervening experiencer. As Orfitelli (2012) observes: “If the experiencer argument can be sufficiently focused in the discourse, and the above explanation [Orfitelli’s interpretation of O’Brien et al.’s finding] is correct, then children’s difficulties should cease” (p. 118).

¹⁷ For the UFH, what underlies children’s difficulty is a grammatical deficit, whereas for PIE, the difficulty comes from performance limitations.

5.1.1 Participants

The participants in this study included 23 native English-speaking children (age 4;4 to 5;5, mean = 4;8), recruited from the UH Mānoa Children's Center in Honolulu, Hawai'i. There were 14 girls and 9 boys; 11 four-year-olds and 12 five-year-olds.

5.1.2 Procedure

A Truth-Value Judgment Task (TVJT) (Crain & McKee, 1985; Crain & Thornton, 1998) was employed. Each participant was presented with animated stories on a laptop computer. At the end of each story, a puppet appeared on the screen, and an experimenter prompted the puppet to make a statement about what happened in the story. The puppet then made a one-sentence statement about what she thought had happened. Participants were asked to determine whether the statement was true or false and to provide justifications for their choice. The whole experiment took no more than 30 minutes for each participant.

5.1.3 Materials

Each child watched 10 stories (2 warm-ups, 2 control items, 4 critical items, and 2 fillers, randomized), after which they judged the truth of a statement made by a puppet. Three types of sentences were used, balanced for match and mismatch:¹⁸ (1) control test items including finite clauses with the verb *think*, (2) unraised sentences with a medial experiencer phrase, and (3) raised sentences with a medial experiencer phrase. These sentences were counterbalanced across six lists to minimize item effects. The complete

¹⁸ Match items are those where the target response is "true"; mismatch items are those where the target response is "false."

script of a sample story and the corresponding pictures are shown below in Figure 5.4 (note that these stories were presented with matching visual scenes, making for a fun, cartoon-like experience for the children). A sample set of test items (match and mismatch) is presented in Table 5.1 (see Appendix C for a full list of test items).

<p>This is a story about three friends: Donald, Daisy, and Mickey.</p>
<p>One day, Donald and Daisy are playing outside, digging a big hole. Just then, Mickey appears and comes close to Donald and Daisy. Mickey sees Donald who is inside the hole and thinks that Donald is very short. Mickey says, “Hey, Donald, I thought you and I are the same height, but I was wrong.”</p>
<p>Without looking at Mickey, Donald says, “What do you mean? We are the same height.” Then, Mickey says, “No, you are so short!” Daisy, who is standing next to Donald, says “No, that’s because you are looking at him from up there. Donald is not short.” But Mickey says, “What do you mean? Donald is so short.”</p>
<p>Still without looking at Mickey, Donald says, “Well, if I’m short, then you are short, too.” Mickey says “Yeah? Turn around and look then.”</p>

Figure 5.4. A sample story and pictures

Table 5.1. A sample set of test items in each condition (Exp.1)

	Match items
Think	At the end of the story, Mickey still thinks Donald is short.
Unraised	At the end of the story, it still seems to Mickey that Donald is short.
Raised	At the end of the story, Donald still seems to Mickey to be short.

	Mismatch items
Think	At the end of the story, Donald still thinks Mickey is short.
Unraised	At the end of the story, it still seems to Donald that Mickey is short.
Raised	At the end of the story, Mickey still seems to Donald to be short.

The Think condition served as a control, in order to determine whether children have difficulty with the concept of thinking or understanding others’ viewpoints, because such knowledge was required to correctly understand the stories presented. It also made it

possible to test the claim of Hirsch and Wexler (2007) that children treat the raising verb *seem* as *think* (i.e., *think-analysis*) (see Section 2.2).

The only verb used in the Unraised and Raised conditions was the verb *seem*, in accordance with Hirsch and Wexler's (2007) observation that this is the most frequently used raising verb in child-directed speech in the CHILDES corpus.¹⁹ The two fillers were unrelated to raising or complementation structures.

5.1.4 Results

Data from two children (both five-year-olds) were excluded from the subsequent analysis because they either did not finish the experiment or did not respond correctly to the filler items. The results from the remaining 21 children are presented in Figure 5.5 in the form of the mean correct percentage for each condition – collapsed across match and mismatch. A breakdown of match versus mismatch items will be presented shortly.

Figure 5.5. Mean accuracy in each condition (Exp. 1)

¹⁹ Although see Orfitelli (2012), who finds the raising predicate *used (to)* to be much more frequent than *seem* in the input to children.

As expected, children did well on the Think condition (mean correct: 81.0%; raw score: 34/42) and the Unraised condition (76.2%; 32/42), scoring significantly above chance level by a one-sample *t*-test (Table 5.2). This shows that they understood the meaning of the raising verb *seem* as well as the meaning of *think*. However, their comprehension of the raised sentences was right at chance (50.0%; 21/42), suggesting that they had difficulty comprehending the raising sentences.

Table 5.2. One sample *t*-test for each condition (Exp. 1)

Condition	Percent correct	<i>t</i>	<i>df</i>	<i>p</i>
Think	81.0%	5.70	20	0.00
Unraised	76.2%	4.69	20	0.00
Raised	50.0%	0.00	20	1.00

The data were further analyzed, using a repeated measures ANOVA with each condition (Think, Unraised, Raised) as a within-subjects variable. The results indicate a main effect of condition ($F(2,40) = 7.00, p = 0.002$). Pairwise comparisons found that while there was no significant difference between the Think and Unraised conditions ($p > 0.1$), the differences between the Think and Raised conditions and between the Unraised and Raised conditions were both significant ($p < 0.05$), revealing children's particular difficulty on the Raised condition.

In addition, there was no significant difference between either the match and mismatch items (paired samples *t*-tests: $p > 0.1$ for all conditions; Figure 5.6) or between ages (one-way ANOVA: $p > 0.1$ for all conditions; Figure 5.7).

Figure 5.6. Mean accuracy on match and mismatch items in each condition (Exp. 1)

Figure 5.7. Mean accuracy by age group in each condition (Exp. 1)

Finally, Figure 5.8 shows the results of only those children who responded to the Unraised condition with perfect accuracy (100%; 22/22). This requirement resulted in the exclusion of data from 10 children, leaving data from 11 children, who scored 40.9% (9/22) on the Raised condition. Overall, the data suggest that even children who

comprehended *seem* in the unraised sentences 100% of the time had difficulty with the raised sentences.²⁰

Figure 5.8. Mean accuracy of children who scored 100% on Unraised (Exp. 1)

5.1.5 Discussion

The primary finding from Experiment 1 is that while children show good comprehension of unraised sentences, they have difficulty with raising sentences that have an experiencer phrase. These results seem to replicate those of the previous studies by Hirsch and Wexler (2007) and Hirsch et al. (2007). However, considering the potential methodological flaws of those studies (see Section 2.2), the present experiment provides better evidence to support the claim that young children have difficulty comprehending raising sentences across an experiencer.

²⁰ Recall from Chapter 4 that in both child-directed and child-produced speech, non-raising sentences are much less frequent than raising sentences. For this reason, I examined how the excluded ten children, who scored 50% overall on the Unraised condition, comprehended raising sentences. Their score on the Raised condition was 60%, which is higher than 40.9% from the above eleven children, but this difference did not yield significance by the independent samples *t*-test ($p > 0.1$). There is thus no reason to think that the excluded children might have acquired the raising pattern before the non-raising pattern.

Furthermore, it is worth noting that the manipulation of having a third character in the story did not improve children's performance with raising sentences, even though it clearly seems to have assisted their comprehension of verbal passives (O'Brien et al., 2006). Not only is this finding incompatible with the prediction of the Argument Intervention Hypothesis (AIH), but the developmental differences between raising and passives also argues against those theories that attempt to group together the development of raising and passives.

In contrast, my findings are consistent with the Universal Phase Requirement (UPR), the Universal Freezing Hypothesis (UFH), and Performance-based Intervention Effects (PIE), all of which predict children's delayed comprehension of raised sentences with an intervening experiencer. Nonetheless, it is unclear where this difficulty comes from. It may be the grammatical operation of raising, as predicted by the UPR, or it may be the presence of an intervening experiencer, as predicted by either the UFH or PIE. These predictions are taken up in Experiment 2, which is described in the following section.

5.2 Experiment 2: Raising with a fronted experiencer²¹

Experiment 2 tests the comprehension of raising sentences in which the experiencer phrase appears at the beginning of the sentence (e.g., *To Mickey, Donald seems to be short*). These sentences are similar to the ones used in Experiment 1 in that they involve raising as well as an experiencer phrase, but they differ in that the experiencer phrase no longer intervenes between the raised NP and the gap. Experiment 2 thus addresses the following question: Is children's difficulty with raising sentences

²¹ An earlier version of this study is presented in Choe (2012).

associated with the raising operation *per se* or is it due to an intervening experiencer phrase?

According to the UPR, children's delayed comprehension of the raised sentences in Experiment 1 follows from their lack of knowledge of the raising operation itself. The presence of the experiencer phrase, as well as its location, should be irrelevant to children's difficulty. Thus, the UPR predicts that the children will fail to comprehend the raising pattern in which the experiencer phrase is fronted in Experiment 2, just as they did in Experiment 1.

As for the UFH, the prediction is not so clear. The claim of the UFH is based on a syntactic analysis of raising that involves smuggling (Collins, 2005a). It is only those structures where smuggling takes place that should be problematic for children. However, Collins (2005a) does not address the question of whether smuggling is involved in raising sentences where the experiencer is fronted. Thus, if it is the case that such sentences still involve the smuggling operation, the UFH expects comprehension problems, while if those sentences do not involve smuggling, the raising pattern with a fronted experiencer should not be as difficult for children as the raising pattern in Experiment 1.

Finally, under the AIH and PIE, the source of difficulty with raising is the presence of an intervening NP (argument for the AIH) within a dependency. Therefore, both theories predict better comprehension of raising sentences with a fronted experiencer, because there is no intervening element in these sentences.

5.2.1 Participants

A total of 28 native English-speaking children (age 3;3 to 5;8, mean=4;7) who had not participated in the previous experiment were recruited for this study from the UH Mānoa Children's Center in Honolulu, Hawai'i. There were 10 girls and 18 boys – 6 three-year-olds, 10 four-year-olds, and 12 five-year-olds.

5.2.2 Procedure and materials

The procedure and materials used in Experiment 2 were identical to Experiment 1, except that the experiencer phrase occurs at the beginning of the test sentences in the Unraised and Raised conditions.²² In addition, the test sentences in the current experiment no longer begin with the phrase *at the end of the story*, because it would not be as natural to have two pre-subject prepositional phrases in these sentences. Instead, this phrase was incorporated into the experimenter's prompt to the puppet, so that "Hey puppet, can you tell us something about the story?" in Experiment 1 was changed to "Hey puppet, can you tell us what happens at the end of the story?" in Experiment 2. A sample set of test items (match and mismatch) is presented in Table 5.3 (see Appendix D for a full list of test items).

²² Fronting the experiencer phrase (thereby topicalizing it) was motivated and natural, as each story contained another potential experiencer which contrasted with the real experiencer in the test sentence.

Table 5.3. A sample set of test items in each condition (Exp. 2)

	Match items
Think	Mickey thinks Donald is short.
Unraised	To Mickey, it seems that Donald is short.
Raised	To Mickey, Donald seems to be short.

	Mismatch items
Think	Donald thinks Mickey is short.
Unraised	To Donald, it seems that Mickey is short.
Raised	To Donald, Mickey seems to be short.

5.2.3 Results

Due to poor performance with filler items, the data from three children (one four-year-old and two five-year-olds) were removed from the subsequent analysis, leaving the data from 25 children.

As illustrated in Figure 5.9, the children demonstrated fairly good comprehension of all of the test sentences, scoring 80% (40/50) in each of the three conditions. An important point is that the children's comprehension of raised sentences with a fronted experiencer was on par with their comprehension of unraised sentences.

Figure 5.9. Mean accuracy in each condition (Exp. 2)

Furthermore, the results of a one-sample t -test (Table 5.4) found their performance in all conditions to be significantly above chance, and there was no main effect of condition ($p > 0.1$) by a one-way repeated measures ANOVA. Children's performance did not differ among the three conditions.

Table 5.4. One sample t -test for each condition (Exp. 2)

Condition	Percent correct	t	df	p
Think	80.0%	6.00	24	0.00
Unraised	80.0%	5.20	24	0.00
Raised	80.0%	6.00	24	0.00

Additional analyses found that there was no significant difference between match and mismatch items in any condition (paired samples t -tests: $p > 0.1$ for all conditions;

Figure 5.10), or among different ages (one-way ANOVA: $p > 0.1$ for all conditions; Figure 5.11).

Figure 5.10. Mean accuracy on match and mismatch items in each condition (Exp. 2)

Figure 5.11. Mean accuracy by age group in each condition (Exp. 2)

To further verify these findings, the results of only those children who responded to the Unraised condition with perfect accuracy (100%; 32/32) were considered

separately. This procedure resulted in excluding data from nine children.²³ The data for the remaining 16 children is presented in Figure 5.12, showing that their score on the Raised condition is quite high, 87.5% (28/32).

Figure 5.12. Mean accuracy of children who scored 100% on Unraised (Exp. 2)

Finally, the overall results of Experiment 2 (repeated from above) are presented together with those of Experiment 1 in Figure 5.13.

²³ The overall scores of the nine excluded children were 44.4% on the Unraised condition and 66.7% on the Raised condition.

Figure 5.13. Comparison of Experiments 1 and 2

In both the Think and Unraised conditions, children showed good comprehension, similar to Experiment 1. However, crucially, in the Raised condition, their comprehension was significantly better in Experiment 2 (with a fronted experiencer, 80.0%) than in Experiment 1 (with an intervening experiencer, 50.0%), $t(44) = 3.59$, $p = 0.001$, indicating that their difficulty with the raising pattern disappears when the relationship between the raised NP and the infinitival clause is not interrupted by an intervening NP.

5.2.4 Discussion

The aim of Experiment 2 was to investigate the source of difficulty associated with raising sentences containing an experiencer. Two possibilities were considered – the raising operation itself and the presence of an intervening experiencer. In order to tease apart these two possible sources of difficulty, Experiment 2 tested children's

comprehension of raising sentences in which the experiencer does not intervene between the raised NP and the gap (e.g., *To Mickey, Donald seems to be short*).

In Experiment 2, the children showed good comprehension of raising sentences with a fronted experiencer, as well as of unraised sentences. Taken together with those of Experiment 1, these results indicate that while children are delayed in comprehending raising sentences with an intervening experiencer, this difficulty is significantly reduced with a fronted experiencer, suggesting that the presence of an intervening experiencer phrase in raising patterns, rather than the movement of the subject NP *per se*, is the source of children's difficulty with raising sentences. Furthermore, the current study provides evidence that an intervening experiencer is indeed an additional crucial factor for testing children's comprehension of raising sentences, and that the failure to take it into account has obscured the real picture of the acquisition of raising.

With respect to the predictions of the different accounts, the children's good comprehension with raising sentences in Experiment 2 argues against the UPR, which predicts children's delayed comprehension of raising sentences, irrespective of the location of the experiencer. Rather, these results are in line with the predictions of the UFH (assuming that smuggling takes place even in experiencer-fronted raising sentences), the AIH, and PIE, all of which propose that the presence of an intervening argument in raising patterns is what underlies children's purported difficulty with raising sentences. However, the three proposals differ in a crucial way: whereas the UFH and AIH associate the difficulty of the intervening argument with a grammatical deficit, PIE attributes it to a performance limitation. This difference will be investigated more closely in Chapter 6.

5.3 Key findings of Chapter 5

- Children have difficulty comprehending raising sentences in which an experiencer phrase intervenes between the raised NP and the infinitival complement (e.g., *Donald seems to Mickey to be short*).
- Children's comprehension of raising sentences shows a significant improvement when the experiencer is moved to the beginning of the sentence (e.g., *To Mickey, Donald seems to be short*).

CHAPTER 6

EFFECT OF NP TYPE ON THE ACQUISITION OF RAISING

6.1 Experiment 3: Raising a lexical NP across a pronominal experiencer

The findings of the previous chapter indicate that what underlies children's difficulty with raising patterns is the presence of an intervening experiencer phrase, rather than the raising operation itself. However, it still remains unclear what the nature of this difficulty is. One possibility is that children's grammars do not permit raising over an intervening argument, as suggested by the Universal Freezing Hypothesis (UFH) or Argument Intervention Hypothesis (AIH). An alternative explanation, which I favor, is based on the idea of Performance-based Intervention Effects (PIE): the nature of the difficulty is not grammatical, but rather the reflection of a processing limitation of the kind observed in other sentence types (e.g., object relative clauses). As noted in Section 3.1, the signature property of this sort of effect is that the type of intervening NP affects children's comprehension. In particular, several studies (e.g., Arnon, 2010) have found improvement in children's comprehension of object relatives when the intervening noun phrase was changed from a lexical NP (*the girl* in [1a]) to a pronoun (*I* in [1b]).

- (1) a. the nurse that the girl is drawing _
 b. the nurse that I am drawing _

If children's difficulty with raising is due to the very same limitation, manipulation of the type of intervening experiencer should have a similar effect on children's comprehension.

That is, children's comprehension should improve with a pronominal experiencer. In contrast, grammatical-deficit accounts such as the UFH and AIH predict that the type of intervener should not be crucial for children's comprehension, as it is the mere presence of an intervening argument of any type that poses difficulties for children. Experiment 3 investigates this possibility by changing the type of intervening noun phrase to a pronoun, while the raised NP remains a lexical NP, as in (2).

(2) Bart seems to her to be studying.

6.1.1 Participants

Nineteen native English-speaking children (age 3;6 to 6;8, mean = 4;7) who had not participated in the previous experiments were recruited for Experiment 3 from the UH Mānoa Children's Center in Honolulu, Hawai'i. There were 6 girls and 13 boys – 8 three-year-olds, 5 four-year-olds, 2 five-year-olds, and 4 six-year-olds.

6.1.2 Procedure and materials

The procedure and materials were identical to those in Experiment 1, except for two changes: there is no Think condition,²⁴ and the experiencer (the intervening NP) is a pronoun rather than a lexical NP for the unraised and raised sentences. Each critical condition (Unraised, Raised) had three items, and four lists were created in a Latin square design. A sample set of test items is presented below (see Appendix E for a full list of test items): In half of the six critical items the referents of the raised NP and the experiencer

²⁴ The Think condition is removed for all the subsequent experiments, because they are no longer designed to test for Hirsh and Wexler's (2007) *think*-analysis. As for cognitive control, the Unraised condition was deemed to be sufficient.

NP had the same gender (Table 6.1), while in the other half they had different genders (Table 6.2).

Table 6.1. A sample set of test items in each condition: same gender (Exp. 3)

	Match items
Unraised	This is a story about Mickey. And at the end of the story, it seems to him that Donald is short.
Raised	This is a story about Mickey. And at the end of the story, Donald seems to him to be short.

	Mismatch items
Unraised	This is a story about Donald. And at the end of the story, it seems to him that Mickey is short.
Raised	This is a story about Donald. And at the end of the story, Mickey seems to him to be short.

Table 6.2. A sample set of test items in each condition: different gender (Exp. 3)

	Match items
Unraised	This is a story about Lisa. And at the end of the story, it seems to her that Bart is studying.
Raised	This is a story about Lisa. And at the end of the story, Bart seems to her to be studying.

	Mismatch items
Unraised	This is a story about Bart. And at the end of the story, it seems to him that Lisa is studying.
Raised	This is a story about Bart. And at the end of the story, Lisa seems to him to be studying.

6.1.3 Results

The data from one three-year-old were excluded as he did not finish the experiment. I also excluded the data from four children (one 3-year-old, two 4-year-olds, and one 6-year-old) who failed to respond correctly to the filler items. The results from the remaining 14 children are presented below in Figure 6.1. While the children correctly responded to the Unraised condition 88.1% (37/42) of the time, their accuracy rate fell to 66.7% (28/42) for the Raised condition. This difference was significant by a paired t -test, $t(13)=2.59$, $p = 0.022$, showing that children were better at comprehending unraised sentences than raised sentences.

Figure 6.1. Mean accuracy in each condition (Exp. 3)

A one sample t -test (Table 6.3) also showed that the children's comprehension of raised sentences was no different from chance level (50%), whereas their score on the Unraised condition was at a rate greater than chance.

Table 6.3. One sample *t*-test for each condition (Exp. 3)

Condition	Percent correct	<i>t</i>	<i>df</i>	<i>p</i>
Unraised	88.1%	8.60	13	0.00
Raised	66.7%	1.69	13	0.12

Further analyses showed that there was no difference in accurate response rates between match and mismatch items (paired samples *t*-tests: $p > 0.1$ for both conditions; Figure 6.2) or between age groups (independent samples *t*-tests: $p > 0.1$ for both conditions; Figures 6.3 and 6.4).

Figure 6.2. Mean accuracy on match and mismatch items in each condition (Exp. 3)

Figure 6.3. Mean accuracy by age group in each condition (Exp. 3)

Figure 6.4. Mean accuracy by age group (collapsed) in each condition (Exp. 3)

The critical items were also divided into Gender match and Gender mismatch, and were compared for each condition. The purpose of this analysis was to see if the children had difficulty finding the correct antecedent of the pronoun when the gender of the pronoun was matched with the gender of the referent of the matrix subject (gender match) as in (3).

- (3) Donald seems to him to be short.

Coreference between *him* and *Donald* in this case is ruled out by Principle B of the Binding Theory (Chomsky, 1981).

- (4) Principle B: A pronoun may not be bound within its governing category.

As the governing category for the pronoun *him* in sentence (3) is the matrix clause, Principle B rules out a referential dependency between *him* and *Donald*. However, prior acquisition studies show that children around age 5 often violate Principle B, allowing the ungrammatical interpretation (e.g., Chien & Wexler, 1990; Grodzinsky & Reinhart, 1993). Because the children in the current study are in a similar age range, it is crucial to establish that their responses on the gender match items did not result from a difficulty with Principle B. Thus, the children's scores on gender match items were compared with their scores on gender mismatch items, where the gender cue prevents the pronoun from being coreferential with the local subject (e.g., *Bart seems to her to be studying*). No difference was observed between gender match and gender mismatch items on any condition (paired samples *t*-tests: $p > 0.1$; Figure 6.5), indicating that the children's responses were not confounded with any effect related to Principle B.

Figure 6.5. Mean accuracy on gender match and mismatch items in each condition

(Exp. 3)

Turning back to the children's overall results, it is clear that the children's comprehension was better on the Unraised condition than the Raised condition. But does this mean that children have the same level of difficulty with raising sentences containing the pronominal experiencer as they do with a lexical NP experiencer? Before drawing this conclusion, let us first examine the results of those children who scored 100% on the Unraised condition. As illustrated in Figure 6.6, once we exclude the data from the five children who failed to comprehend the verb *seem*,²⁵ the remaining nine children comprehended the raised sentences with pronominal experiencers at far higher rates (81.5%; 22/27) than our initial results suggest.

²⁵ The overall scores of the five excluded children were 73.3% on the Unraised condition and 60.0% on the Raised condition.

Figure 6.6. Mean accuracy of children who scored 100% on Unraised (Exp. 3)

Let us compare the results of Experiment 3 to the previous experiments. First, the overall results of both Unraised and Raised conditions in Experiments 1, 2, and 3 are presented in Figure 6.7.

Figure 6.7. Comparison of Experiments 1, 2, and 3 (Unraised and Raised)

A 2 x 3 repeated measures ANOVA was conducted with Condition (Unraised and Raised) as a within-subjects variable and Experiment (Experiment 1, 2, and 3) as a between-subjects variable. The main effect of Condition was significant ($F(1, 57) = 10.756, p = 0.002$), showing that children were better at comprehending unraised sentences than raised sentences. There was also a main effect of Experiment ($F(2, 57) = 3.906, p = 0.026$), suggesting that children's scores differed by experiments. Post hoc tests revealed no significant difference between Experiment 2 (with a fronted experiencer) and Experiment 3 (with an intervening pronominal experiencer) ($p > 0.1$), but the difference between Experiment 1 (with an intervening lexical NP experiencer) and Experiment 2 was significant ($p = 0.01$), and the difference between Experiment 1 and Experiment 3 was at significance ($p = 0.057$). Additionally, there was a significant interaction between Condition and Experiment ($F(2, 57) = 3.316, p = 0.043$).

Following up on this interaction effect, two one-way ANOVAs conducted for each condition showed that while no difference was observed among experiments on the Unraised condition ($p > 0.1$), there was a significant difference on the Raised condition ($F(2, 57) = 5.547, p = 0.006$). Post hoc tests showed that this was due to a significant difference between Experiment 1 and Experiment 2 ($p = 0.002$). That is, children comprehended the raised sentences in Experiment 3 (66.7%) at rates between those of Experiments 1 (50.0%) and 2 (80.0%), but the difference was not significant in either direction.

Finally, Figure 6.8 presents a comparison of the results of the Raised condition from children who scored 100% on the Unraised condition in Experiments 1, 2, and 3.

Figure 6.8. Comparison of Experiments 1, 2, and 3 (Raised)

In this case, there was a statistically significant difference among the experiments as determined by a one-way ANOVA ($F(2, 33) = 8.847, p = 0.001$). A Bonferroni post hoc test revealed that the children's score on the Raised condition was significantly higher in Experiment 2 (fronted experiencer; $p = 0.001$) and Experiment 3 (intervening pronominal experiencer; $p = 0.013$), compared to Experiment 1 (intervening lexical NP experiencer). However, there was no difference in the children's score between Experiment 2 and Experiment 3 ($p > 0.1$). This suggests that children's difficulty with raising is significantly reduced when the intervening experiencer is a pronoun, to the extent that the results are almost on par with those of Experiment 2 where the experiencer was fronted.

6.1.4 Discussion

Experiment 3 was conducted to explore the effect of the type of the intervening NP on children's comprehension of raising sentences by changing it to a pronoun. When

compared with the results of Experiment 1, in which the raising sentences such as (5a) contain a lexical NP experiencer, the results of Experiment 3 demonstrate that having a pronominal experiencer, as in sentence (5b), facilitates children's comprehension.

- (5) a. Experiment 1: Donald seems to Mickey to be short.
 b. Experiment 3: Donald seems to him to be short.

At first glance, it may be surprising that children did well on sentences like (5b). Setting aside the fact that it is a raising pattern with an intervening element, the sentence is also subject to Principle B, as the pronoun *him* cannot refer to *Donald*, but has to refer to an extra-sentential referent. As noted earlier, a number of studies have observed that children's acquisition of Principle B is significantly delayed (e.g., Chien & Wexler, 1990; Jakubowicz, 1984; see also Conroy, Takahashi, Lidz, & Phillips, 2009, for a review). Furthermore, a recent study by Friedmann, Novogrodsky, and Balaban (2011) found that Hebrew-speaking children (age 2;4 to 6;7, mean = 4;7, $n = 54$) often misinterpret pronouns by selecting the NP that is linearly closest to the pronoun as the antecedent when the dependency between the antecedent and the pronoun crosses another NP. If such a strategy had been applied to sentences like (5b), the children would have chosen the incorrect antecedent *Donald* in the test sentences that had the same gender for the referents of the raised NP and the experiencer NP. However, when the children's scores on the gender match items were compared to their scores on the gender mismatch items, there was no difference, suggesting that the children did not have difficulty establishing the link between the pronoun and its correct antecedent. Thus, it seems that the outcome

of Experiment 3 goes against the findings of Friedmann et al. (2011), as well as many studies that show children's delayed acquisition of Principle B.

However, these seemingly conflicting results can be easily accounted for when the influence of topicality on pronoun interpretation is taken into consideration. In Experiment 3, there was a lead-in sentence before the test sentence, in order to promote the naturalness in the use of the pronoun. An example sequence is presented in (6).

(6) This is a story about Mickey.

And at the end of the story, Donald seems to him to be short.

Since the sequence in (6) sets up *Mickey* as the topic, the referent of the pronoun is clearly established. This sort of pragmatic information has been put forward as one of the factors that affect children's pronoun comprehension (Conroy et al., 2009; Spenader, Smits, & Hendriks, 2009). Specifically, Spenader et al. (2009) attribute children's difficulty in some pronoun comprehension tasks to topicality considerations, and they show that Dutch-speaking children's comprehension of pronouns improves significantly when the referent of the pronouns are clearly established as the topic of the target sentence. For example, when the two sequences in (7) were contrasted in a Truth-Value Judgment Task conducted by Spenader et al., children's comprehension was significantly better in the Single Topic Condition (7b) than in the Classic Condition (7a).

(7) a. Condition 1: Classic Condition

Hier zie je een olifant en een krokodil. De olifant slat hem.

‘Here you see an elephant and an alligator. The elephant is hitting him.’

b. Condition 2: Single Topic Condition

Hier zie je een krokodil. De olifant slat hem.

‘Here you see an alligator. The elephant is hitting him.’

Given the similarity between the sequence used in Experiment 3 (6) and the Single Topic Condition in Spenader et al. (7b), it is not surprising that the children in Experiment 3 were able to correctly interpret the pronoun.

Returning to the issue of raising across an intervener, the children’s improved comprehension with a pronominal experiencer demonstrates that their difficulty with raising patterns is sensitive to the same factors as other structures for which intervention effects have been posited, and not to any grammatical effects per se. Thus, these findings directly contradict grammatical-deficit hypotheses of the kind considered in the field to date, such as the UFH or AIH, because those theories predict that children’s difficulty should persist as long as there is an intervener, regardless of its NP type. In contrast, this pattern of results is consistent with the idea of Performance-based Intervention Effects, which places children’s difficulty with raising at the performance level, and not in their competence.

Also noteworthy is the fact that these findings establish that intervention effects apply beyond the previously described constructions. As mentioned earlier, intervention

effects have been observed typically in structures that involve *wh*-movement. However, following Friedmann and Costa (2010), who report intervention effects in coordinated structures (e.g., *Grandma tickled the girl and _ smiled*), this experiment provides additional evidence that intervention effects may occur in structures involving a broader range of dependencies, including A-movement dependencies. Thus, these findings suggest that intervention effects are not limited to particular structures, but are a more general property of human language.

Given the pronoun advantage on raising patterns that we have observed, we are now in a position to consider how these results relate to the explanations of intervention effects discussed in Chapter 3. Recall that there were three main accounts – experience-based, Relativized Minimality (RM), and Dependency Locality Theory (DLT)-based accounts. The pattern of results from the current experiment would not be expected under the experience-based account, because raising sentences containing the experiencer are extremely rare in the input, regardless of the type of intervener (see Chapter 4). However, these results are consistent with predictions generated from both the RM and DLT-based accounts of how different types of NPs affect children’s comprehension. As for the RM account, raising sentences containing a pronominal experiencer should be easier than those with a lexical NP experiencer, as the types of the raised NP and the intervening NP differ. The DLT-based account also predicts children’s better comprehension, because the intervening NP is a pronoun – with an old discourse referent that does not contribute to the integration cost. Thus, in order to tease apart the two accounts, a different type of raising sentences should be tested, which reverses the order of the pronoun and lexical NP. It is to this end that Experiment 4 was conducted.

6.2 Experiment 4: Raising a pronoun across a lexical NP experiencer

Experiment 4 tests children's comprehension of raising sentences in which a pronoun is raised across a lexical NP experiencer, as in (8).

- (8) He seems to Lisa to be studying.

As in Experiment 3, the RM account predicts that the raising sentence in (8) should be comprehended well by children, as the moved NP and the intervening NP are sufficiently different in terms of their feature specifications – one is a pronoun and the other is a proper name. According to the DLT-based account, however, children should have the same amount of difficulty that they had with the raising sentence in Experiment 1, an example of which is given in (9), because the intervener is a lexical NP and hence a new discourse element.

- (9) Bart seems to Lisa to be studying.

6.2.1 Participants

Eighteen native English-speaking children (age 3;9 to 6;5, mean = 4;8) who had not participated in the previous experiments were recruited for Experiment 4 from Montessori Community School in Honolulu, Hawai'i. There were 7 girls and 11 boys – 2 three-year-olds, 7 four-year-olds, 4 five-year-olds, and 5 six-year-olds.

6.2.2 Procedure and materials

The procedure and materials were identical to those in Experiment 3 except that the raised NP is a pronoun rather than a lexical NP. A sample set of test items is presented below in Table 6.4, which gives the same gender items, and Table 6.5, which gives the different gender items (see Appendix F for a full list of test items).

Table 6.4. A sample set of test items in each condition: same gender (Exp. 4)

	Match items
Unraised	This is a story about Donald. And at the end of the story, it seems to Mickey that he is short.
Raised	This is a story about Donald. And at the end of the story, he seems to Mickey to be short.

	Mismatch items
Unraised	This is a story about Mickey. And at the end of the story, it seems to Donald that he is short.
Raised	This is a story about Mickey. And at the end of the story, he seems to Donald to be short.

Table 6.5. A sample set of test items in each condition: different gender (Exp. 4)

	Match items
Unraised	This is a story about Bart. And at the end of the story, it seems to Lisa that he is studying.
Raised	This is a story about Bart. And at the end of the story, he seems to Lisa to be studying.

	Mismatch items
Unraised	This is a story about Lisa. And at the end of the story, it seems to Bart that she is studying.
Raised	This is a story about Lisa. And at the end of the story, she seems to Bart to be studying.

6.2.3 Results

Data from one child were excluded due to the child's failure to respond correctly to filler items. The results of the remaining 17 children are presented in Figure 6.9.

Figure 6.9. Mean accuracy in each condition (Exp. 4)

Unexpectedly, the children's mean score on the Unraised condition reached only 52.9% correct (27/51). A potential explanation for this low score will be explored in the discussion in Section 6.2.4. The children's mean score was similar in the Raised condition, with an average of 43.1% correct (22/51). A paired t -test showed that there was no significant difference between the two conditions ($t(16) = 1.23, p > 0.1$), and a one sample t -test (Table 6.6) showed that children's scores on both conditions were no different from chance level (50%).

Table 6.6. One sample t -test for each condition (Exp. 4)

Condition	Percent correct	t	df	p
Unraised	52.9%	0.51	16	0.62
Raised	43.1%	-1.44	16	0.17

Further analyses show that there was no difference between match and mismatch items (paired t -tests: $p > 0.1$; Figure 6.10) or among age groups (one-way ANOVA: $p > 0.1$; Figure 6.11).

Figure 6.10. Mean accuracy on match and mismatch items in each condition (Exp. 4)

Figure 6.11. Mean accuracy of age group in each condition (Exp. 4)

When the overall results were divided into two age groups (Figure 6.12), a younger group (3- and 4-year-olds, $n = 8$) and an older group (5- and 6-year-olds, $n = 9$), independent t -tests revealed a marginally significant difference between the two in the Unraised condition ($t(15) = -2.015$, $p = 0.062$), showing that the older children responded correctly to these items more often than the younger children, but there was no difference in the Raised condition ($p > 0.1$).

Figure 6.12. Mean accuracy of age group (collapsed) in each condition (Exp. 4)

As in the previous experiment, children's responses to the critical items were analyzed based on the match/mismatch of the gender of the raised NP and the experiencer NP, and the results yielded no significant differences in either condition (paired t -tests: $p > 0.1$; Figure 6.13).

Figure 6.13. Mean accuracy on gender match and mismatch items in each condition

(Exp. 4)

The results from only those children who responded fairly well on the Unraised condition were also considered. However, out of the 17 children, there was only one six-year-old who scored 100% (3/3) on the unraised sentences, and it turned out that she had gotten all of the raised items incorrect (0/3). The cutoff point was therefore lowered to include those children who scored 67% (2 out of 3 items correct) in the Unraised condition, which added nine more children.²⁶ The data from these ten children (Figure 6.14) showed that they still had difficulty comprehending raised sentences (43.3%; 13/30).

²⁶ The overall scores of the seven excluded children were 28.6% on the Unraised condition and 42.9% on the Raised condition.

Figure 6.14. Mean accuracy of children who scored at least 67% on Unraised (Exp. 4)

Finally, Figure 6.15 compares the results of Experiment 4 with the results of Experiments 1 and 3 (Experiment 1 tested raising sentences with a lexical NP intervener, such as *Donald seems to Mickey to be short*, and Experiment 3 tested raising sentences with a pronominal intervener, such as *Donald seems to him to be short*).

Figure 6.15. Comparison of Experiments 1, 3, and 4 (Unraised and Raised)

A 2 x 3 repeated measures ANOVA was conducted with Condition (Unraised and Raised) as a within-subjects variable and Experiment (Experiments 1, 3, and 4) as a between-subject variable. This analysis showed no interaction effect, but there was a main effect of Condition ($F(1, 49) = 12.476, p = 0.001$) and Experiment ($F(2, 49) = 9.815, p < 0.001$). To further investigate the effects within each condition, two one-way ANOVAs were conducted with the three experiments as the independent variable. In the Unraised condition, a significant difference was observed among the experiments ($F(2, 51) = 9.699, p < 0.001$), and the post hoc tests revealed that while there was no significant difference between Experiment 1 and Experiment 3, the children's score in Experiment 4 (52.9%) was significantly lower than in Experiment 1 (76.2%; $p = 0.003$) and Experiment 3 (88.1%; $p < 0.001$). This suggests that children had difficulty comprehending unraised sentences only in Experiment 4.

As for the Raised condition (see Table 6.7), the effect of Experiment was found to be marginally significant ($F(2, 51) = 2.47, p = 0.095$). The post hoc tests showed that this was due to the difference between Experiment 3 (66.7%) and Experiment 4 (43.1%; $p = 0.03$), and no significant difference was found between Experiment 1 (50.0%) and Experiment 4 (43.1%; $p > 0.1$). In other words, children's comprehension of raised sentences was significantly better when the intervening experiencer was a pronoun than when it was a lexical NP, regardless of the type of the raised NP.

Table 6.7. A summary table of the Raised condition in Experiments 1, 3, and 4

Experiment	Test sentence	Mean accuracy
1	Bart seems to Lisa to be studying.	50.0%
3	Bart seems to her to be studying.	66.7%
4	He seems to Lisa to be studying.	43.1%

6.2.4 Discussion

Experiment 4 was conducted to investigate the effect of the type of the raised NP on children's comprehension. Specifically, it tested raising sentences such as *He seems to Lisa to be studying*, where the raised NP is a pronoun, but the intervening experiencer is a lexical NP. The results showed that children's comprehension of such raising sentences is significantly worse than their comprehension of raising sentences with a pronominal experiencer tested in Experiment 3. Furthermore, their score in Experiment 4 was similar to the children's poor score in Experiment 1, which tested raising sentences where both the raised NP and the experiencer were lexical NPs. That is, changing the type of the raised NP from a proper name to a pronoun did not facilitate children's comprehension of raising sentences. Thus, this pattern of results is not expected under the RM account, which predicts children's better comprehension as a result of the dissimilarity of the two NPs – the raised NP being a pronoun and the experiencer being a lexical NP. Rather, these findings confirm the prediction of the DLT-based account, which predicts that children's difficulty will persist regardless of the type of the raised NP so long as the intervener is a lexical NP.

Before drawing this conclusion, however, there is one issue that needs to be addressed – namely, the children’s poor comprehension of unraised sentences in the current experiment. This is especially surprising given that children consistently showed fairly good comprehension of unraised sentences in previous experiments. A closer inspection of the unraised test items used in Experiment 4 offers a clue to understanding this unexpected result. Consider the unraised sentence in (10):

(10) This is a story about Donald.

And at the end of the story, it seems to Mickey that he is short.

The purpose of the first sentence was to increase the naturalness of the pronoun in the second sentence. Yet the referent of the pronoun is, in fact, ambiguous in that it can refer to either *Donald* or *Mickey*. That is, although the intended referent is *Donald* in the preceding sentence, nothing rules out coreference between *he* and *Mickey*. As the governing category of the pronoun is the embedded clause, it is free within its domain regardless of whether its antecedent is *Donald* or *Mickey*. What determines the referent of the pronoun seems to be the salience of the character, because pronouns must refer to salient referents (e.g., Song & Fisher, 2007). Then the question becomes: Which character is more salient when the pronoun *he* is introduced? Although the first sentence mentions *Donald* as the topic of the discourse and thus increases its salience, its topicality is offset by the phrase *it seems to Mickey* in the next sentence, which arguably makes *Mickey* the topic at this point. As such, when the pronoun is reached in the embedded clause, there is a preference to choose *Mickey* as its antecedent. This in turn results in the

children's poor score on the Unraised condition. Taken together, the ambiguity of the referent of the pronoun along with the preference to take the experiencer as its antecedent seem to be plausible confounding factors that led to children's failure to comprehend the unraised sentences in Experiment 4. To test this possibility, Experiment 4b was conducted with a revised protocol to increase the topicality of the intended referent.

6.3 Experiment 4b: Raising a pronoun across a lexical NP experiencer (with a revised protocol)

The aim of Experiment 4b is to investigate the possible cause for the unexpected findings in Experiment 4 that children often failed to comprehend the unraised sentences in the intended way in cases such as (11).

(11) This is a story about Donald.

And at the end of the story, it seems to Mickey that he is short.

The previous section suggested a hypothesis that this unexpected finding might be due to the pronoun *he* having the two possible referents, either *Donald* or *Mickey*, as well as children's bias toward interpreting it as referring to the experiencer, *Mickey*. To test this hypothesis, Experiment 4b uses stimuli that modify the context of the pronoun, so that the link between the pronoun and its intended antecedent (e.g., *Donald* in the previous sentence) should be easier for the children to establish. If it is indeed the pronoun interpretation that has confounded the results of Experiment 4, then Experiment 4b

should show improvement in children's comprehension of unraised sentences, while their comprehension of raised sentences should remain the same.

6.3.1 Participants

Twenty native English-speaking children (age 3;0 to 5;11, mean = 4;1) who had not participated in the previous experiments were recruited for Experiment 4b from Montessori Community School and Kaimuki Christian School in Honolulu, Hawai'i. There were 8 girls and 12 boys – 10 three-year-olds, 7 four-year-olds, and 3 five-year-olds.

6.3.2 Procedure and materials

The procedure and materials were identical to those in Experiment 4 except that the experimenter's prompt and the puppet's lead-in sentence were revised in order to increase the topicality of the intended referent. A sample context for one of the stories (see Figure 5.4) is presented below: (12) shows the match item and (13) the mismatch item. For example, in the match item (12), only the intended referent *Donald* is explicitly mentioned in the first sentence of the experimenter's prompt. Then in the second sentence, a pronoun is used to refer to the same referent, together with the pointing to the picture of *Donald*. Then the puppet also mentions the intended referent, thus making *Donald* the undisputed topic, which leads children to easily choose *Donald* as the antecedent of the pronoun in the test sentence.

(12) <Match item>

Experimenter's prompt: That was a fun story about Donald and his friends.

He (*pointing to Donald*) is playing with Daisy, and then Mickey comes along. Hey, puppet, can you tell us what happens next?

Puppet: Donald is in a hole. He's playing down there, and ...

(*Unraised*) it seems to Mickey that he is short.

(*Raised*) he seems to Mickey to be short.

(13) <Mismatch item>

Experimenter's prompt: That was a fun story about Mickey and his friends.

He (*pointing to Mickey*) sees Donald and Daisy playing, and Donald turns around to look at him. Hey, puppet, can you tell us what happens next?

Puppet: Mickey is by the hole. He's just standing up there, and ...

(*Unraised*) it seems to Donald that he is short.

(*Raised*) he seems to Donald to be short.

6.3.3 Results

Data from six children (five 3-year-olds and one 4-year-old) were excluded from the subsequent analysis as the children failed to understand the instructions or did not respond correctly to all the filler items. The results from the remaining 14 children are presented in Figure 6.16.

Figure 6.16. Mean accuracy in each condition (Exp. 4b)

While children showed fairly good comprehension of sentences in the Unraised condition (78.6%, 33/42), their mean score on the Raised condition was only 38.1% (16/42). This difference between the two conditions was significant by a paired samples t -test ($t(13) = 3.82, p = 0.002$). A one sample t -test (Table 6.8) also showed that the children's score on the Unraised condition was at a rate greater than chance, whereas their comprehension of raised sentences was no different from chance level (50%).

Table 6.8. One sample t -test for each condition (Exp. 4b)

Condition	Percent correct	t	df	p
Unraised	78.6%	4.31	13	0.001
Raised	38.1%	-1.41	13	0.183

Additional analyses show that there was no difference between children's responses to match items and to mismatch items in any condition ($p > 0.1$; Figure 6.17), and no effect of age was found within conditions ($p > 0.1$; Figure 6.18).

Figure 6.17. Mean accuracy on match and mismatch items in each condition (Exp. 4b)

Figure 6.18. Mean accuracy by age group in each condition (Exp. 4b)

Furthermore, there was no significant difference between mean correct response on gender match items and on gender mismatch items in either condition ($p > 0.1$; Figure 6.19).

Figure 6.19. Mean accuracy on gender match and mismatch items in each condition (Exp. 4b)

To confirm children's difficulty with raising sentences, the results from only those who responded correctly to all the unraised sentences were considered. This analysis excluded data from seven children.²⁷ The results from the remaining seven children still demonstrated a low score (38.1%; 8/21) on the Raised condition (Figure 6.20).

²⁷ The overall scores of the seven excluded children were 57.1% on the Unraised condition and 38.1% on the Raised condition.

Figure 6.20. Mean accuracy of children who scored 100% on Unraised (Exp. 4b)

Finally, the results of Experiment 4b were compared with the results of Experiment 4. As illustrated in Figure 6.21, the mean accuracy on the Unraised condition increased from 52.9% in Experiment 4 to 78.6% in Experiment 4b. In contrast, there was no such increase in comprehension of raised sentences, with a mean accuracy of 43.1% in Experiment 4 and 38.1% in Experiment 4b.

Figure 6.21. Comparison of Experiments 4 and 4b (Unraised and Raised)

To statistically investigate the overall impact of Condition (Unraised vs. Raised within participants) and Experiment (Experiment 4 vs. Experiment 4b across participants), a mixed model 2 x 2 ANOVA was conducted. This analysis showed an interaction effect between Condition and Experiment ($F(1, 29) = 5.56, p = 0.025$). Additionally, a main effect of Condition was found ($F(1, 29) = 14.95, p = 0.001$), but the Experiment factor alone did not reach significance ($p > 0.1$). To find the source of this significant interaction effect, independent-samples *t*-tests assessed the mean scores across experiments within one condition. This revealed an effect of Experiment for the Unraised condition ($t(29) = -2.93, p = 0.007$), suggesting that children's comprehension was significantly better in Experiment 4b than in Experiment 4. However, no such difference was observed in the Raised condition ($p > 0.1$). Overall, this means that the difference between the two experiments lies in children's comprehension of unraised sentences, and further, that the children comprehended the raised sentences similarly in both experiments.

6.3.4 Discussion

Experiment 4b was identical to Experiment 4 in all respects, except for the modification of the prompt and the lead-in sentence. In Experiment 4, pronominalization of the intended referent was inherently awkward for unraised sentences, but by setting up the intended referent as more salient in Experiment 4b, a dramatic increase was observed in children's comprehension of unraised sentences. Thus, there is good reason to conclude that topicality was indeed responsible for children's poor comprehension of unraised sentences in Experiment 4. Furthermore, in light of the similarity of children's

comprehension of raised sentences in both Experiments 4 and 4b, it is unlikely that children's poor comprehension of raised sentences in Experiment 4 was due to the issue of topicality or due to their low score on the Unraised condition in the same experiment.

Taken together, the results of Experiments 4 and 4b suggest that children are sensitive to the pragmatic properties of utterances – a finding consistent with previous work in the acquisition literature (e.g., Conroy et al., 2009; Elbourne, 2005; Spenader et al., 2009) – and this finding highlights the importance of considering topicality in experimental design, especially when the task involves children's pronoun comprehension.

Returning to children's mean score on the Raised condition, Experiment 4b found (as did Experiment 4) that children had as much difficulty comprehending raising sentences such as (14a), as they did with the raising sentences tested in Experiment 1 (14b).

- (14) a. He seems to Lisa to be studying. (Experiments 4 and 4b)
b. Bart seems to Lisa to be studying. (Experiment 1)

In other words, children's difficulty persisted even when the raised NP was changed to a pronoun. Therefore, this pattern of results confirms what was found in Experiment 4, which is that changing the type of the raised NP did not affect children's comprehension of raising sentences. This is not expected under the RM account, but is consistent with the DLT-based account of intervention effects.

In sum, the results of Experiment 4 and 4b are directly contrasted with the results of Experiment 3, which found improvement in children's comprehension of raising sentences when it was the intervener that was changed to a pronoun, as in (15).

(15) Bart seems to her to be studying. (Experiment 3)

That is, it reveals an interesting asymmetry in that the effect of the NP type on children's comprehension of raising sentences is observed only when a lexical NP is raised across a pronominal intervener (Experiment 3), and not when a pronoun is raised over a lexical NP experiencer (Experiments 4 and 4b).

6.4 Key findings of Chapter 6

- Children's comprehension of raising sentences improves significantly when the intervening experiencer is a pronoun (e.g., *Bart seems to her to be studying*).
- Children have difficulty comprehending raising sentences, in which a pronoun is raised across a lexical NP experiencer (e.g., *He seems to Lisa to be studying*).

CHAPTER 7

ACQUISITION OF COPY-RAISING

In the two preceding chapters, I argued for the Performance-based Intervention Effects (PIE) hypothesis to explain errors in children's comprehension of raising patterns, in which an experiencer phrase intervenes between the matrix subject and the infinitival clause with which it is semantically associated. The present chapter attempts to take this generalized intervention analysis of raising one step further and asks whether another type of raising pattern, which involves a pronominal copy, also causes similar difficulties in comprehension.

7.1 Experiment 5: Copy-raising across the experiencer

Experiment 5 investigates children's comprehension of copy-raising (CR) patterns such as (1b), in which a pronominal copy occupies the embedded subject position, in contrast to the gap found in standard raising patterns such as (1a).

- (1) a. Standard raising: Bart seems to Lisa _ to be studying.
- b. Copy-raising: Bart seems to Lisa like he is studying.

As noted in Chapter 1, another key difference between (1a) and (1b) is that copy-raising patterns (1b) take a finite complement, not an infinitive as in standard infinitival raising patterns (1a).

To the best of my knowledge, no study has investigated children's comprehension of the CR pattern, which presents an opportunity to explore how children interpret the

pronoun in the embedded clause – do they correctly interpret it as a pronominal copy coreferential with the matrix subject, or do they misinterpret it as a regular pronoun, possibly coreferential with the intervening experiencer?

Because this CR pattern (1b) is similar to the standard raising pattern (1a) tested in Experiment 1 in that both the raised NP and the intervener are lexical NPs, the Relativized Minimality (RM) account predicts that children will have the same difficulty observed in Experiment 1. As for the Dependency Locality Theory (DLT)-based account, it seems plausible to assume that it also predicts intervention effects, given its emphasis on the referential property of the intervening NP. Finally, the experience-based account predicts that the CR patterns should be difficult, due to their rarity in the input (see Chapter 4).

7.1.1 Participants

A total of 22 native English-speaking children (age 3;10 to 5;3, mean = 4;8) who had not participated in the previous experiments were recruited for Experiment 5 from the UH Mānoa Children's Center in Honolulu, Hawai'i. There were 10 girls and 12 boys – 1 three-year-old, 11 four-year-olds, and 10 five-year-olds.

7.1.2 Procedure and materials

The procedure and materials were identical to those in Experiment 1, except that there was no Think condition, and a CR sentence was used instead of a standard raising pattern. Three types of sentences were used, balanced for match and mismatch: (1) unraised sentences with a medial experiencer-phrase; (2) CR sentences with Gender

Mismatch, in which the experiencer and the pronominal copy are of different genders; and (3) CR sentences with Gender Match, in which the experiencer and the pronominal copy are of the same gender. These sentences were counterbalanced across three lists. A sample set of test items (match and mismatch) is presented in Table 7.1 (see Appendix G for a full list of test items).

Table 7.1. A sample set of test items in each condition (Exp.5)

	Match items
Unraised	It seems to Mickey like Donald is short.
CR Gender Mismatch	Bart seems to Lisa like he is studying.
CR Gender Match	Donald seems to Mickey like he is short.

	Mismatch items
Unraised	It seems to Donald like Mickey is short.
CR Gender Mismatch	Lisa seems to Bart like she is studying.
CR Gender Match	Mickey seems to Donald like he is short.

7.1.3 Results

Data from one child (a four-year-old) were excluded from the subsequent analysis as he did not respond correctly to the filler items. The results from the remaining 21

children are presented in Figure 7.1 in the form of the mean correct percentage for the three different conditions (Unraised, CR-Gender Mismatch, and CR-Gender Match).

Figure 7.1. Mean accuracy in each condition (Exp. 5)

The children showed fairly good comprehension on the Unraised condition (81%, 34/42), but their comprehension on the CR-Gender Match condition was right at chance, 50% (21/42). Comprehension was better on the CR-Gender Mismatch condition (71.4%, 30/42); I take this to mean that children used the gender cue to interpret the referent of the pronominal copy. The CR-Gender Match condition is thus the crucial pattern for assessing children's comprehension of CR, which turns out to be problematic for children.

When a repeated measures ANOVA was conducted with each condition as a within-subject variable, it revealed a main effect of condition ($F(2, 40) = 6.79, p = 0.003$). Pairwise comparisons found that while there was no significant difference between Unraised and CR-Gender Mismatch conditions ($p > 0.1$), the differences between

Unraised and CR-Gender Match conditions and between CR-Gender Mismatch and CR-Gender Match conditions were both significant ($p = 0.004$ and $p = 0.035$, respectively).

To further assess whether the mean accuracy in each condition was different from chance performance, one-sample t -tests were conducted for each condition. As shown in Table 7.2, only the CR-Gender Match condition failed to reach significance.

Table 7.2. One sample t -test for each condition (Exp. 5)

Condition	Percent correct	t	df	p
Unraised	81.0%	4.81	20	0.00
CR Gender Mismatch	71.4%	3.29	20	0.004
CR Gender Match	50.0%	0.00	20	1.00

Additional analyses showed that there was no difference in accurate response rates either between match and mismatch items (paired samples t -tests: $p > 0.1$ for all conditions; Figure 7.2) or among age groups (one-way ANOVA: $p > 0.1$ for all conditions; Figure 7.3).

Figure 7.2. Mean accuracy on match and mismatch items in each condition (Exp. 5)

Figure 7.3. Mean accuracy by age group in each condition (Exp. 5)

Finally, Figure 7.4 presents the results of only those children who responded to the Unraised condition with perfect accuracy (100%). This requirement resulted in the exclusion of data from seven children,²⁸ leaving data from 14 children.

²⁸ The overall scores of the seven excluded children were 42.9% on the Unraised, 50.0% on the CR-Gender Mismatch, and 42.9% on the CR-Gender Match condition.

Figure 7.4. Mean accuracy of children who scored 100% on Unraised (Exp. 5)

The results are similar to the overall results shown in Figure 7.1 in that the children still had difficulty only in the CR-Gender Match condition (53.6%, 15/28), while their comprehension on the CR-Gender Mismatch condition was fairly good (82.1%, 23/28).

7.1.4 Discussion

Experiment 5 was conducted to investigate children's comprehension of CR patterns (e.g., *Bart seems to Lisa like he is studying*) in which a lexical NP is raised across a lexical NP experiencer, leaving behind a pronominal copy. The results showed that the children had difficulty comprehending the CR pattern when the intervener was a possible candidate for the antecedent of the pronominal copy. That is, the children's mean accuracy on the CR-Gender Match condition, where the gender of the pronominal copy was matched with that of the experiencer NP, as in (2a), was significantly lower than their mean accuracy on the CR-Gender Mismatch condition, as in (2b), or on the Unraised condition, as in (2c).

- (2)
 - a. CR-Gender Match: Donald seems to Mickey like he is short.
 - b. CR-Gender Mismatch: Bart seems to Lisa like he is studying.
 - c. Unraised: It seems to Mickey that Donald is short.

The pattern that was found is not surprising, because the gender cue was available for the children to correctly interpret the referent of the pronoun only on the CR-Gender Mismatch condition, resulting in better comprehension than on the CR-Gender Match condition.²⁹ As such, the children's poor comprehension on the CR-Gender Match condition suggests that CR patterns containing an intervening experiencer pose a difficulty for children, when there is no gender cue to help them pick out the correct referent of the pronominal copy. Thus, the results of Experiment 5 provide further evidence for the role of intervention effects in children's misinterpretation of raising-type patterns, in which an intervening nominal (in this case the experiencer) causes difficulties that result in degraded comprehension. Furthermore, these results are consistent with the finding of Friedmann, Belletti, and Rizzi (2009) that Hebrew-speaking children have difficulty comprehending object relatives regardless of whether there is a gap or a resumptive pronoun, which Friedmann et al. also attribute to the presence of an intervening NP within the dependency. Also noteworthy is that despite the name, it is usually assumed that copy-raising patterns are not formed with the help of A-movement; rather, the matrix subject appears in the appropriate position to begin with (Potsdam & Runner, 2001; Asudeh & Toivonen, 2012). Thus, the results of Experiment 5 call for a

²⁹ One may wonder why the differences between gender match and mismatch items showed up only in Experiment 5, but not in Experiments 3 and 4, both of which also involved the use of a pronoun. The reason is that the gender cue was available only in the copy-raising pattern, where there is a pronoun in the embedded clause. In other words, since standard raising patterns contain a gap instead of a pronoun, there was no gender cue available for the gender mismatch items (e.g., *Bart seems to her _ to be studying*).

more generalized intervention account to explain children's difficulty, counter to the claim of accounts such as the Argument Intervention Hypothesis (AIH) that limit children's difficulty with an intervening argument only to A-movement structures.

7.2 Key finding of Chapter 7

- Children have difficulty comprehending copy-raising (CR) patterns with an intervening experiencer (e.g., *Donald seems to Mickey like he is short*) when there is no gender cue available to help them correctly interpret the referent of the pronominal copy.

CHAPTER 8

GENERAL DISCUSSION AND CONCLUSION

This dissertation investigates how English-speaking children comprehend various types of raising sentences that contain an experiencer. This final chapter begins by summarizing the findings of each study described in Chapters 4, 5, 6, and 7. The second section discusses the implications of these findings for our understanding of the acquisition of raising and of intervention effects in general. The third section concludes the dissertation by outlining remaining issues and suggesting further research questions.

8.1 Summary of the findings

Chapter 4 presented a corpus study of the raising verb *seem* in child-directed speech and child-produced speech (from the CHILDES database) with a view to investigating how frequently children hear and produce utterances with the verb *seem*. The main finding from this study was that children very rarely produce or hear *seem* sentences that involve raising over an experiencer phrase. Indeed, the corpus did not contain a single utterance in which an experiencer phrase intervenes between the raised NP and the infinitival complement, as in *Donald seems to Mickey to be short*. Yet, this is the kind of sentence that has been used to test children's knowledge of raising patterns in the previous literature (Hirsch, Orfitelli, & Wexler, 2007; Hirsch & Wexler, 2007) as well as in the current dissertation.

In Chapter 5, a set of experiments was conducted with children to examine their comprehension of raising sentences with a sentence-medial experiencer (Experiment 1)

and with a sentence-initial experiencer (Experiment 2). Given the methodological shortcomings found in the previous studies on the acquisition of raising (reviewed in Chapter 2), the purpose of Experiment 1 was to provide a better assessment of children's comprehension of raising patterns with an intervening experiencer (e.g., *Donald seems to Mickey to be short*) by addressing the issue of felicity conditions on the use of the raising verb *seem* and the experiencer phrase. Despite the modifications, the results of Experiment 1 showed that children still had difficulty comprehending raising sentences across the experiencer – a finding consistent with the results of Hirsch and Wexler's (2007) and Hirsch et al.'s (2007) studies.

Experiment 2 was conducted to investigate whether the source of the difficulty comes from the operation of raising or the presence of an intervening experiencer phrase. To tease apart these two factors, Experiment 2 tested raising sentences where the experiencer phrase is moved to the beginning of the sentence (e.g., *To Mickey, Donald seems to be short*). When the results of Experiment 2 were compared to those of Experiment 1, it was found that children's difficulty with raising sentences is significantly reduced with a fronted experiencer. In other words, when the experiencer no longer intervenes between the raised NP and the gap, children's difficulty with raising seems to disappear, to the extent that their comprehension of raising sentences becomes similar to their comprehension of unraised sentences. Thus, the results of Experiments 1 and 2 are incompatible with the maturation accounts such as the Universal Phase Requirement (UPR; Wexler, 2004), which predicts that children have trouble comprehending raising sentences irrespective of the location of the experiencer, as it is the grammatical operation of raising itself that is unavailable to children. Rather, these

results support accounts that attribute the difficulty to the intervening experiencer phrase: Hyams and Snyder's Universal Freezing Hypothesis (UFH; 2005), Orfitelli's Argument Intervention Hypothesis (AIH; 2012), and Performance-based Intervention Effects (PIE), proposed in this dissertation.

Chapter 6 described a set of experiments that explored the effect of NP type on children's comprehension of raising sentences. Experiment 3 tested raising patterns in which a lexical NP is raised across a pronominal experiencer (e.g., *Donald seems to him to be short*). The results showed that children were able to comprehend the raising sentences with a pronominal experiencer significantly better than those with a lexical NP experiencer (Experiment 1: *Donald seems to Mickey to be short*), and that their comprehension was as accurate as when there was no intervener (Experiment 2: *To Mickey, Donald seems to be short*). That is, having a pronominal experiencer facilitated the comprehension of raising sentences, even though the pronoun interrupts the filler-gap dependency. This pronoun advantage argues against grammar-based approaches to the acquisition of raising, such as the UFH and AIH, which claim that a grammatical deficit makes raising impossible for children.³⁰ However, this lexical NP/pronoun difference is in fact expected under the Performance-based Intervention Effects (PIE) hypothesis, as this kind of intervention effect is known to be sensitive to the NP type. Thus, the results of Experiment 3 provide a key piece of evidence that children's difficulty with raising is due to the same limitations that affect other structures for which intervention effects have been found.

³⁰ But note that these results are not inconsistent with the RM account, which is a grammar-based approach to the intervention effects.

To further investigate the nature of the intervention effects in raising patterns, Experiment 4 tested raising sentences in which a pronoun is raised across a lexical NP experiencer (e.g., *He seems to Mickey to be short*). The results demonstrated that children had difficulty comprehending the raising sentences, but their comprehension of the unraised sentences was also quite poor, which was unexpected given the results of previous experiments in which the Unraised condition did not pose a particular difficulty to children in a similar age range. It was hypothesized that this unexpected finding might be due to the low topicality of the intended antecedent of the pronoun: it might have been difficult for the children to establish the link between the pronoun and its intended antecedent.

To test this idea, Experiment 4b was conducted with the same test sentences in Experiment 4, but with a protocol that increased the saliency of the intended referent by revising the experimenter's prompt and the puppet's lead-in sentence. What seemed to be a small change in the protocol made a big difference in the results, which showed a significant improvement in the children's comprehension of the unraised sentences. Furthermore, because the issue of topicality was relevant only to the Unraised condition, the children's comprehension of the raised sentences remained the same as in Experiment 4, as expected. Thus, Experiment 4b confirmed that children have difficulty with raising sentences in which a pronoun is raised across a lexical NP experiencer.

Taken together, the results of Experiments 3 and 4 demonstrated that while a pronominal experiencer facilitated children's comprehension of raising sentences, no such effect was observed in the reverse situation, with a raised pronominal and a lexical NP experiencer. In other words, a pronoun/lexical NP difference showed up in the case of

the intervening experiencer phrase, but not the raised NP. This finding is not expected under the RM account, which focuses on the (dis)similarity of the two NPs. In contrast, the results are consistent with the prediction of the Dependency Locality Theory (DLT)-based approach to intervention effects, as this approach emphasizes the role of the discourse status of the intervening NP in determining ease of processing.

Chapter 7 presented the last experiment of this dissertation, Experiment 5, which investigated children's comprehension of a non-standard raising pattern, known as "copy-raising," such as *Bart seems to Lisa like he is studying*, in which a pronominal copy occupies the embedded subject position, in contrast to the gap found in standard infinitival raising sentences. As with the previous experiments, an experiencer phrase was added so as to examine whether children can correctly interpret the antecedent of the pronominal copy. The results of Experiment 5 showed children's poor comprehension of the copy-raising pattern when the gender cue was not available to help them correctly interpret the referent of the pronominal copy (e.g., *Donald seems to Mickey like he is short*). This finding provides additional evidence for the role of intervention effects in children's misinterpretation of raising-type sentences, in which an intervening NP causes parsing difficulties that result in degraded comprehension. The experimental results for each experiment are summarized in Table 8.1 and Figure 8.1.

Table 8.1. A summary of the experimental results

Exp.	Raising sentence tested (Raised NP – Experiencer)		Results
1	Donald seems to Mickey _ to be short.	Lexical NP – Lexical NP	Poor comprehension
2	To Mickey, Donald seems _ to be short.	No Intervener	Good comprehension
3	Donald seems to him _ to be short.	Lexical NP – Pronoun	Good comprehension
4	He seems to Mickey _ to be short.	Pronoun – Lexical NP	Poor comprehension
5	Donald seems to Mickey like he is short.	Copy-raising	Poor comprehension

Figure 8.1. Mean accuracy in the Raised condition across each experiment
(of children who scored 100% on the Unraised condition)

8.2 Implications of the findings

The set of findings reported in this dissertation has several implications for our understanding of the acquisition of raising and of intervention effects in general. With

respect to the acquisition of raising, the methodological improvements applied to each experiment provide a more reliable picture of the acquisition of raising than ever before. In particular, the results of Hirsch's (2011) study were directly contradicted by the improvement in children's comprehension of raising sentences containing the fronted experiencer (Experiment 2), highlighting the shortcomings of the picture-selection task involving thought-bubbles used in the previous studies.

Furthermore, children's good comprehension of raising sentences with a pronominal experiencer (Experiment 3) suggests that the difficulty associated with raising patterns cannot be attributed to children's underdeveloped syntactic abilities or to grammatical deficits, as has previously been suggested (e.g., Borer & Wexler, 1987; Hyams & Snyder, 2005; Orfitelli, 2012; Wexler, 2004). Rather, it leads to an alternative theory based on Performance-based Intervention Effects (PIE) that attributes the difficulty to grammar-external factors (Arnon, 2005; Bloom 1990; Valian, 1991). Drawing on memory-based interference in adult sentence processing, this explanation attempts to link children's difficulty with raising patterns to a performance effect rather than a grammatical constraint.

Finally, children's difficulty with the copy-raising patterns (Experiment 5) further strengthens the argument for a more generalized intervention analysis of raising that extends across multiple constructions since copy-raising does not involve A-movement. In other words, such a broader explanation for the difficulty associated with raising sentences serves to better capture the findings of the current dissertation, as compared to the previous accounts which restrict the difficulty to particular constructions, such as A-movement structures.

The findings of the current dissertation also add to the growing body of literature demonstrating the presence of intervention effects in a number of sentence types (e.g., object relatives, object topicalizations, object *wh*-questions), suggesting that this phenomenon is not limited to a single structure. Furthermore, focusing on raising patterns has allowed us to evaluate three theories of intervention effects that have been considered in the fields of acquisition and adult sentence processing – the Relativized Minimality (RM) account, an experience-based account, and the Dependency Locality Theory-based account. As raising sentences with the experiencer are extremely rare, the role of experience is negligible. The experience-based account is thus ruled out as an explanation for the intervention effects in raising, since it does not predict the pronoun advantage, where children showed improved comprehension of raising sentences with a pronominal experiencer (Experiment 3).

While the other RM and the DLT-based accounts are compatible with the pronoun advantage, further investigation in Experiment 4 revealed an interesting asymmetry in children's comprehension of raising sentences. In particular, children showed poor comprehension of raising sentences in which a pronoun is raised across a lexical NP experiencer (*He seems to Lisa to be studying*). Thus, the results of Experiment 3 and Experiment 4 are also inconsistent with the prediction of the RM account, as the (dis)similarity of the raised NP and the experiencer NP alone cannot explain the children's asymmetric comprehension. Overall, this pattern of findings is most compatible with the DLT-based account, which appeals to the referential accessibility of the intervening NPs and predicts that the intervening NP incurs less processing cost, resulting in the improved comprehension, only when it is a pronoun.

As the DLT is a theory that relates sentence processing to the available computational resources (Gibson, 2000), it is also in line with the acquisition theory embodied in the PIE, which attributes children's difficulty with raising to a performance limitation. At this point, however, it is worthwhile to consider whether intervention effects can be explained solely by processing factors rather than by a certain grammatical principle (e.g., RM). While the findings of the dissertation may provide circumstantial evidence that the intervention effects are processing- or parsing-related, further research needs to be conducted before any definitive conclusion is drawn. Yet, it also seems clear that no current grammar-based theory of intervention can account for the differences in the comprehension of raising sentences containing a pronoun and a lexical NP, as reported in this dissertation.

Lastly, let us return to the theory of PIE and discuss its implications for the acquisition of other structures. One structure that is predicted to be subject to intervention effects involves *tough*-movement, as in (1).

- (1) [s The boy is tough for the girl [s to please _].

Since the overt experiencer *the girl* intervenes between the NP *the boy* and the object position of the embedded verb with which it is associated, the PIE predicts delayed acquisition of such structures. However, matters are complicated by the fact that previous studies show that *tough*-constructions are problematic for children even when there is no experiencer phrase (e.g., *The monkey was easy to teach*) (Anderson, 2005; Chomsky, 1969; but see Becker, Estigarribia, & Gylfadottir, 2012). The main reported finding is

that children initially interpret the matrix subject NP as the semantic subject of the embedded clause, instead of the object. For example, '*The monkey was easy to teach*' is incorrectly interpreted as '*It is easy for the monkey to teach someone.*' If this is the case, then we might expect improved performance with the addition of an experiencer, as in sentence (1). This is because the intervening experiencer may guide the children to the correct interpretation by serving as the semantic subject of the embedded clause, permitting (1) to be correctly interpreted as '*It is tough for the girl to please the boy*'. However, an alternative prediction is that the introduction of the intervener may make matters worse for the children as the intervening nominal becomes yet another factor to be considered and overcome. Thus, further investigation is required to identify the effect of the intervener on children's comprehension of *tough*-constructions.

Another particularly interesting pattern that should be considered with respect to the predictions of PIE involves a plain pronoun. Recall that in Experiment 5, children were shown to have difficulty comprehending copy-raising sentences such as (2), in which an experiencer intervenes between the matrix subject NP *Donald* and the pronominal copy *he*.

- (2) Donald seems to Mickey like he is short.

This difficulty was interpreted as another manifestation of the intervention effects observed in pronoun comprehension. This raises the question of whether the same effects would occur in sentences like (3) and (4), in which the pronoun *he* is ambiguous in that it

can refer to either the nearest antecedent *Mickey* or the matrix subject NP *Donald* (in which case, the referential dependency holds across the intervening NP *Mickey*).

(3) Donald says to Mickey that he is short.

(4) Donald told Mickey that he is short.

Given the structural similarity of (3) and (4) to the copy-raising sentence in (2), PIE seems to predict intervention effects, and thus leads us to expect that children will have difficulty comprehending sentences in which the pronoun *he* refers to the matrix subject NP *Donald* across the intervening NP *Mickey*. However, this prediction seems inconsistent with the results of previous studies on pronoun comprehension by both adults and children that show a strong tendency to consider the grammatical subject as the antecedent of the pronoun³¹ (e.g., Arnold, Eisenband, Brown-Schmidt, & Trueswell, 2000; Gordon, Grosz, & Gilliom, 1993; Song & Fisher, 2005). Thus, this subject bias seems to go against the predictions of PIE. However, as mentioned earlier, it is important to note that there are multiple factors influencing pronoun comprehension, as both adults and children use many sources of information –both linguistic (definiteness, number and gender) and non-linguistic (topicality, plausibility, discourse prominence, etc.) (e.g., Arnold et al., 2000; Clark & Haviland, 1977; Garnham, 2000; Heim, 1982; Kintsch, 1988; Tanenhaus, Spivey-Knowlton, Eberhard, & Sedivy, 1995). Thus, it is not implausible to think that intervention effects may be overridden by, for example, the stronger subject bias in sentences like (3) and (4). This also implies that the magnitude of the intervention

³¹ But note that these were the cases where the pronoun refers to an antecedent that was the subject of the preceding sentence (i.e., an antecedent across a sentence boundary).

effects that show up in a number of other sentence types may vary, once other factors are taken into consideration.

8.3 Remaining issues

While the findings of this dissertation have shed some light on how children comprehend raising sentences with the verb *seem*, a number of questions still remain unanswered. First and foremost, further investigation is necessary to examine children's comprehension of raising sentences without an experiencer phrase (e.g., *John seems to be short*). As things now stand, the results are controversial in that some studies claim delayed acquisition (e.g., Hirsch, Orfitelli, & Wexler, 2008), while others claim no delay (e.g., Becker, 2006). However, as noted in Section 2.1, each of the previous studies raises methodological concerns that need to be addressed before any definitive conclusion can be drawn.

Second, following up on the parallels posited between raising patterns and the structures inducing intervention effects (e.g., object relatives), it would be informative to explore whether manipulating the animacy of the raised NP would reduce the difficulty associated with raising sentences, as was the case with the pronoun advantage. Many studies of adult sentence processing have demonstrated that the processing difficulty of object relatives is mediated when the relative clause head is an inanimate NP (e.g., *the movie that the director watched* _) (Mak, Vonk, & Schriefers, 2002, 2006; Traxler, Morris, & Seely, 2002; Traxler, Williams, Blozis, & Morris, 2005). Furthermore, similar results have been reported from the acquisition study by Kidd et al. (2007), which found that 3- and 4-year-old children were better at correctly repeating object relatives

containing inanimate head nouns, compared to those with animate head nouns. In light of these findings, further research is called for to see whether the same effect occurs in raising sentences in which the raised NP has an inanimate referent, as in *The rock seems to Mickey to be small*.

Lastly, one natural direction for future research is to investigate whether adults are sensitive to the manipulation of the NP type in raising patterns in the way that children are. In particular, it would be interesting to see whether the same asymmetries found in children are manifested in adults, perhaps in the form of reading time differences. Such a finding would suggest that the factors that underlie children's difficulty with raising also plays a role in adult sentence processing.

APPENDIX A.

Unraised with an experiencer in child-directed speech

- (1) *Seems to me that those were twenty nine or thirty two dollars.*
(10b.cha, line 936)
- (2) *Seems to me that is th(e) dinosaur book.*
(820314b.cha, line 144)
- (3) *It seems to me that you tire of your games very easily.*
(adam20.cha, line 3643)
- (4) *It seems to me you place these long ones on top of one another.*
(adam53.cha, line 2099)
- (5) *It seems to me she's taking very much in the attitude of ...*
(charlie.cha, line 3708)
- (6) *It seems to me that ya ...*
(charlie.cha, line 3859)
- (7) *Seems to me I had you on my lap most of last night.*
(fleur11b.cha, line 562)
- (8) *It seems to me that these zoo animals want to be transferred.*
(job.cha, line 11070)
- (9) *It seems to me that they xxx suppose to be ...*
(kif.cha, line 4915)
- (10) *Seems to me he's about to get on his ear.*
(lew05.cha, line 2636)

- (11) *It seems to me he should have his name someplace.*
(lil44.cha, line 1676)
- (12) *Well it seems to me if something is your favorite color you ...*
(lil74.cha, line 331)
- (13) *It seems to me that there are a lot of ...*
(maa.cha, line 21433)
- (14) *But it seems to me that he and Jason had a giant ...*
(mat54.cha, line 204)
- (15) *Seems to me you need to find some more.*
(nai53.cha, line 1015)
- (16) *It seems to me like it's Uncle_Buster that's done everything.*
(sarah096.cha, line 2342)
- (17) *It seems to me they that that was ...*
(sarmt3.cha, line 721)
- (18) *It seemed to her that roots and branches of trees reached out ...*
(vicbr1.cha, line 183)
- (19) *Seems to me that somebody wrote on the wall over there.*
(vio07.cha, line 1462)

APPENDIX B.

Raised with an experimenter in child-directed speech

- (1) *That seems acceptable to me.*
(74b1.cha, line 2776)
- (2) *It seems barbaric to me.*
(84a1.cha, line 1094)
- (3) *Today seems like Friday to me for some reason.*
(guy.cha, line 870)
- (4) *All day it seemed like Friday to me.*
(guy.cha, line 876)
- (5) *Seems like Monday to me.*
(guy.cha, line 881)
- (6) *Did they seem that way to you?*
(helen.cha, line 3094)
- (7) *I don't know what I do but it seems funny to me you know ...*
(jaf.cha, line 12330)
- (8) *I don't know seems like 'kreinkinis@u [: crankyness] to me.*
(lil07.cha, line 1705)
- (9) *It'll seem like a new toy to her.*
(lil22.cha, line 653)
- (10) *You seem very familiar to me he said have we met?*
(lil38.cha, line 1171)

(11) *Does that seem loud to you?*

(mat06.cha, line 147)

(12) *It seems very aggressive to me.*

(mat47.cha, line 272)

(13) *That's not okay, what does it seem to me that if you're dropping ...*

(mat48.cha, line 800)

(14) *And a hum came suddenly into his head which seemed to him a good hum
such as is a hum hopefully to others.*

(nai63.cha, line 116)

(15) *Is that hundred dollars seems like too much money to me to spend*

(nai77.cha, line 164)

(16) *She seems tired to me.*

(shem17.cha, line 880)

(17) *You seem pretty tired to me.*

(shem21b.cha, line 1175)

(18) *Seems big to me.*

(vio53.cha, line 621)

(19) *Seem to me like you wouldn't be trying to use the water.*

(w3-1107.cha, line 1516)

APPENDIX C.

Test sentences for Experiment 1

Item	Condition	M/MM	Test sentence
1	Think	Match	At the end of the story, Mickey still thinks Donald is short.
1	Unraised	Match	At the end of the story, it still seems to Mickey that Donald is short.
1	Raised	Match	At the end of the story, Donald still seems to Mickey to be short.
1	Think	Mismatch	At the end of the story, Donald still thinks Mickey is short.
1	Unraised	Mismatch	At the end of the story, it still seems to Donald that Mickey is short.
1	Raised	Mismatch	At the end of the story, Mickey still seems to Donald to be short.
2	Think	Match	At the end of the story, Piglet still thinks Pooh is wearing a blue shirt.
2	Unraised	Match	At the end of the story, it still seems to Piglet that Pooh is wearing a blue shirt.
2	Raised	Match	At the end of the story, Pooh still seems to Piglet to be wearing a blue shirt.
2	Think	Mismatch	At the end of the story, Pooh still thinks Piglet is wearing a blue shirt.
2	Unraised	Mismatch	At the end of the story, it still seems to Pooh that Piglet is wearing a blue shirt.
2	Raised	Mismatch	At the end of the story, Piglet still seems to Pooh to be wearing a blue shirt.
3	Think	Match	At the end of the story, Lisa still thinks Bart is studying.
3	Unraised	Match	At the end of the story, it still seems to Lisa that Bart is studying.
3	Raised	Match	At the end of the story, Bart still seems to Lisa to be studying.
3	Think	Mismatch	At the end of the story, Bart still thinks Lisa is studying.
3	Unraised	Mismatch	At the end of the story, it still seems to Bart that Lisa is studying.
3	Raised	Mismatch	At the end of the story, Lisa still seems to Bart to be studying.
4	Think	Match	At the end of the story, Lisa still thinks Bart plays

			the saxophone well
4	Unraised	Match	At the end of the story, it still seems to Lisa that Bart plays the saxophone well.
4	Raised	Match	At the end of the story, Bart still seems to Lisa to play the saxophone well.
4	Think	Mismatch	At the end of the story, Bart still thinks Lisa plays the saxophone well.
4	Unraised	Mismatch	At the end of the story, it still seems to Bart that Lisa plays the saxophone well.
4	Raised	Mismatch	At the end of the story, Lisa still seems to Bart to play the saxophone well.
5	Think	Match	At the end of the story, Homer still thinks Lisa is crying.
5	Unraised	Match	At the end of the story, it still seems to Homer that Lisa is crying.
5	Raised	Match	At the end of the story, Lisa still seems to Homer to be crying.
5	Think	Mismatch	At the end of the story, Lisa still thinks Homer is crying.
5	Unraised	Mismatch	At the end of the story, it still seems to Lisa that Homer is crying.
5	Raised	Mismatch	At the end of the story, Homer still seems to Lisa to be crying.
6	Think	Match	At the end of the story, Goofy still thinks Mickey is purple.
6	Unraised	Match	At the end of the story, it still seems to Goofy that Mickey is purple.
6	Raised	Match	At the end of the story, Mickey still seems to Goofy to be purple.
6	Think	Mismatch	At the end of the story, Mickey still thinks Goofy is purple.
6	Unraised	Mismatch	At the end of the story, it still seems to Mickey that Goofy is purple.
6	Raised	Mismatch	At the end of the story, Goofy still seems to Mickey to be purple.

APPENDIX D.

Test sentences for Experiment 2

Item	Condition	M/MM	Test sentence
1	Think	Match	Mickey thinks Donald is short.
1	Unraised	Match	To Mickey, it seems that Donald is short.
1	Raised	Match	To Mickey, Donald seems to be short.
1	Think	Mismatch	Donald thinks Mickey is short.
1	Unraised	Mismatch	To Donald, it seems that Mickey is short.
1	Raised	Mismatch	To Donald, Mickey seems to be short.
2	Think	Match	Piglet thinks Pooh is wearing a blue shirt.
2	Unraised	Match	To Piglet, it seems that Pooh is wearing a blue shirt.
2	Raised	Match	To Piglet, Pooh seems to be wearing a blue shirt.
2	Think	Mismatch	Pooh thinks Piglet is wearing a blue shirt.
2	Unraised	Mismatch	To Pooh, it seems that Piglet is wearing a blue shirt.
2	Raised	Mismatch	To Pooh, Piglet seems to be wearing a blue shirt.
3	Think	Match	Lisa thinks Bart is studying.
3	Unraised	Match	To Lisa, it seems that Bart is studying.
3	Raised	Match	To Lisa, Bart seems to be studying.
3	Think	Mismatch	Bart thinks Lisa is studying.
3	Unraised	Mismatch	To Bart, it seems that Lisa is studying.
3	Raised	Mismatch	To Bart, Lisa seems to be studying.
4	Think	Match	Lisa thinks Bart plays the saxophone well
4	Unraised	Match	To Lisa, it seems that Bart plays the saxophone well.
4	Raised	Match	To Lisa, Bart seems to play the saxophone well.
4	Think	Mismatch	Bart thinks Lisa plays the saxophone well.
4	Unraised	Mismatch	To Bart, it seems that Lisa plays the saxophone well.
4	Raised	Mismatch	To Bart, Lisa seems to play the saxophone well.
5	Think	Match	Homer thinks Lisa is crying.
5	Unraised	Match	To Homer, it seems that Lisa is crying.
5	Raised	Match	To Homer, Lisa seems to be crying.
5	Think	Mismatch	Lisa thinks Homer is crying.
5	Unraised	Mismatch	To Lisa, it seems that Homer is crying.
5	Raised	Mismatch	To Lisa, Homer seems to be crying.
6	Think	Match	Goofy thinks Mickey is purple.

6	Unraised	Match	To Goofy, it seems that Mickey is purple.
6	Raised	Match	To Goofy, Mickey seems to be purple.
6	Think	Mismatch	Mickey thinks Goofy is purple.
6	Unraised	Mismatch	To Mickey, it seems that Goofy is purple.
6	Raised	Mismatch	To Mickey, Goofy seems to be purple.

APPENDIX E.

Test sentences for Experiment 3

Item	Condition	M/MM	Test sentence
1	Unraised	Match	This is a story about Mickey, and it seems to him that Donald is short.
1	Raised	Match	This is a story about Mickey, and Donald seems to him to be short.
1	Unraised	Mismatch	This is a story about Donald, and it seems to him that Mickey is short.
1	Raised	Mismatch	This is a story about Donald, and Mickey seems to him to be short.
2	Unraised	Match	This is a story about Piglet, and it seems to him that Pooh is wearing a blue shirt.
2	Raised	Match	This is a story about Piglet, and Pooh seems to him to be wearing a blue shirt.
2	Unraised	Mismatch	This is a story about Pooh, and it seems to him that Piglet is wearing a blue shirt.
2	Raised	Mismatch	This is a story about Pooh, and Piglet seems to him to be wearing a blue shirt.
3	Unraised	Match	This is a story about Lisa, and it seems to her that Bart is studying.
3	Raised	Match	This is a story about Lisa, and Bart seems to her to be studying.
3	Unraised	Mismatch	This is a story about Bart, and it seems to him that Lisa is studying.
3	Raised	Mismatch	This is a story about Bart, and Lisa seems to him to be studying.
4	Unraised	Match	This is a story about Lisa, and it seems to her that Bart plays the saxophone well.
4	Raised	Match	This is a story about Lisa, and Bart seems to her to play the saxophone well.
4	Unraised	Mismatch	This is a story about Bart, and it seems to him that Lisa plays the saxophone well.
4	Raised	Mismatch	This is a story about Bart, and Lisa seems to him to play the saxophone well.
5	Unraised	Match	This is a story about Homer, and it seems to him that Lisa is crying.
5	Raised	Match	This is a story about Homer, and Lisa seems to him to be crying.

5	Unraised	Mismatch	This is a story about Lisa, and it seems to her that Homer is crying.
5	Raised	Mismatch	This is a story about Lisa, and Homer seems to her to be crying.
6	Unraised	Match	This is a story about Goofy, and it seems to him that Mickey is purple.
6	Raised	Match	This is a story about Goofy, and Mickey seems to him to be purple.
6	Unraised	Mismatch	This is a story about Mickey, and it seems to him that Goofy is purple.
6	Raised	Mismatch	This is a story about Mickey, and Goofy seems to him to be purple.

APPENDIX F.

Test sentences for Experiment 4

Item	Condition	M/MM	Test sentence
1	Unraised	Match	This is a story about Donald, and it seems to Mickey that he is short.
1	Raised	Match	This is a story about Donald, and he seems to Mickey to be short.
1	Unraised	Mismatch	This is a story about Mickey, and it seems to Donald that he is short.
1	Raised	Mismatch	This is a story about Mickey, and he seems to Donald to be short.
2	Unraised	Match	This is a story about Pooh, and it seems to Piglet that he is wearing a blue shirt.
2	Raised	Match	This is a story about Pooh, and he seems to Piglet to be wearing a blue shirt.
2	Unraised	Mismatch	This is a story about Piglet, and it seems to Pooh that he is wearing a blue shirt.
2	Raised	Mismatch	This is a story about Piglet, and he seems to Pooh to be wearing a blue shirt.
3	Unraised	Match	This is a story about Bart, and it seems to Lisa that he is studying.
3	Raised	Match	This is a story about Bart, and he seems to Lisa to be studying.
3	Unraised	Mismatch	This is a story about Lisa, and it seems to Bart that she is studying.
3	Raised	Mismatch	This is a story about Lisa, and she seems to Bart to be studying.
4	Unraised	Match	This is a story about Bart, and it seems to Lisa that he plays the saxophone well.
4	Raised	Match	This is a story about Bart, and he seems to Lisa to play the saxophone well.
4	Unraised	Mismatch	This is a story about Lisa, and it seems to Bart that she plays the saxophone well.
4	Raised	Mismatch	This is a story about Lisa, and she seems to Bart to play the saxophone well.
5	Unraised	Match	This is a story about Lisa, and it seems to Homer that she is crying.

5	Raised	Match	This is a story about Lisa, and she seems to Homer to be crying.
5	Unraised	Mismatch	This is a story about Homer, and it seems to Lisa that he is crying.
5	Raised	Mismatch	This is a story about Homer, and he seems to Lisa to be crying.
6	Unraised	Match	This is a story about Mickey, and it seems to Goofy that he is purple.
6	Raised	Match	This is a story about Mickey, and he seems to Goofy to be purple.
6	Unraised	Mismatch	This is a story about Goofy, and it seems to Mickey that he is purple.
6	Raised	Mismatch	This is a story about Goofy, and he seems to Mickey to be purple.

APPENDIX G.

Test sentences for Experiment 5

Item	Condition	M/MM	Test sentence
1	Unraised	Match	It seems to Mickey like Donald is short.
1	Unraised	Mismatch	It seems to Donald like Mickey is short.
1	CR (sg)	Match	Donald seems to Mickey like he is short.
1	CR (sg)	Mismatch	Mickey seems to Donald like he is short.
2	Unraised	Match	It seems to Piglet like Pooh is wearing a blue shirt.
2	Unraised	Mismatch	It seems to Pooh like Piglet is wearing a blue shirt.
2	CR (sg)	Match	Pooh seems to Piglet like he is wearing a blue shirt.
2	CR (sg)	Mismatch	Piglet seems to Pooh like he is wearing a blue shirt.
3	Unraised	Match	It seems to Lisa like Bart is studying.
3	Unraised	Mismatch	It seems to Bart like Lisa is studying.
3	CR (dg)	Match	Bart seems to Lisa like he is studying.
3	CR (dg)	Mismatch	Lisa seems to Bart like she is studying.
4	Unraised	Match	It seems to Lisa like Bart plays the saxophone well.
4	Unraised	Mismatch	It seems to Bart like Lisa plays the saxophone well.
4	CR (dg)	Match	Bart seems to Lisa like he plays the saxophone well.
4	CR (dg)	Mismatch	Lisa seems to Bart like she plays the saxophone well.
5	Unraised	Match	It seems to Homer like Lisa is crying.
5	Unraised	Mismatch	It seems to Lisa like Homer is crying.
5	CR (dg)	Match	Lisa seems to Homer like she is crying.
5	CR (dg)	Mismatch	Homer seems to Lisa like he is crying.
6	Unraised	Match	It seems to Goofy like Mickey is purple.
6	Unraised	Mismatch	It seems to Mickey like Goofy is purple.
6	CR (sg)	Match	Mickey seems to Goofy like he is purple.
6	CR (sg)	Mismatch	Goofy seems to Mickey like he is purple.

REFERENCES

- Anderson, D. (2005). *The acquisition of tough-movement in English* (Doctoral dissertation). University of Cambridge, Cambridge, UK.
- Arnold, J. E., Eisenband, J. G., Brown-Schmidt, S., & Trueswell, J. C. (2000). The rapid use of gender information: Evidence of the time course for pronoun resolution from eyetracking. *Cognition*, 76, B13–B26.
- Arnon, I. (2005). Relative clause acquisition in Hebrew: Towards a processing-oriented account. In A. Brugos, & S. Ha (Eds.), *Proceedings of the 29th Annual Boston University Conference on Language Development (BUCLD)* (pp. 37–48). Somerville, MA: Cascadilla Press.
- Arnon, I. (2010). Rethinking child difficulty: The effect of NP types on children's processing of relative clauses in Hebrew. *Journal of Child Language*, 37(1), 27–57.
- Asudeh, A., & Toivonen, I. (2006). Copy raising and its consequences for perceptual reports. In J. Grimshaw, J. Maling, C. Manning, J. Simpson, & A. Zaenen (Eds.), *Architectures, rules, and preferences: A festschrift for Joan Bresnan* (pp. 49–67). Stanford, CA: CSLI Publications.
- Asudeh, A., & Toivonen, I. (2012). Copy raising and perception. *Natural Language and Linguistic Theory*, 30, 321–380.
- Avrutin, S. (2000). Comprehension of Wh-questions by children and Broca's aphasics. In Y. Grodzinsky, L. P. Shapiro, & D. A. Swinney (Eds.), *Language and the brain: Representation and processing* (pp. 295–312). San Diego, CA: Academic Press.

- Becker, M. (2004). Learning verbs that lack argument structure: the case of raising verbs. In J. van Kampen, & S. Baauw (Eds.), *Proceedings of GALA 2003 (Generative Approaches to Language Acquisition)* (pp. 115–125). Utrecht: LOT.
- Becker, M. (2006). There began to be a learnability puzzle. *Linguistic Inquiry*, 37(3), 441–456.
- Becker, M. (2007). Animacy, expletives, and the learning of the raising-control distinction. In A. Belikova, L. Meroni, & M. Umeda (Eds.), *Proceedings of the 2nd Conference on Generative Approaches to Language Acquisition North America (GALANA)* (pp. 12–20). Somerville, MA: Cascadilla Proceedings Project.
- Becker, M., Estigarribia, B., & Gylfadottir, D. (2012). Tough-adjectives are easy to learn. In *Supplemental Proceedings of BUCLD 36*, Cascadilla Proceedings Project.
<http://www.bu.edu/buclد/proceedings/supplement/vol36/4>
- Belletti, A., & Rizzi, L. (forthcoming). Ways of avoiding intervention: Some thoughts on the development of object relatives, passives and control. To appear in M. Piattelli-Palmarini, & R. Berwick (Eds.), *Rich grammars from poor inputs*. Oxford: Oxford University Press.
- Bloom, P. (1990). Subjectless sentences in child language. *Linguistic Inquiry*, 21, 491–504.
- Boeckx, C. (1999). Conflicting c-command requirements. *Studia Linguistica*, 53, 227–250.
- Boeckx, C. (2003). Case matters and minimalist concerns. *Harvard Working Papers in Linguistics*, 8, 159–187.

- Boeckx, C. (2008). Raising across experiencers cross-linguistically. In *Aspects of the syntax of agreement* (pp. 150–161). London: Routledge.
- Borer, H., & Wexler, K. (1987). The maturation of syntax. In T. Roeper, & E. Williams (Eds.), *Parameter setting* (pp. 123–172). Dordrecht: Reidel.
- Caplan, D., & Waters, G. (2002). Working memory and connectionist models of parsing: A reply to MacDonald and Christiansen (2002). *Psychological Review*, 109, 66–74.
- Carpenter, P., Miyake, A., & Just, M. (1994). Working memory constraints in comprehension: Evidence from individual differences, aphasia, and aging. In M. Gernsbacher (Ed.), *Handbook of Psycholinguistics* (pp. 1075–1122). San Diego, CA: Academic Press.
- Chien, Y.-C., & Wexler, K. (1990). Children's knowledge of locality conditions in binding as evidence for the modularity of syntax and pragmatics. *Language Acquisition* 1(3), 225–295.
- Choe, J. (2011). What seems to be real may be illusory: Acquisition of raising with an experiencer. In N. Danis, K. Mesh, & H. Sung (Eds.), *Proceedings of the 35th Annual Boston University Conference on Language Development (BUCLD)* (pp. 110–118). Somerville, MA: Cascadilla Press.
- Choe, J. (2012, April). *Acquisition of Raising: Intervention effects in A-movement*. Paper presented at the 48th Annual Meeting of the Chicago Linguistic Society (CLS), Chicago, IL.
- Chomsky, C. (1969). *The acquisition of syntax in children from 5 to 10*. Cambridge, MA: MIT Press.

- Chomsky, N. (1981). *Lectures on government and binding*. Dordrecht: Foris.
- Chomsky, N. (1995). *The minimalist program*. Cambridge, MA: MIT Press.
- Chomsky, N. (2000). Minimalist inquiries: The framework. In R. Martin, D. Michaels, & J. Uriagereka (Eds.), *Step by step: Essays on minimalist syntax in honor of Howard Lasnik* (pp. 89–155). Cambridge, MA: MIT Press.
- Chomsky, N. (2001). Derivation by phase. In M. Kenstowicz (Ed.), *Ken Hale: A life in language* (pp. 1–52). Cambridge, MA: MIT Press.
- Chung, S. (1978). *Case marking and grammatical relations in Polynesian*. Austin, TX: University of Texas Press.
- Clark, H. H., & Haviland, S. E. (1977). Comprehension and the given-new contract. In R. O. Freedle (Ed.), *Discourse production and comprehension* (pp. 1–40). Norwood, NJ: Ablex.
- Collins, C. (2005a). A smuggling approach to raising in English. *Linguistic Inquiry*, 36(2), 289–298.
- Collins, C. (2005b). A smuggling approach to the passive in English. *Syntax*, 8, 81–120.
- Conroy, A., Takahashi, E., Lidz, J., & Phillips, C. (2009). Equal treatment for all antecedents: How children succeed with Principle B. *Linguistic Inquiry*, 40(3), 446–486.
- Contreras, H. (1987). Small clauses in English and Spanish. *Natural Language and Linguistics Theory* 5(2), 225–243.
- Córrea, L. M. (1995). An alternative assessment of children's comprehension of relative clauses. *Journal of Psycholinguistic Research*, 24, 183–203.

- Crain, S., & McKee, C. (1985). The acquisition of structural restrictions on anaphora. In S. Berman, J.-W. Choe, & J. McDonough (Eds.), *Proceedings of the 16th Annual Meeting of the North East Linguistic Society (NELS)* (pp. 94–110). Amherst, MA: GLSA Publications.
- Crain, S., & Thornton, R. (1998). *Investigations in Universal Grammar: A guide to experiments in the acquisition of syntax and semantics*. Cambridge, MA: MIT Press.
- de Vincenzi, M., Arduino, L. S., Ciccarelli, L., & Job, R. (1999). Parsing strategies in children comprehension of interrogative sentences. In S. Bagnara (Ed.), *Proceedings of European Conference on Cognitive Science* (pp. 301–308). Rome: Istituto di Psicologia del CNR.
- Deprez, V. (1992). Raising constructions in Haitian Creole. *Natural Language and Linguistic Theory*, 10, 191–232.
- Diessel, H., & Tomasello, M. (2005). A new look at the acquisition of relative clauses. *Language*, 81, 882–906.
- Elbourne, P. (2005). On the acquisition of Principle B. *Linguistic Inquiry*, 36(3), 333–365.
- Epstein, S. D., Groat, E. M., Kawashima, R., & Kitahara, H. (1998). *A derivational approach to syntactic relations*. Oxford: Oxford University Press.
- Friedmann, N., Belletti, A., & Rizzi, L. (2009). Relativized relatives: Types of intervention in the acquisition of A-bar dependencies. *Lingua*, 119, 67–88.
- Friedmann, N., & Costa, J. (2010). The child heard a coordinated sentence and wondered: On children's difficulty in understanding coordination and relative clauses with crossing dependencies. *Lingua*, 120(6), 1502–1515.

- Friedmann, N., & Lavi, H. (2006). On the order of acquisition of A-movement, Wh-movement and V-C movement. In A. Belletti, E. Bennati, C. Chesi, E. Di Domenico, & I. Ferrari (Eds.), *Language acquisition and development* (pp. 211–217). Cambridge, UK: Cambridge Scholars Press/CSP.
- Friedmann, N., & Novogrodsky, R. (2004). The acquisition of relative clause comprehension in Hebrew: A study of SLI and normal development. *Journal of Child Language*, 31, 661–681.
- Friedmann, N., Novogrodsky, R., & Balaban, N. (2010). The effect of crossing dependencies on the acquisition of pronoun comprehension. In J. Costa, A. Castro, M. Lobo, & F. Pratas (Eds.), *Proceedings of GALA 2009 (Generative Approaches to Language Acquisition)* (pp. 146–156). Cambridge, UK: Cambridge Scholars Press.
- Fujii, T. (2005). Cycle, linearization of chains, and multiple case checking. In S. Blaho, L. Vicente, & E. Schoorlemmer. (Eds.), *Proceedings of Console XIII* (pp. 39–65). Student Organization of Linguistics in Europe, University of Leiden.
- Garnham, A. (2000). *Mental models and the interpretation of anaphora*. East Sussex: Psychology Press.
- Gibson, E. (1998). Linguistic complexity: Locality of syntactic dependencies. *Cognition*, 68(1), 1–76.
- Gibson, E. (2000). The dependency locality theory: A distance-based theory of linguistic complexity. In Y. Miyashita, A. Marantz, & W. O’Neil (Eds.), *Image, language, brain* (pp. 95–126). Cambridge, MA: MIT Press.

- Gordon, P. C., Grosz, B. J., & Gilliom, L. A. (1993). Pronouns, names, and the centering of attention in discourse. *Cognitive Science*, 17, 311–347.
- Gordon, P. C., Hendrick, R., & Johnson, M. (2001). Memory interference during language processing. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 27, 1411–1423.
- Gordon, P. C., Hendrick, R., & Johnson, M. (2004). Effects of noun phrase type on sentence complexity. *Journal of Memory and Language*, 51, 97–114.
- Gordon, P. C., Hendrick, R., & Levine, W. H. (2002). Memory load interference in syntactic processing. *Psychological Science*, 13, 425–430.
- Grodzinsky, Y., & Reinhart, T. (1993). The innateness of binding and coreference. *Linguistic Inquiry*, 24(1), 69–101.
- Gundel, J., Hedberg, H., & Zacharski, R. (1993). Referring expressions in discourse. *Language*, 69, 274–307.
- Hamburger, H., & Crain, S. (1982). Relative acquisition. In S. Kuczaj (Ed.), *Language development, Vol. 1: Syntax and semantics* (pp. 245–274). Hillsdale, NJ: Erlbaum.
- Heim, I. (1982). *The semantics of definite and indefinite noun phrases* (Doctoral dissertation). University of Massachusetts, Amherst, MA.
- Hirsch, C. (2011). *The acquisition of raising* (Doctoral dissertation). Massachusetts Institute of Technology, Cambridge, MA.
- Hirsch, C., Orfitelli, R., & Wexler, K. (2007). When seem means think: The role of the experiencer-phrase in children’s comprehension of raising. In A. Belikova, L. Meroni, & M. Umeda (Eds.), *Proceedings of the 2nd Conference on Generative*

- Approaches to Language Acquisition North America (GALANA)* (pp. 135–146).
Somerville, MA: Cascadilla Proceedings Project.
- Hirsch, C., Orfitelli, R., & Wexler, K. (2008). The acquisition of raising reconsidered. In A. Gavarro, & M. J. Freitas (Eds.), *Proceedings of GALA 2007 (Generative Approaches to Language Acquisition)* (pp. 253–262). Cambridge, UK: Cambridge Scholars Press.
- Hirsch, C., & Wexler, K. (2007). The late acquisition of raising: What children seem to think about seem. In S. Dubinsky, & B. Davies (Eds.), *New horizons in the analysis of control and raising* (pp. 35–70). New York, NY: Springer.
- Hyams, N., & Snyder, W. (2005, November). *Young children never smuggle: Reflexive clitics and the universal freezing hypothesis*. Paper presented at the 30th Annual Boston University Conference on Language Development (BUCLD), Boston, MA.
- Jakubowicz, C. (1984). On markedness and binding principles. In C. Jones, & P. Sells (Eds.), *Proceedings of the 14th Annual Meeting of the North East Linguistic Society (NELS)* (pp. 154–182). Amherst, MA: GLSA Publications.
- Joseph, B. D. (1976). Raising in Modern Greek: A copying process. In J. Hankamer, & J. Aissen (Eds.), *Harvard Studies in Syntax and Semantics, vol. 2* (pp. 241–281). Cambridge, MA: Harvard University, Department of Linguistics.
- Kidd, E., & Bavin, E. L. (2002). English-speaking children's comprehension of relative clauses: Evidence for general-cognitive and language-specific constraints on development. *Journal of Psycholinguistic Research, 31*, 599–617.

- Kidd, E., Brandt, S., Lieven, E., & Tomasello, M. (2007). Object relatives made easy: A cross-linguistic comparison of the constraints influencing young children's processing of relative clauses. *Language and Cognitive Processes*, 22, 860–897.
- Kintsch, W. (1988). The role of knowledge in discourse comprehension: A construction-integration model. *Psychological Review*, 65, 163–182.
- Kirby, S. (2009). *Semantic scaffolding in first language acquisition: The acquisition of raising-to-object and object control* (Doctoral Dissertation). University of North Carolina at Chapel Hill, Chapel Hill, NC.
- Kitagawa, Y. (1986). *Subjects in English and Japanese*. (Doctoral dissertation). University of Massachusetts, Amherst, MA.
- Kitahara, H. (1997). *Elementary operations and optimal derivations*. Cambridge, MA: MIT Press.
- Koopman, H., & Sportiche, D. (1991). The position of subjects. *Lingua*, 85, 211–258.
- Kuroda, S.-Y. (1988). Whether we agree or not: A comparative syntax of English and Japanese. In W. J. Poser (Ed.), *Papers from the Second International Workshop on Japanese Syntax* (pp. 103–144). Stanford, CA: CSLI.
- Landau, I. (2009). This construction looks like a copy is optional. *Linguistic Inquiry*, 40(2), 343–346.
- Landau, I. (2011). Predication vs. aboutness in copy raising. *Natural Language and Linguistic Theory*, 29(3), 779–813.
- Lappin, S. (1984). Predication and raising. In C. Jones, & P. Sells (Eds.), *Proceedings of the 14th Annual Meeting of the North East Linguistic Society (NELS)* (pp. 236–252). Amherst, MA: GLSA Publications.

- Lewis, R. L. (1996). Interference in short term memory: The magical number two (or three) in sentence processing. *Journal of Psycholinguistic Research*, 25, 93–117.
- MacDonald, M., & Christiansen, M. (2002). Reassessing working memory: A comment on Just & Carpenter (1992) and Waters & Caplan (1996). *Psychological Review*, 109, 35–54.
- MacWhinney, B. (2000). *The CHILDES Project: Tools for analyzing talk. Third Edition*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Mak, W. M., Vonk, W., & Schriefers, H. (2002). The influence of animacy on relative clause processing. *Journal of Memory and Language*, 47, 50–68.
- Mak, W. M., Vonk, W., & Schriefers, H. (2006). Animacy in processing relative clauses: The hiker that rocks crush. *Journal of Memory and Language*, 54, 466–490.
- McCloskey, J., & Sells, P. (1988). Control and A-chains in Modern Irish. *Natural Language and Linguistics Theory*, 6, 143–189.
- McGinnis, M. (1998). Locality and inert case. In P. Tamanji, & K. Kusumoto (Eds.), *Proceedings of the 28th Annual Meeting of the North East Linguistic Society (NELS)* (pp. 267–281). Amherst, MA: GLSA Publications.
- McKee, C., McDaniel, D., & Snedeker, J. (1998). Relatives children say. *Journal of Psycholinguistic research*, 27, 573–596.
- Moore, J. (1998). Turkish copy-raising and A-chain locality. *Natural Language and Linguistic Theory*, 16, 149–189.
- Müller, G. (1998). *Incomplete category fronting*. Dordrecht: Kluwer.
- O'Brien, K., Grolla, E., & Lillo-Martin, D. (2006). Long passives are understood by young children. In D. Bamman, T. Magnitskaia, & C. Zaller (Eds.), *Proceedings*

- of the 30th Annual Boston University Conference on Language Development (BUCLD) (pp. 441–451). Somerville, MA: Cascadilla Press.
- Orfitelli, R. (2012). *Argument intervention in the acquisition of A-movement* (Doctoral dissertation). University of California, Los Angeles, Los Angeles, CA.
- Perlmutter, D. M., & Soames, S. (1979). *Syntactic argumentation and the structure of English*. Berkeley, CA: University of California Press.
- Pierce, A. (1992). *Language acquisition and syntactic theory: A comparative analysis of French and English child grammars*. Dordrecht: Kluwer.
- Poeppel, D., & Wexler, K. (1993). The full competence hypothesis of clause structure in early German. *Language*, 69, 1–33.
- Postal, P. (1974). *On raising*. Cambridge, MA: MIT Press.
- Potsdam, E., & Runner, J. (2001). Richard returns: Copy raising and its implications. In M. Andronis, C. Ball, H. Elston, & S. Neuvel (Eds.), *Proceedings of the 37th Regional Meeting of the Chicago Linguistic Society (CLS)* (pp. 453–468). Chicago, IL: Chicago Linguistic Society.
- Real, F., & Christiansen, M. (2007). Processing of relative clauses is made easier by frequency of occurrence. *Journal of Memory and Language*, 57, 1–23.
- Rizzi, L. (1990). *Relativized Minimality*. Cambridge, MA: MIT Press.
- Rizzi, L. (2004). Locality and left periphery. In A. Belletti (Ed.), *Structures and beyond: The cartography of syntactic structures, Vol. 3* (pp. 223–251), New York: Oxford University Press.
- Rogers, A. (1971). Three kinds of physical perception verbs. In D. Adams, M. A. Campbell, V. Cohen, J. Lovins, E. Maxwell, C. Nygren, & J. Reighard (Eds.),

- Papers from the seventh regional meeting of the Chicago Linguistic Society* (pp. 206–222). Chicago, IL: Chicago Linguistic Society.
- Snyder, W., & Hyams, N. (2008, September). Children's passives: The role of discourse features. Paper presented in the Psycholinguistics Brownbag Series, University of Connecticut, Storrs, CT.
- Song, H., & Fisher, C. (2005). Who's 'she'? Discourse prominence influences preschoolers' comprehension of pronouns. *Journal of Memory and Language*, 52, 29–57.
- Song, H., & Fisher, C. (2007). Discourse prominence effects on 2.5-year-old children's interpretation of pronouns. *Lingua*, 117, 1959–1987.
- Speas, M. (1986). *Adjunctions and projections in syntax* (Doctoral dissertation). Massachusetts Institute of Technology, Cambridge, MA.
- Spenader, J., Smits, E. J., & Hendriks, P. (2009). Coherent discourse solves the pronoun interpretation problem. *Journal of Child Language*, 36, 23–52.
- Stromswold, K. (1996, November). *Does the VP-internal subject stage really exist?* Paper presented at the 21st Annual Boston University Conference on Language Development (BUCLD), Boston, MA.
- Tanenhaus, M. K., Spivey-Knowlton, M. J., Eberhard, K. M., & Sedivy, J. C. (1995). Integration of visual and linguistic information in spoken language comprehension. *Science*, 268, 1632–1634.
- Tavakolian, S. L. (1981). The conjoined-clause analysis of relative clauses. In S. L. Tavakolian (Ed.), *Language acquisition and linguistic theory* (pp. 167–187). Cambridge, MA: MIT Press.

- Traxler, M. J., Morris, R. K., & Seely, R. E. (2002). Processing subject and object relative clauses: Evidence from eye movements. *Journal of Memory and Language*, 47, 69–90.
- Traxler, M. J., Williams, R. S., Blozis, S. A., & Morris, R. K. (2005). Working memory, animacy and verb class in the processing of relative clauses. *Journal of Memory and Language*, 53, 204–224.
- Ura, H. (1998). Checking, economy, and copy-raising in Igbo. *Linguistic Analysis*, 28, 67–88.
- Valian, V. (1991). Syntactic subjects in the early speech of American and Italian children. *Cognition*, 40, 21–81.
- Wanner, E., & Maratsos, M. (1978). An ATN approach to comprehension. In M. Halle, J. Bresnan, & G. Miller (Eds.), *Linguistic theory and psychological reality* (pp. 119–161). Cambridge, MA: MIT Press.
- Warren, T., & Gibson, E. (2002). The influence of referential processing on sentence complexity. *Cognition*, 85, 79–112.
- Wexler, K. (2004). Theory of phasal development: Perfection in child grammar. *MIT Working Papers in Linguistics* 48, 159–209.
- Zagona, K. (1988). *Verb phrase syntax: A parametric study of English and Spanish*. Dordrecht: Kluwer Academic Publishers.