Semantic scaffolding in first language acquisition: The acquisition of raising-to-object and object control

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Abstract

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(Under the direction of Misha Becker)

This dissertation joins the debates on whether language is innate and/or modular, by examining English-speaking children's acquisition of raising-to-object (RO; (1)) and object control (OC; (2)) utterances.

1. RO: Suki wanted/needed Neil$_i$ [t_i to kiss Louise]

2. OC: Suki asked/told Neil$_i$ [PRO$_i$ to kiss Louise]

While these verbs may appear in the same surface string, they map onto two distinct underlying structures. As a result, they differ in their syntactic and semantic behaviors, including the interpretation of embedded passives, and whether the subject of the embedded clause may be expletive or inanimate.

Several truth-value and sentence judgment tasks yielded the following results:

- Children have adultlike comprehension of active RO/OC utterances by age 4.

- Children who fail on tests of matrix passives can interpret passives embedded under RO verbs (despite their greater length and syntactic complexity), but not under OC verbs (which have syntax more like matrix passives).

- In sentence judgment tasks, children preferentially parse the embedded clause alone.

To account for these patterns, I offer the *semantic scaffolding hypothesis*, which comprises two major proposals: (a) children assume a canonical alignment of thematic and grammatical roles, resulting in agent-subjects and patient-objects, and (b) children assume a default clausal shape of contiguous subject and predicate. I argue that children use semantic scaffolding as a stepping stone on their way to adultlike syntactic and processing power. In short, movement may be easier than control structures, if these assumptions are not violated.

Moreover, the fact that children do maintain a distinction between the verb classes is evidence for innateness and modularity in language. However, the language module interacts crucially with other cognitive modules (e.g., the conceptual-semantic system) and with domain-general faculties (e.g., attention, memory).

Finally, the results presented here also bear on the following issues:

- There is no evidence for maturation of A-chains and/or control, contra Wexler (e.g., 1992, 2004).

- Children's performance on active RO, passives, and embedded passives suggest that RO utterances should instead be analyzed as instances of "exceptional case marking."

- The data can neither support nor refute Hornstein's (1999) proposal that RO and OC both be analyzed as instances of movement.

To Saint Jude, who I know must have been here, for me to finish it.

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▽

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It always works out okay in the end.

If it's not okay, it's not the end.

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Chapter 1

Introduction

1.1 Innateness and Modularity

One of the fundamental issues in child language acquisition and cognitive development at large is the extent to which language is "special." Researchers take strong positions in the argument over the possible innateness and/or modularity of the language facility, and struggle to discern which pieces of language are domain-specific and which domain-general.

At one end of this spectrum are the nativists, who believe that development is largely independent of interaction with the world. Nativist linguists[1] (e.g., Chomsky, 1959; Bickerton, 1984; Hyams, 1986; Behrend, 1990, among many others) believe in an innate language module,[2] containing the blueprints of Universal Grammar (UG). At the very least, UG is thought to constrain the child's hypotheses about the multiple, but finite, possible shapes a human language can take; however, UG may even comprise

[1] I would like to state clearly for the record that the nativist/empiricist dichotomy I am posing is a radical simplification of the theoretical landscape; even the most staunch proponents of an innate language-specific module will not deny that some interaction with the world is necessary (for instance, a child born into a Swahili-speaking family will not spontaneously acquire Cherokee), and even the loudest empiricists must still accept the existence of some innate tendencies or abilities (for instance, attention, memory, a social drive, etc.). That being said, it is useful to abstract away from the finer theoretical details in order to introduce the debate. For a nice (and concise) introduction to the issue—though, to be fair, one which is obviously biased towards nativism—see Spelke (1998).

[2] Though the issues of innateness and modularity are in fact orthogonal, there is a strong tendency towards correlation between them in theoretical belief; many who believe in domain-specificity also believe in an innately endowed language facility, and, *mutatis mutandis*, many who believe that language arises as a result of domain-general abilities also assume that this occurs as a result of children's interaction with the environment.

default "settings" (i.e., parameters; Hyams, 1986) for the different principles on which languages may differ. Language "acquisition," then, is actually a matter of the input allowing UG to expand naturally, in just the same way any other biological system develops.

At the other end of the spectrum are the empiricists, who believe that language acquisition is largely dependent on interaction with the world. For empiricist linguists (e.g., Tomasello and Farrar, 1986; Nelson, 1988; Tomasello, 1992; Samuelson and Smith, 1998—again, among others), language is simply one more use to which we can put a diverse and intelligent "generalist" brain.[3] That is to say, language does not comprise its own module, but instead simply arises as an epiphenomenon of other cognitive abilities. Since there is no such thing as a language domain, *per se*, no piece of language can be innate.[4] Instead, the human brain—with its extreme facility for learning, and a strong desire to communicate—draws conclusions from the input (and perhaps especially from caretaker guidance), resulting in the child's ultimately coming to share the communicative system of the greater social group.

As with any issue of great theoretical import, there are many versions of each side of the debate, which differ to a greater or smaller extent on the exact details of the account. Moreover, there are many other points along the nativism/empiricism spectrum which accept aspects of the proposals from each of the camps in varying proportions (for instance, see Fodor, 1983, as well as the general caveat in Footnote 1 above).

How is it possible to test the contrasting claims of the two camps? One way to do so would be to search for evidence of elements that are peculiar to language alone,

[3]An even more extreme version of this position would be Skinner (1957), who espoused a completely behaviorist view of language learning. Under this view, the entirety of language (from its earliest stages in acquisition, to its use by adult speakers) arises as response to stimulus. Although I do not know of any researcher currently advocating this theory in its strong form, it might be argued that there are elements of behaviorism in current-day connectionist (neural network) models of language. For example, see Rumelhart and McClelland (1986) or Dawson (1998).

[4]Although some of the cognitive abilities whose interactions are hypothesized to result in language—for instance, memory, attention, a social drive, and so on—may themselves be innate.

rather than just domain-general mechanisms functioning in the service of language. Even more decisive would be evidence for language-specific mechanisms which are not open to observation in the child's input; the indication that any such elements exist would weigh strongly on the sides of nativism as well as modularity.

Luckily for the debate, such language-specific units do exist, in the forms of NP-trace[5] (*t*) and PRO. Moreover, these two items cannot possibly be learned simply on the basis of attending to the input, since they are silent (that is, phonologically null).

As a result, if we could find evidence to support the hypothesis that young children treat structures which contain *t* and PRO differently, in terms of linguistic behavior, then we would have solid evidence for language-specific architecture as well as for innateness. On the other hand, if children appear to conflate utterances containing these contrasting elements in their linguistic behavior, we would lack the evidence necessary to support the nativist and modularity hypotheses.

One pair of constructions which differ in whether they contain *t* or PRO are raising-to-object (RO) and object control (OC) constructions, seen in (1). These utterance types may share an identical surface string, but they differ in their underlying syntax: specifically, RO utterances contain a silent *t* as the subject in the embedded clause, while OC utterances contain a silent PRO in this position.

(1) RO: Suki believed/expected Neil$_i$ [t_i to make coffee]

OC: Suki allowed/persuaded Neil$_k$ [PRO$_k$ to make coffee]

As a result of this distinction in underlying syntax, RO and OC verbs may appear in some, but crucially not all, of the same syntactic and semantic environments. Thus, RO and OC provide the necessary linguistic environments to allow us to check for evidence of language-specific behavior that could only be the result of an innate endowment of

[5] Throughout the rest of this paper, I will generally refer to NP-trace simply as "trace"; this is not to ignore the fact that wh-trace also exists. In addition, I will be somewhat lax in using the terms *NP* and *DP* more or less interchangeably. Though I do subscribe to a DP analysis of all NPs, the essence of the points made should hold, regardless of the theoretical stance. Furthermore, using the term *NP* here will, in many cases, allow consistence with much of the literature I will reference.

linguistic knowledge. The goal of this dissertation in its largest context is to comment on the theoretical debate about innateness and modularity by attempting to characterize the path children take in their acquisition of RO and OC verbs—abstract verbs which share a surface string but diverge in their underlying syntax.

1.1.1 A Note on Theoretical Stance

Both my design and analysis of this project will depend strongly on the notions of *t* and PRO—theoretical constructs which are not universally accepted. However, while my arguments for innateness here might be less convincing to those who do not accept the existence of these elements (or something like them), the learning challenges posed by the constructions under consideration still stand.

First, it should be uncontroversial that there are long-distance semantic dependencies between lexical items in raising and control constructions, and that these dependencies cannot be directly observed from the surface string. It is precisely these relationships which generative linguists usually represent with the elements *t* and PRO. But regardless of theoretical approach, any account of language development will have to propose a mechanism by which children are able to acquire verb classes whose syntax relies crucially on these invisible dependencies. The ability to do so points strongly in the direction of domain-specificity, as it is not immediately clear how the ability to represent long-distance semantic dependencies between lexical items could arise from general cognitive mechanisms utilized in other areas. Moreover, since the existence of these dependencies is not directly observable in (and therefore cannot be learned from) the input, evidence that children respect such semantic structure would strongly support the notion that the ability to do so is innate.

A related issue is my proposal that the acquisition of biclausal constructions like RO and OC should be more difficult than that of monoclausal constructions such as simple transitives. Simple transitive utterances have a highly transparent θ-structure and a one-to-one correspondence between surface string and underlying syntax,[6] while biclausal RO and OC utterances have no such thematic transparence or correspondence. It is for these reasons that the acquisition of such verbs should be of great interest to all developmental psycholinguists.

1.2 RO and OC in the Context of Acquisition of the Verb Lexicon

The question of how children treat RO and OC constructions is not only interesting for the light it might shed on debates regarding innateness and modularity, but also for the special case it represents in terms of lexical acquisition, and in particular, the acquisition of verbs. One of the enduring questions in child language research is how children assimilate the complex semantic and syntactic knowledge related to a single lexical entry. For instance, to have adultlike knowledge about a particular verb, a child must know the denotation and connotation of the verb as well as the verb's semantic and syntactic subcategorization requirements. To give a concrete example, a child must learn that the verb *wonder* means something like *to ponder* or *to ask oneself*, and that it usually requires a clausal complement beginning with the complementizer *if* or *whether*. Potentially, such mental-state verbs like *wonder*, whose occurrences are not subject to observation, will pose more of a problem for learners than easily observable, agentive verbs with a visible and distinct end-state, such as *break* or *melt*.[7]

Some verbs pose an even more difficult learning problem: namely, those verbs which, like RO and OC, require silent syntax in the form of *t* or PRO. These verbs are more complicated than the agentive verbs just mentioned in a number of ways. First, raising verbs like *seem* or *expect*, which co-occur with *t*, and control verbs like *try* or *persuade*, which require PRO, usually take multiclausal frames. Moreover, the semantics

[6]Here I am leaving aside the potential problem of null argument languages. Such languages do present a significant learning puzzle, but the issue is clearly outside the scope of this project.

[7]This relative difficulty would be expected if the primary cues to lexical meanings come from watching events. On the other hand, if the primary cues come from the syntactic frames in which these verbs appear, the mental-state verbs could prove easier for the child. See below for more on syntactic bootstrapping and "unobservable" verbs.

of these verbs is often more opaque than those of single-clause, change-of-state verbs like *break*, or even agentive intransitive verbs like *run*. Finally—and perhaps most obviously—in the case of RO and OC, children must take an ambiguous string (e.g., *Suki gorped Neil to make coffee*), identify the necessary silent subject in an embedded clause (either t or PRO), and link that empty element with its range of syntactic behaviors. The silent subject in an embedded clause has wide-reaching effects in terms of how that sentence may behave, both syntactically and semantically, as I will discuss in detail in the coming chapters. Importantly, though, the particular silent element involved in such an utterance distinguishes constructions that on the surface might appear to be syntactically identical.

Let us consider the cases of RO and OC verbs in somewhat greater depth. RO verbs like *want* and *need* and OC verbs like *ask* and *tell* may appear in some contexts which—at first glance—would suggest that they have similar subcategorization properties, as in (2).

(2) Neil wanted/needed/asked/told Louise to feed Karl

However, these surface forms belie the verbs' distinct silent syntax. The subject in the embedded complement clause of an RO verb is generated in the lower clause but raises into matrix object position, leaving a coreferential trace behind (3a), while the object complement of an OC verb is generated in that higher position and coreferential with a PRO generated at D-structure in the lower clause (3b).

(3) a. Neil wanted/needed Louise$_i$ [t_i to feed Karl] (RO)

b. Neil asked/told Louise$_i$ [PRO$_i$ to feed Karl] (OC)

The occurrence of t versus PRO in a sentence has serious effects on how that sentence may behave. To give just two examples of these effects, consider the fact that RO verbs like *want* or *need* may grammatically embed sentences containing either expletive or inanimate subjects (4a), while OC verbs like *ask* and *tell* may not (4b).

(4) a. Neil wanted/needed [there to be more coffee/the steak to be rare]

b. * Neil asked/told [there to be more coffee/the steak to be rare]

The question then arises, how does the child come to have knowledge of the syntax which constrains RO and OC utterances? How does the child assimilate the various pieces of the lexical entry, and then incorporate the given verb into its appropriate syntactic environments, including the necessary silent syntax? And specifically, how is the child able to do this, considering the fact that what is perhaps the single most informative part of the syntax *is*, in fact, silent?

There seem to be two distinct logical possibilities here, neither of which by necessity precludes a learning trajectory that is guided at each step of the way by UG.

First, the child may learn in a way that is akin to "one-stop shopping" or "one fell swoop" acquisition. That is, the child could learn (or, indeed, come to the acquisition task with the innate knowledge) that there are two silent elements—*t* and PRO—and that they function differently. Once the child understands the distinction between these two elements, the child should use each correctly: for instance, not inappropriately embedding an expletive or an inanimate subject under an OC verb, but allowing such subjects under a RO verb. In short, under this hypothesis, if the child is able to use the silent syntax correctly *anywhere*, they should be able to correctly use it *everywhere*; in some ways, this strategy would be the lexical counterpart to the type of parameter setting posited by Hyams (1986). Moreover, this style of learning would suggest that, once a child had built up a representation of RO or OC verbs as an independent class, assigning a particular verb to one class or the other would allow the child to attach all the constraints of that class to the verb, without having to resort to lexically-driven learning. I will refer to this learning style as *top-down learning*.

The second possibility is that the child may slowly build up representations of how RO and OC verbs behave as a function of their appearances in the input. On this more "piecemeal" account, children would learn each of the constraints guiding RO and OC verbs on a case-by-case basis: first, whether they may occur with embedded expletive subjects, then whether they may embed inanimate subjects, and so on. The learning could in fact be so very case-by-case that it is rather like lexical learning. That is, rather than building representations of *classes* of verbs, the child may learn how each verb functions as an independent player (although this need not be the case). In general, though, given this learning strategy, the child may be able to use any given RO or OC verb correctly in a subset of its possible adultlike environments while still lacking adultlike knowledge of the verb's full range of behaviors. I will refer to this type of learning as *bottom-up learning*.[8]

Notice that the two hypotheses about how such complex learning takes place make different predictions about the trajectory that learning will take, as intimated above. Top-down learning predicts that, once a child has assigned a particular verb to a class (either RO or OC), all the characteristic requirements and constraints of the verb class should "trickle down" to that particular lexical entry, allowing the child to use the verb correctly in all of its possible contexts. As suggested above, this predicts a sort of "if anywhere, then everywhere" pattern of adultlike performance. In contrast, bottom-up learning predicts that adultlike knowledge of a verb's syntactic behavior may be assembled bit by bit, resulting in the child showing adultlike performance on some verbs and in some contexts before others. Adultlike performance on a given verb or on a given semantic or syntactic context which appears earlier in development may be positively correlated with that verb's or that construction's frequency of appearance in the input.

It is important to note again, however, that this bottom-up learning strategy does not preclude the notion of UG-guided acquisition. It is possible that each step along the path towards adultlike knowledge is not random and haphazard, but instead constrained and guided by an innate and domain-specific language module. In fact,

[8] It is possible to take this conclusion to extremes. For instance, under this second hypothesis, *t* and PRO could be assumed not to have any psychological reality for speakers apart from the epiphenomenon of the sum of their behaviors. However, such an assumption is not necessarily an inevitable extension of the bottom-up approach.

evidence supporting the notion of a bottom-up learning strategy which is able to assemble the necessary information comprised in adult knowledge of a language by selectively "filtering" the input might be a more impressive version of UG than a learning mechanism which is simply activated by exposure to a single instance of "triggering data" (à la Hyams, 1986).

Thus, the issue of these contrasting possible learning mechanisms for language is of importance not only to the field of linguistics, but to any area of cognitive or conceptual development involving complex and multi-faceted knowledge.

As a field, we still know so little about verb learning as a component of the language instinct (if indeed such does exist) at large. This dissertation is my hopeful contribution towards rectifying that dearth of knowledge in some small way. To date, the verb learning literature has focused strongly on monoclausal structures, and little is known about the acquisition of verbs like RO and OC that take multiclausal frames. The case of RO and OC is also of interest for other reasons, too: the meanings of these verbs are fairly abstract and/or unobservable, and unlike verbs that appear in single clauses, the underlying structure of these utterances is ambiguous, given the surface string. In short, the distinction between RO and OC is quite opaque to a learner hoping to find a way into the syntax. How, then, do children assemble the lexical-semantic and syntactic information for these verbs?

The acquisition of RO has not been examined at all, and while OC has been extensively discussed in the literature, it has not been examined with this learning challenge in mind. Because the syntax of these constructions is indeed so complex, it is possible that children, who have limited processing resources, may initially capitalize on the syntax-semantics interface, using a strategy for interpretation which is not entirely syntax-internal. As such, I hypothesized that on their way to adultlike knowledge of these verbs, children may rely on the semantics of the RO or OC utterance in their interpretation and assessment of the construction as a whole. This hypothesis is borne out to a large extent in the data, as we shall see in the coming chapters.

1.3 The Agenda

Is language innate? To what extent can language be argued to comprise its own module? And how do children learn verbs? In this dissertation, I will attempt to provide some answers to these questions by describing a series of experiments designed to probe young children's nascent and burgeoning knowledge of RO and OC predicates. Ultimately, I will sketch a picture of children's verb learning which depends very crucially on innate knowledge—both linguistic and extralinguistic. Moreover, the picture that arises of language and cognition in development is one which points to the interaction of separately-functioning modules. As a result, this dissertation weighs very heavily on the sides of both innateness and modularity.

In Chapter 2, I will consider in greater detail the task of verb learning: both the difficulty of acquiring verbs in general, as well as the specific problems posed by verbs whose meanings are abstract and whose syntax may include silent elements. Here I will discuss and assess several theories which have been put forth to explain how children overcome these learning difficulties. In Chapter 3, I give an in-depth outline of the syntax of raising and control, as well as A-movement in general (of which raising is only one example), including syntactic controversies relating to these constructions, information about how these verbs pattern in adult speech, and what we currently know about them in child language acquisition. In Chapter 4, I present some results from an exploratory corpus study of spontaneous child and adult uses of the RO verbs *want* and *need*, the OC verbs *ask* and *tell*, and matrix passives, as found in the CHILDES database (MacWhinney, 2000). But spontaneous data is only so informative, especially as these constructions are fairly rare in children's production. As a result, in Chapter 5, I detail the first half of the experimental portion of the current research, including a series of truth-value judgment tasks with children, which examined the same verbs listed above. These tasks examine children's comprehension of basic active RO and OC utterances, their comprehension of matrix passives (as another example of A-movement), and their comprehension of passives embedded under RO and OC verbs. In Chapter 6, I begin to sketch my analysis of the experimental data, an account which I will term "semantic scaffolding" and which claims that in the absence of adultlike syntactic knowledge and/or processing power,[9] children draw on the semantics of an utterance (in a number of ways) to support their syntactic interpretation. I argue that in the results presented in Chapter 5, we see one component of semantic scaffolding: namely, that there is a default canonical alignment of thematic roles in natural language, one which biases children to expect agent-subjects and patient/theme-objects. In this Chapter, I will also have a fair amount to say about linguistic and non-linguistic cognition and how the structure of language—which itself constitutes a module—is cognitively sound. In Chapter 7, I present the results from the remainder of the experiments, including two sentence judgment tasks with child subjects and two with adults. These tasks probe both age groups for their semantic and syntactic restrictions on the embedded subject in RO and OC utterances. Chapter 8 fleshes out the picture of the semantic scaffolding hypothesis through an analysis of the data from this second set of experiments: here I propose that children approach the language learning task not only with innate expectations about thematic alignment, but also with the default assumption that the clause (i.e., *subject+predicate*) is the minimal parsing unit. Finally, in Chapter 10, I draw some conclusions—in particular, about what this work has to say on the questions of innateness and modularity in language, and about verb learning in acquisition—and make some suggestions for further directions in research.

[9] The "and/or" here is purposefully vague, as I suspect that the distinction drawn between syntactic knowledge and processing power may be a misleading one. In Section 10.3, I will discuss the possibility that "chunking," an observed tendency in working memory, may be a strategy used by adult speakers who have had sufficient experience with a given construction; if this proposal is correct, "processing power" may to a large extent correlate with syntactic knowledge (or syntactic experience). In fact, GORDON ET AL. (2002) provide evidence indicating that syntactic processing and a memory-load task (i.e., remembering a list of NPs) both utilized the same memory function.

However, while both memory and syntactic processing power are necessary for language, the two are not completely identical. Future research should attempt to tease apart the relative contributions of each, in order to see whether a sharp dichotomy actually exists between the two. See 10.3 below for more thoughts on this issue.

My hope is that this dissertation will not only constitute academic progress in the struggle to understand how acquisition of syntax (in its relationship with the verb lexicon) proceeds, but will also act as a contribution to the greater field of cognitive science, which attempts to understand human cognitive development and adult cognition as a functioning whole, made up of many complex and interlocking parts.

Chapter 2

Learning Complex Verbs

2.1 The Task of Verb Learning

Crosslinguistically, children learn nouns first; this seems to be a fairly robust generalization regardless of native language (Gentner, 1982), and few studies have provided evidence to the contrary.[1] We have some general ideas about how this phenomenon might arise: Gentner's Natural Partitions Hypothesis postulates that because objects are easier to conceptualize than actions—they have delineable edges and are thus individuated, they persist through space and time, and exist independently of any event named by a verb—the words that label objects (viz. nouns) are themselves easier to learn. Furthermore, there appear to be some noun-learning constraints which, if not innate, arise quite early in acquisition to guide and shape the process (Markman, 1990, 1994).

However, a set of nouns does not a lexicon make. At some point, children must expand their lexical acquisition to include verbs, and as Gentner's Natural Partitions notes, verbs are comparatively much harder to learn.

Bowerman and Brown (2008) acknowledge that verbs are the core "glue" of clauses, and that learning how arguments are associated with verbs, both semantically and syntactically, is a major task in language acquisition. In short, "argument structure is seen as a critical interface between the lexical semantic properties of verbs and the morphosyntactic properties of the clauses in which they appear" (p. 1). How are children

[1] But for evidence that children acquiring "verb-friendly" languages may produce verbs before nouns, see, e.g., Gopnik and Choi (1995) for Korean and Dhillon (To appear) for Mandarin.

able to do this?

The acquisition of novel verbs is a complex task involving both the deduction of the lexical meaning of a given verb and the assimilation of its underlying syntactic structure; a full lexical entry for a verb will include not only its semantics, but also the syntactic frames in which the verb may grammatically occur. These two components of knowledge are interlocking puzzles, and for a given verb, the two pieces may be easier or more difficult to incorporate. For instance, when a verb has a concrete visible manifestation (e.g., *dance, hit*),[2] its meaning may be easy to surmise, since the meaning of the verb corresponds to an observable real-world result. Similarly, the number and arrangement of (overt) NP arguments in an utterance help reveal the verb's syntax to a language learner (e.g., 1-argument predicates like *dance* vs. 2-argument predicates like *hit* vs. 3-argument predicates like *give*).

The meaning and syntax of a particular verb are clearly related: for example, knowing what verbs like *seem* or *try* mean will allow a learner to reason whether the verb in question should appear with a semantic subject (*try*) or not (*seem*). These effects are related to the notions of the θ-Criterion and the Projection Principle, which—taken together—require that all and only the NPs which a verb subcategorizes for will show up in syntactic representation.

Exactly how children acquire all this knowledge, though, has proven to be a complicated question to answer. As a result, much of the verb learning literature to date has focused on monoclausal structures.

2.2 Theories of Learning: Syntactic Bootstrapping

The process of first language acquisition is a precipitous one; the more a learner already knows, the easier it is for her to learn even more. Researchers have some ideas about how a learner may exploit existing language knowledge (including knowledge that may come "prepackaged," as part of UG, or which is amassed over the course of early

[2]But Gleitman (1990) gives reasons why even these cases may be problematic for word-to-world mapping.

acquisition) and language input in order to "bootstrap" into the language and acquire new lexical items and/or structural knowledge.

Of special importance to the verb learning phenomenon is the *syntactic bootstrapping* hypothesis (Gleitman, 1990). This theory proposes that once children have aquired a substantial noun lexicon and enough linguistic knowledge to understand the semantics-to-syntax mapping rules, they may use the syntactic structure of a sentence to deduce the meaning of novel words. For instance, sentences with the structure NP-V-NP-PP (e.g., *Neil poured the coffee into the mug*) often denote "externally caused transfer or change of possessor of an object from place to place" (Gleitman, 1990, p. 30). These mapping rules may not need to be "learned" by the child: since these sorts of syntax/semantics relationships appear in all known languages, they could in fact comprise a part of UG. In fact, future research may provide more evidence for the notion that the θ-Criterion (or something like it) is an innate and universal component of language.

Indeed, home sign systems—in which a deaf child spontaneously creates her own signed language, with basically no input—lend credence to such a suggestion. Goldin-Meadow and colleagues have found that like spoken languages, home sign systems tend to use 1-place predicates for intransitives like *sleep*, 2-place predicates for transitives like *eat*, and 3-place predicates for change-of-possessor predicates like *give*, just as discussed above (Feldman et al., 1978; Goldin-Meadow and Mylander, 1984). Moreover, signers in different countries tend to place elements expressing like θ-roles in a consistent way across utterances, relative to other elements in the string; *ergo*, the semantics of the utterance is expressed (at least partially) via the syntax (Goldin-Meadow and Feldman, 1977; Feldman et al., 1978; Goldin-Meadow and Mylander, 1984, 1998). Such evidence suggests that two elements relating to the θ-Criterion—namely, the number of θ-roles assigned by a given predicate, as well as the tendency for a predicate to consistently assign a given θ-role to a particular argument—may be part of UG.

Adult language offers support for claims made in the syntactic bootstrapping literature. Fisher et al. (1991) tested the hypothesis that the closer the perceived meaning of two verbs, the greater the overlap should be in their allowable subcategorization frames, thereby assessing the extent to which syntax is predictive of semantics. To accomplish this, the authors asked English- and Italian-speaking adults to make judgments on semantic similarity and grammaticality. First, adults were asked to select the semantic "outlier"—that is, the one least similar in meaning to the other two—in a group of three verbs presented to them. The verbs used were 24 common verbs comprising a number of semantic categories, including motion verbs (e.g., *walk, stand*), location verbs (*balance, remain*), verbs of cognition (*think, believe*) and perception (*see, listen*), and "symmetrical" verbs (*collide, marry*). Then, adults judged the acceptability of these same verbs appearing in different subcategorization frames. The stimuli sentences varied on the spectrum of grammaticality (e.g., *Louise gave*, *Louise gave Neil*, *Louise gave Neil an espresso machine*), but were all semantically felicitous (i.e., *Louise gave an espresso machine to Neil* but not *Louise gave Neil to an espresso machine*).

The resulting data indicated a strong correlation between semantic content and subcategorization, thus supporting the hypothesis that syntax can be powerfully predictive of semantics, and vice versa.[3] Specifically, verbs that shared particular syntactic properties with regard to the range of frames in which they may appear in were also judged to be similar in meaning.[4] For instance, verbs which were judged to be grammatical in the frame *NP V PP* (e.g., *Neil Xed towards Louise*) all shared the semantic property of "position in or motion through space" (and, mutatis mutandis, verbs which shared that semantic property were judged to be grammatical in that frame). Likewise,

[3]It should be noted, however, that the reliability measure among subjects' judgments for some frames were higher than for other frames. I will return to this issue in Section 2.4 below.

[4]Related to this issue, Gropen et al. (1989) explore the learning problem posed by the dative alternation in English. Namely, while some verbs allow both prepositional dative and double-object frames (*Neil gave the steak to Louise/Neil gave Louise the steak*), others do not (*Neil donated the money to Louise/*Neil donated Louise the money*). The authors link this pattern to two constraints—one of which, importantly, is semantic. Subtle differences in meaning result in some verbs' ability to undergo this alternation, and the authors propose that children can ultimately deduce this syntax from semantics.

verbs that pertained to "perception and cognition" were judged to be grammatical in the frame *NP V SComp* (e.g., *Neil Xed that Louise was pretty*), and vice versa, and verbs that could appear in a "3-NP" frame (e.g., *Neil Xed Louise the espresso* or *Neil Xed the espresso to Louise*) related semantically to "(mental or physical) transfer" (e.g., *explain, give*, p. 358).[5]

The authors concluded that a verb's "meaning" is parceled out between the lexicon and the clausal structure, and they argue that the meaning components of a verb that are not discoverable via the extralinguistic context must be accessible to children via the syntax.

Furthermore, a growing body of evidence supports the idea that children themselves exploit the sentence frame in conjecturing the meaning of a novel verb. Naigles (1990) showed children ages 1;11–2;3 a video depicting two simultaneous actions (one causative, one noncausative) with an audio track containing a nonsense verb in either a transitive or an intransitive frame (*The duck is gorping the bunny* or *The duck and the bunny are gorping*, respectively). When given a choice of two videos, each containing only one of the previously simultaneous actions, and asked to find the referent of the verb (*Where's gorping now?*), children looked longer at the video that corresponded to the syntactic frame they had heard: children who had heard a transitive frame looked at the causative action, while those who had heard the intransitive frame looked at the noncausative action. This supports the notion that children conjecture meanings for novel verbs based on the syntactic frame in which those verbs appear.

Evidence also indicates that children make use of multiple syntactic frames in verb learning. Naigles (1996) showed 2-year-olds videos involving both contact and causation (e.g., a duck touches a frog, and the frog bends over) while playing an audio

[5]The authors do, however, note that these correspondences are not always perfect, and furthermore that some frames and semantic niches are more predictive than others. For instance, the verbs *crawl, run* and *jump* were judged to be in the same group as *throw, cut* and *fight*; however, while the latter may appear in the 3-NP frame, the former may not. Fisher et al. (1991, p. 358) refer to this verb cluster as a "semantic monster," but even monsters comprise a piece of the child's input, and therefore cannot be swept entirely under the rug. I return to this issue in Section 2.4 below.

recording of either causative (CS) alternation sentences (*The duck is sebbing the frog, The frog is sebbing*; cf. English 'sink') or omitted object (OO) alternation sentences (*The duck is sebbing the frog, The duck is sebbing*; cf. English 'dust'); a frameless condition (*Sebbing!*) and an intransitive-only condition (*The duck is sebbing*) were included as controls, to test children's baseline preference between the videos. Children then saw two videos (one showing only the contact action, and one showing only the caused motion) and were asked to find the referent of the verb. Naigles's results were somewhat complicated, in that all children (but especially boys) showed a strong preference for the causative actions, and in no condition did children look significantly longer at the contact action than the causative action. However, girls in the OO condition did *not* look significantly longer at the causative action than the contact action, indicating that—at least for girls, who (as Naigles notes) are generally regarded to be more linguistically sophisticated than their male agemates—the linguistic input seems to have (to some extent) overridden a strong initial preference for the "salience" of the causative action. Although these results are suggestive at best, Naigles concluded that this study provided the first experimental evidence that children can exploit the multiple frames in which a novel actional verb appears to deduce the meaning of that verb.[6]

A number of problems still surround the issue of syntactic bootstrapping. First, the syntactic bootstrapping research to date has focused on monoclausal utterances, and very little is known about the acquisition of verbs that take multiclausal frames. It is unclear if the findings presented above will generalize to the latter, or if new evidence will support the notion that children exploit distinct strategies for verbs which subcategorize for "longer" frames.

[6]These findings clearly support the idea that syntax can be exploited to deduce novel verb semantics. However, given the strong correlation between semantics and syntax found by Fisher et al. (1991), we should expect to see bidirectional influences of each on the other. Naigles (1988; reported in Naigles et al., 1993) did in fact find such evidence. When given a known verb in an ungrammatical verb frame (e.g., **The lion goes the zebra*), young children (2–4) show "frame compliance"; that is, they are willing to interpret the verb in a new way, based on the syntactic frame ('The lion causes the zebra to go'). Thus, young children may use the semantics of a known verb in a known (but novel for that verb) frame to forge a composite meaning based on the two.

But perhaps more importantly, an obvious challenge to the strategy itself is the fact that verbs with very distinct meanings can appear in the same syntactic frame (*Suki wrote/mailed/read/burned the letter*);[7] as a response, Fisher et al. (1991) (and to some extent, Gleitman, 1990) maintain (quite strongly, at some turns) that attending to the *range* of subcategorization frames in which a particular verb may appear will allow the child to home in on a fairly specific and refined meaning for a verb; thus, the syntax-semantics correspondences mark not just the divisions between, but also within, broad semantic domains. On the other hand, the authors also admit that there are limitations to the extent and types of meaning that syntactic frames can carry: specifically, the information in verb frames is limited to "properties that (a) affect the argument structure, (b) are domain general (i.e., show up all through the lexicon), and (c) are closed to observation" (Gleitman, 1990, p. 35). Thus, we should

> keep in mind that the syntax is not going to give the learner information delicate and specific enough, for example, to distinguish among such semantically close items as *break, tear, shatter*, and *crumble*... Luckily, these distinctions are almost surely of the kinds that can be culled from transactions with the world of objects and events.

Ergo, for both the finest-grained semantic distinctions as well as the semantic properties that have no "syntactic reflex" whatsoever, real-world observation of the events (and, perhaps, semantic bootstrapping; see below) may be required to disentangle a multitude of possible meanings (Fisher et al., 1991; Naigles et al., 1993). Unfortunately, in the case of (e.g.) mental state verbs with very similar meanings, real-world observation will not suffice to tease apart distinctions in meaning, since such verbs have almost no observable components to their meaning (cf. *Suki considered/remembered/expected/hated*

[7] As Bowerman and Brown (2008, p. 7) note, simple uniclausal utterances may not be particularly informative for children seeking the meanings of novel verbs, since—for instance—a NP-V-NP sequence may map onto verbs from semantic classes ranging as widely as state change (*Suki broke the vase*), surface contact (*Suki wiped the table*), perception (*Suki heard a strange noise*), and cognition (*Suki admires Neil and Louise*).

the letter).[8] That is to say, for verbs whose meaning is abstract or unobservable (such as mental state verbs like *think* and *expect*, raising and control verbs like *seem* and *try*, and also syntactically "simpler" 2-NP predicates like *remember* and *interest*), it is likely the case that the structure of the utterance, rather than the associated real-world contingencies, must be exploited for clues to the verb's lexical meaning. One difficulty for a learning mechanism which exploits a verb's syntactic privileges of occurrence, however, is the fact that abstract verbs like "seem" and "try" may not be differetiated by a given syntactic frame, at least on its surface (cf. *Janine seemed/tried to like sushi*; Becker, 2006). With the syntactic frame failing to differentiate such verbs unambiguously, a learner may attempt to differentiate such verbs via real-world observation; however, as noted, unlike the case of *shatter* vs. *crumble*, observation is unlikely to disambiguate the precise meanings of these verbs with any degree of success.

To make matters even worse, regardless of the type of verb or its canonical[9] syntactic frame, a number of elements (e.g., *t*, PRO) and transformations (e.g., A-movement, wh-movement) in language may obscure the actual number and/or arrangement of NP arguments related to a verb. How are young children able to learn the underlying syntax of abstract or unobservable verbs when the syntax of those verbs is so complex?

[8] It could be argued that the accepted dichotomy between observable transitive change-of-state verbs (whose semantics are open to real-world observation) and mental state verbs (whose semantics are essentially unobservable) is a false one, as it is possible to observe some of the *results* of the mental state verbs. For instance, I might witness the effects of *knowing* a language by hearing a person speak it; I can observe the results of *liking* ice cream by heading to Ben & Jerry's. But while the entire contingencies of *breaking* or *hitting* or *dancing* are open to observation, the entire range of ramifications (and thus semantics) of *knowing* or *liking* are not similarly observable. As such, the learning challenge posed by this verb class and traditionally acknowledged by linguists still stands.

[9] Throughout this dissertation, I will use the word "canonical" fairly loosely. However, like "[un]marked," this word not only is flagrantly polysemous but also tends to be used by researchers to fit their current demand, without explicit operationalization of the term. My sense is that both "unmarked" and "canonical" are used to mean anything from *most frequent* (which often correlates with *most basic*), to *least processing power required*, to *first seen in acquisition*, to *"easiest to acquire."* These issues may or may not overlap in any given case.

Much to my chagrin, the current dissertation may be an act of complicity in this state of affairs. However, I will attempt to quantify my meaning, especially in situations in which the most confusion might occur. Here, "canonical syntactic frame" refers to the verb along with its most common arguments in their most common constellation—where "most common" is a reference to sheer frequency of occurence. This is usually the meaning of the word that I will intend.

Such cases are not necessarily rare outliers in language. Carol CHOMSKY (1969, p. 6–7) defined "complex utterances" as those in which

> (A) The true grammatical relations which hold among the words in a S[entence] are not expressed directly in its surface structure.
> (B) The syntactic structure associated with a particular word is at variance with a general pattern in the language.
> (C) A conflict exists between two of the potential syntactic structures associated with a particular verb.[10]

Chomsky's point in (A) is exactly what was mentioned above: namely, that empty elements and transformations may obscure the actual grammatical relations which obtain in a sentence. Point (B) implicates constructions which are "noncanonical" by dint of their being multiclausal (if we assume a single clause to be the most basic form) and/or requiring transformations. Point (C), however, is of particular interest in the context of the syntactic bootstrapping strategy—not just for single verbs that may appear in multiple possible syntactic structures, but also for multiple verbs that may appear in the same single syntactic frame. As mentioned above, verbs which fall into this category—and especially those which also fall under points (A) and (B)—may prove to be cases that are too difficult to resolve with syntactic bootstrapping alone.

And indeed, there are a number of constructions that fall into this class. Chomsky examined a number of "complex" structures and how children acquire them in later childhood, noting that "The less clearly these relations are expressed in the surface structure, the more analysis [the child] must perform in order to recover them, and the more knowledge he must bring to bear on the situation" (p. 7).

As examples of the types of constructions which fall under this rubric, consider the multiclausal sentences in in (5) and (6).

[10] CHOMSKY (1969) includes a fourth criterion for complex utterances: "(D) Restrictions on a grammatical operation apply under certain limited conditions only." This could be considered true of RO/OC utterances when we consider that one surface string has distinct syntactic and semantic restrictions depending upon which underlying syntax it corresponds to. For instance, *Suki gorped it to be time for coffee* would be grammatical for an RO—but not an OC—verb.

(5) a. Suki is eager to please

b. Suki is easy to please

(6) a. Suki appeared to Louise to be proud of herself

b. Suki appealed to Louise to be proud of herself

These sentence pairs constitute such cases of "surface same, syntax different" frames which may stump children who hope to exploit the strategy of syntactic bootstrapping, since a single surface syntactic frame is associated not only with two distinct verbs/predicates, but also with very different meanings as a result of the underlying structure. To reach adultlike competence on such constructions, the child must eventually come to see that in (5a), Suki is pleasing someone else, but in (5b), she herself is the one being pleased. Likewise, in (6a), *Suki* is the proud individual, while in (6b), *Louise* is.

Such cases stand in sharp contrast with the mental state verbs, which—although they also take multiclausal frames—subcategorize for a CP complement in a fairly unambiguous way (e.g., *Suki gorped that Louise was proud of herself*). Moreover, with respect to riddling out the semantic content of the predicates in (5) and (6), there is no "easy out" provided by real-world observation: each pair constitutes fairly abstract, if not downright unoservable, events.

Here, then, is the learning challenge: how are children able to learn verbs that appear in multiclausal frames—especially those which differ in their underlying syntax (including the relevant empty elements and transformations) but are ambiguous given only the surface string?

In this context, the twin phenomena of raising and control become quite interesting. Raising and control verbs (both subject raising/subject control (7), and raising-to-object/object control (8)) constitute cases which may "stump" syntactic bootstrapping, given the reasons discussed above.

(7) Suki gorped to eat meat

Subject raising: Suki seemed to eat meat

Subject control: Suki tried to eat meat

(8) Suki gorped Louise to eat meat

Raising-to-object: Suki wanted Louise to eat meat

Object control: Suki asked Louise to eat meat

Unlike many verbs that appear in single clauses, the surface string of a biclausal raising or control utterance could map to one of two possible underlying syntactic structures. In short, the distinction between raising and control is quite opaque to a learner hoping to bootstrap into syntax. How, then, do children assemble the lexical-semantic and syntactic information for these verbs?

Before exploring this issue further, it should be noted that syntactic bootstrapping is not the only tool which children bring to the verb-learning task. First, children can observe and experience the real world via their five senses, a process which may allow children to easily tease apart verb meanings, for those verbs appearing in identical syntactic frames (*Suki poured/drank the coffee*). In addition, though, a number of researchers have postulated that children are also equipped with some innate biases about how real-world semantics and lexical-syntactic structures may align. These notions play an important role in the theory of *semantic bootstrapping*, to which we will now turn.

2.3 Theories of Learning: Semantic Bootstrapping

A number of researchers have hypothesized that children use semantics—and in particular, semantics in the context of an observable real-world scene—as a way to bootstrap into the invisible syntax and abstract syntactic categories of their native language. In various versions of what has since come to be termed "semantic bootstrapping," several researchers (in particular, Bowerman, 1973; Grimshaw, 1981; Pinker, 1984) have suggested that children come to the language learning task with inborn knowledge and/or biases about semantics which allow them to "bootstrap" into the syntax of their language. The particulars of the account vary from researcher to researcher, but the two major components hypothesized to be part of this task—namely, the categorization of words into syntactic classes, and the identification of syntactic functions within an utterance—are both connected inextricably to the (linguistic and cognitive) semantics of an utterance.

For instance, Pinker (1984) claims that the child comes to the language learning task with the assumption that certain archetypal semantic notions of syntactic categories and grammatical functions, features, etc., hold in the linguistic input. The general idea is that children use early-developing (or possibly innate) cognitive categories (e.g., "object" and "action") to assign words to syntactic categories (e.g., "noun" and "verb," respectively). This preconception should help children access the semantic and syntactic information housed in a basic sentence like *Suki drinks coffee*, where the first noun phrase denotes an animate agent of the action, which is denoted by the verb, and the second noun phrase denotes the patient of that action. This default strategy certainly will not allow for an exhaustive categorization of nouns or verbs, but once a learner has heard and categorized enough words from the ambient language which do conform to these canonical sorts, they should be able to extract enough data about the morphosyntactic markings and phrase structures associated with these classes to then recognize non-canonical examples of these classes.

Likewise, proponents of the semantic bootstrapping proposal suggest that children are biased to associate syntactic positions (e.g., "subject" and "object") with particular thematic roles (e.g., "agent" and "patient/theme," respectively). This default assumption will aid children when they are presented with a linguistic description of an observable event: for instance, upon hearing *Neil is kissing Louise* in the context of a kissing event, the child will be able to determine the word order of the language they are learning (in the case of English, SVO, since the agent *Neil*, mentioned first, should map onto the subject, and the patient *Louise*, mentioned second, should map onto the object; the action will be labeled with a verb, given the considerations above). As with syntactic categorization, the learner must depend on utterances that display the canonical semantics (e.g., active-voice clauses with agentive-transitive verbs) as the learner builds up a basic level of knowledge; only after this can they go on to identify subjects and objects that do not conform to this general scheme.[11]

The hypothesis of the presence of such biases is supported by a number of crosslinguistic semantic universals, especially in regard to the qualities of subjects and objects, and the assignment of θ-roles to verbal arguments. For instance, many researchers (e.g., Fillmore, 1968; Keenan, 1976; Baker, 1997) have noted that if a verb projects an agent θ-role, it will appear in subject position, and Keenan's (1976) Subject Properties List indicates that across languages, basic subjects normally denote the agent of the action, if one exists. Dowty (1991) went so far as to suggest that the entire list of proposed θ-roles could be stripped down to two thematic "proto-roles," namely a proto-agent[12] and proto-patient, which—according to his proposed *Argument Selection Principle*—will generally (if not always) be lexicalized as the subject and object, respectively. Examining crosslinguistic data would then suggest that it is a wise strategy to assume that a human will be labeled with a noun, and that this noun-human is likely the agent of the action named by the verb. While it is not the case taht all animate noun phrases act syntactically as subjects, it is true that most subjects are agents, and that all agent-subjects are animate; even the assumption of this tendency will significantly narrow the hypothesis space for the child language learner.

Baker (1997) widens the scope of the observation somewhat by proposing the

[11]Clearly, these proposals suggest a strong relation between linguistic and non-linguistic knowledge (Grimshaw, 1981). We will return to the issue of the interface between linguistic and non-linguistic cognitive modules in Sections 6.8 and 9.6 below.

[12]Dowty (1991) proposes a proto-agent θ-role whose properties include volitional involvement, sentience/perception, causing an event or change of state, movement, and existence independent of the event named by the verb; all of these properties describe humans (and perhaps other animate beings) quite well.

Uniformity of Theta Assignment Hypothesis (UTAH), which states that crosslinguistically, identical thematic relationships correspond to identical structural relationships at D-structure;[13] thus, all agents are underlyingly subjects, and all themes, objects. At the roughest level of focus, LARSON (1988) posits a Thematic Hierarchy which states that agents will appear above (that is, c-command) themes in the syntactic structure.

The existence of such universals naturally begs the question of what gives rise to the semantic assumptions hypothesized above: UG or some non-linguistic cognitive phenomenon? Does UG itself include these default assumptions as part of the "starter pack" that children bring to the language learning task (i.e., *language* has them, therefore *children* do; e.g., DOWTY, 1991)? Or is it instead the case that children make these semantic assumptions based on some language-external cognitive drive? If this were the case, languages may simply have evolved to reflect the relationships that children respect (i.e., *children* have them, therefore *language* does; e.g., BOWERMAN, 1973). Regardless of the answer to this question, these crosslinguistic similarities in θ-marking suggest that these tendencies are robust and therefore that children can safely assume them to hold.

Other researchers (CHAPMAN AND KOHN, 1977; MARATSOS, 1974; LEMPERT, 1989; HYAMS ET AL., 2006) have observed the effects of children's initial assumptions about θ-structuring, and have in fact linked children's non-adultlike behaviors in some arenas to these default assumptions about the appearance of agents and themes. For instance, CHAPMAN AND KOHN (1977) presented evidence that children performed better on interpreting sentences with animate (agent) subjects and inanimate (theme) objects than on sentences with inanimate subjects and animate themes—that is, they performed best with Dowty-style proto-agent subjects and proto-theme objects. As a related phenomenon, it is also known that the passive construction is late to be acquired in spontaneous speech, and that young children perform poorly on interpretations of passive utterances before they begin to produce the passive themselves. As an example,

[13] Surface differences may result from NP-movement (however that movement is motivated), but at the most "basic" level, all utterances respect UTAH.

Maratsos (1974) found that children appear to use a default "behavioral" strategy when confronted with NVN sequences; this processing shortcut leads them to interpret such sequences (regardless of syntax) as actor-action-object utterances. In related work, Lempert (1989) found that children (ages 2;6–5;3) produced more novel passive sentences when they had been trained on items with animate (rather than inanimate) patients. These results are consistent with the hypothesis that for children, the "concept" of subject is a category that includes animacy as a component. Taking such evidence into account, Hyams et al. (2006) have suggested that children's trouble with the passive in fact stems from a noncanonical arrangement of θ-roles. They propose the *Canonical Alignment Hypothesis* (CAH), which states that in the earliest grammar, any external argument (for instance, an agent) must map onto subject position (Spec TP). Thus, it is not A-chains *per se* that give children trouble, but rather, only A-chains that result in a violation of the CAH. The authors suggest that it is only with an increase in pragmatic and processing resources that children become able to deal with utterances whose transformations distort fundamental syntactic shape.

Finally, Chomsky's (1986) formulation of the θ-criterion—and especially the projection principle—is particularly leading. He writes, "the projection principle…states that lexical structure must be represented categorically at every syntactic level…. A consequence of the projection principle is, to put it informally, that if some element is 'understood' in a particular position, then it is *there* in syntactic representation" (p. 84). This formulation suggests a system in which the learner would expect to find particular arguments in particular positions, and would perform in a non-adultlike fashion on those utterances which did not conform to this expectation. While Chomsky suggests that one way to satisfy the projection principle is for an empty (i.e., phonetically null, as in the case of PRO or *t*) category to fill a particular position, it is not unreasonable to assume that young speakers would initially seek a phonetically overt element in such positions. Combining this assumption with observations above about the canonical alignment of θ-

roles in syntactic structure, we should not be surprised to observe that children perform poorly when canonical syntactic structure is violated in any one of a number of ways.

Consider again example sentences (5), (6), (7), and (8) above, reproduced here as (9), (10), (11), and (12), respectively.

(9) Suki is eager/easy to please

(10) Suki appeared/appealed to Louise to be proud of herself

(11) Suki seemed/tried to eat meat

(12) Suki wanted/asked Louise to eat meat

Each of these sentences will pose its own set of challenges to the semantic bootstrapping approach.[14] First, the basic task of sorting words into their appropriate lexical categories relies on the canonical association between verbs and the actions they tend to label; none of the verbs here can be so easily sorted, with the possible exceptions of *appealed* and *asked*, since these involve an observable "appealing" or "asking" event (but even these are not prototypical "actions," since they do not involve dynamic motion or a resulting change-of-state).

But suppose that a child has amassed enough of a representative store of canonical action verbs to be able to identify the particular inflectional morphology associated with verbs, thus allowing the child to identify new verbs which do not fall under the canonical semantics. The next task is to identify the grammatical roles that the nouns in the sentences play—and here, too, the learner would be stymied.

Take for instance the phenomenon of A-movement, which constitutes such a case of confusion. A-movement includes the related phenomena of passives, unaccusatives,

[14] The type of syntactic ambiguity inherent in the examples in (9) and (10) also extends to the interpretation of pronouns. For instance, C. Chomsky (1969) also examined such instances as *I asked/told him what to do*—in which the "doer" changes, depending on the verb—and *[He] found out that Mickey won the race/After [he] got the candy, Mickey left/Pluto thinks [he] knows everything*—in which the reference of *he* differs, depending on the pronoun's appearance in the structure. Naturally, even these additions do not comprise an exhaustive list; the phenomenon of syntactic ambiguity is a pervasive one, and important to consider if we wish to completely understand the feat of language-learning.

and raising verbs, and is at work in (9) (with *easy*), (10) (with *appear*), (11) (with *seem*), and (12) (with *want*). An utterance which utilizes A-movement has no one-to-one mapping between the linear string of words appearing in that utterance and the verb's selectional properties or θ-grid, and as a result of these (and other) characteristics, such an utterance will usually not conform to the syntactic-semantic regularities necessary for semantic bootstrapping to be of use. For instance, in the raising sentence *Suki seemed to eat meat*, the NP *Suki* is not the agent of some action labeled by the verb *seem*; in fact, the verb *seem* does not refer to any action or change of state at all. Furthermore, the verb *seem* does not stand in any selectional relationship with the NP *Suki*, since *seem* does not project a θ-role for an external argument. Moreover, in a passive sentence like *The meat was eaten by Suki*, the first NP in the linear string is not the semantic subject of any predicate at all, but rather the semantic object, or patient. Thus, A-movement appears to damage the two strategic routes—syntactic and semantic—that the learner has to the meaning of an utterance. Specifically, by destroying the prototypical argument structure in its linear mapping, A-movement may be a significant obstacle to discovering the meaning of a novel verb.

As such, A-movement in all its forms provides an interesting instance of a more "complex" step in first language acquisition. Within the realm of A-movement, raising structures prove to be an especially challenging test case, since the linear order of their syntactic components appears identical with that of control constructions in several contexts; sentences which have been derived by A-movement cannot be correctly interpreted without appealing to the empty category of NP-trace. Another such empty category is PRO, the phonetically null subject NP of embedded infinitival clauses in control constructions (as in (11) with *tried*, and (12) with *asked*, above). The existence of these empty categories poses a compelling question to the field of language acquisition: how do children cope with linguistic information that has semantic content, but is not phonetically present in the input?

Although the twin strategies of syntactic and semantic bootstrapping are likely at play in verb learning, they clearly cannot comprise the whole story. There are simply too many stumper cases and challenges which these two strategies in isolation cannot overcome.

2.4 Bootstrapping Approaches: General Challenges and Problems

For as helpful as the two bootstrapping strategies are, neither one will get the child through the language learning task without a hitch. As Gleitman (1990, p. 50) points out, "both semantic and syntactic bootstrapping are perilous and errorful procedures, and their explanatory power must be evaluated with this additional proviso in mind."

Semantic bootstrapping clearly has its limits as a verb-learning tool (Gleitman, 1990; Fisher et al., 1991). Perhaps the most obvious is that any strategy that depends upon observation of the real world will run into problems when lexical items refer to unobservable concepts or events. And it is not only blind children who deal with this issue: even sighted individuals cannot see the processes to which mental-state verbs refer. Clearly, hearing a verb in the context of a *thinking* or *knowing* event will not buy the child (sighted or not) much, in terms of linking the verb label with its semantic referent. As Gleitman puts it, "many words are related to the real world only in the most obscure and invisible ways, if at all" (Gleitman, 1990, p. 19). For novel verbs whose meanings are abstract and/or unobservable, both adults and children are in the same boat (dictionaries notwithstanding), and it is precisely this issue which the syntactic bootstrapping hypothesis was meant to address.

However, even for verbs whose referents *can* be observed, Gleitman rightly notes that in some situations, the same real-world observation can be equally well described with multiple verbs (and their multiple corresponding structures), e.g., *The dog chases the cat/The cat flees from the dog.*

And to whatever extent semantic bootstrapping does seem to provide a mechanistic description of the verb-learning task, it simultaneously pushes back the explanatory question one degree; it does not entirely address the issue of how learners acquire the semantic/syntactic linking rules in the first place (Gleitman, 1990).

While semantic bootstrapping suffers from its own shortcomings, Fisher et al. (1991) also note a number of limitations on syntactic bootstrapping. First, some subcategorization frames are less predictive than others. For instance, the frame variables PP (prepositional phrase), SComp (sentence complement), and 3-NP (three NP arguments) are highly correlated with particular semantic classes (location and motion, perception and cognition, and transfer, respectively), while the frame variables IPP (imperative, progressive, and pseudo-cleft constructions) and ICon (intransitive with a conjoined NP subject, e.g., *Neil and Suki met*) were much less reliably correlated with a particular semantic class of verbs.

However, even for highly predictive frames, there is still an imperfect syntax-semantics correlation; for instance, note that the sentence *Neil wrote to Louise* contains a PP but does not involve a motion or location verb (though in this case, "write" is essentially a transfer verb). In short, while Fisher et al. (1991, p. 352) found "powerful correlations... between subjects' semantic partitioning of a set of verbs and other subjects' syntactic partitioning of that same set of verbs", they also noted that "the semantic judgment task yields a considerably richer partitioning of the verb set than the syntactic judgment class" (p. 359).

This is likely due to the fact that even verbs *within* a given semantic class still "differ in many aspects" (Fisher et al., 1991, p. 358). To some extent, real-world observation of the "extralinguistic contingencies" of a particular verb may help to tease apart myriad closely related items (cf. the *break* and *shatter* case noted above), and the authors note that it may be exactly these easily observable semantic properties that have no "syntactic reflexes" (p. 381).

Indeed, when all is said and done, Fisher et al. (1991, p. 381) hypothesize that "semantic properties whose instances are closed to observation are among those which are exhibited in the clause structure." Naturally, the begged question here then becomes how the child is able to arrive at the semantic differences among closely related verbs whose meanings are *closed* to observation—to expand Gleitman's own example, consider mental-state verbs like *think, ponder, mull, muse, ruminate, brood* and more.

Even if we leave this issue to the side, however, there is still the question of how orderly the input is. If the child is meant to make use of the syntactic frames in which novel verbs appear, this would presumably necessitate that those subcategorization frames hold some useful information about the verb—or at the least, that verbs would not surface in purportedly "ungrammatical" structures. Even disregarding speech errors, a number of phenomena in the input belie this assumption, and Gleitman (Gleitman, 1990; Fisher et al., 1991) notes several of these. First, she argues that a major component of the semantics that can be discerned from the frames in which a verb appears is its meaning as an argument-taking predicate. However, not all arguments with which a verb appears are θ-marked by that verb. In a sentence like *Neil wrote a letter to Louise at his desk*, how is the learner to know which structures are actual frame specifications and which are adjuncts? Moreover, idiomatic uses of verbs (e.g., *Neil saw Louise out of the room, Suki sneezed the steak off the table*) and innovative or playful utterances, in which a verb shows up in a non-canonical frame (e.g., intransitive verbs appearing with an object, as in *Gepetto danced Pinocchio*, Fisher et al., 1991, or *it's raining men*), may prove misleading (or, at the very least, distracting) to a learner attempting to deduce the subcategorization frames in which a verb may "grammatically" appear.

A further problem is the issue of whether children actually make use of the input in the ways that syntactic bootstrapping hypothesizes that they do. Specifically, it is proposed that in order for syntactic bootstrapping to work, given the fact that semantically dissimilar verbs may in some instances appear in identical syntactic frames, children (especially those at a young age) must reason across multiple syntactic frames to arrive at the meaning of a novel verb. However, Naigles's (1996) research probing exactly this issue was suggestive, at best—certainly not conclusive.

It should be expressly noted that it is *not* the case that one of these strategies—syntactic or semantic bootstrapping—can be used only to the exclusion of the other; in fact, the most likely scenario is instead that both types of bootstrapping are necessary and complement one another in language acquisition (Gleitman, 1990). This complementarity becomes more clear when we elucidate the distinct predictions each hypothesis makes about what type of learning is occurring. Semantic bootstrapping claims that the individual words and their meanings, along with observations of the world, allow the learner to access the meaning of a novel verb—and, by extension, the syntax of a sentence. In contrast, syntactic bootstrapping claims that the sentence's syntax itself tells the learner about the properties of the verb housed in that syntactic frame.

It is moreover likely that semantic and syntactic bootstrapping may prove useful as primary strategies at different points in the language-learning trajectory. Gleitman (1990, p. 36–37) puts it this way:

> There is a timing difference in the requirements of the semantic and syntactic bootstrapping approaches: for the latter, the learner has to be able to parse the sentences heard in order to derive a syntactic analysis. Moreover, at least some of the mapping rules have to be in place before the verb meanings are known, or else the whole game is over.

Thus, semantic bootstrapping may prove to be the most helpful in the initial stages of the game, when the child is building up stores of lexical categories and learning the canonical (i.e., most basic, most conversationally unremarkable) structure and word order of their language. Indeed, these very steps are clearly necessary before the child can make use of syntactic bootstrapping, which may then step into the driver's seat once the child has built a foundational store of knowledge about the ambient language—including a lexicon of nouns, and the ability to parse subcategorization frames.

But as indicated, neither strategy will work all the time. Gleitman (1990, pp. 50–51) again:

> The position I have been urging is that children usually succeed in ferreting out the forms and the meanings of the language just because they can play off these two imperfect and insufficient data bases (the saliently interpretable events and the syntactically interpreted utterances) against each other to derive the best fit between them. Neither syntactic nor semantic bootstrapping works all the time, nor taken together do they answer all the questions about how children acquire the verb vocabulary and argument structures.

Our goal here, then, is to examine what—if any—other strategies might be in play in first language acquisition, and specifically in the acquisition of surface-same/syntax-different constructions like those under consideration here.

Moving away from the bootstrapping approaches to the properties of human language, though, we see that a number of aspects of language prove challenging for the strategies of syntactic and semantic bootstrapping, since they render the surface string non-isomorphic with the underlying syntax and/or semantics. As seen above, these include A-movement, verbs which subcategorize for multiclausal utterances (with their concomitant empty elements of PRO and*t*), and verbs whose lexical meanings are unobservable or abstract. When several of these phenomena coincide within a single surface string, the learner's task is only made harder, by rendering strings ambiguous as to the corresponding underlying syntax and/or semantics, as exemplified in examples (9)–(12) above.

The question then clearly becomes, once the input gets "complicated" in this way, how does the learner proceed? To couch this larger question in a more concrete case, how does a child acquire the distinction between raising-to-object and object control?

(13) Suki gorped Louise to eat meat.

Raising-to-object: Suki wanted Louise$_i$ [t_i to eat meat]

Object control: Suki asked Louise$_i$ [PRO$_i$ to eat meat]

Before we can address this issue fully, it will help to examine the particular constructions that are under consideration here. Chapter 3 discusses the syntax of raising and control, as well as other types of A-movement, in greater detail, and presents previous data on the acquisition of these constructions in childhood.

Chapter 3

The Syntax of Raising and Control

In this chapter, I discuss some syntactic considerations associated with raising and control verbs, as well as with A-movement in general. First I will present the syntactic and theoretical assumptions I make, in terms of the end-state adultlike knowledge of these verbs. Then I will present the current evidence on children's acquisitions of these verbs and their associated syntactic structures.

3.1 Syntactic and Theoretical Assumptions

3.1.1 Subject Raising and Subject Control in Adult Grammars

From a linear order standpoint, raising and control structures appear identical, as the sentences in (14) illustrate.

(14) a. Suki tends to eat meat (raising)

b. Suki wants to eat meat (control)

Establishing an account of raising and control—an account that syntactically describes each type and, possibly, their relation—has been a central concern of generative syntax for four decades (Davies and Dubinsky, 2004). A long-accepted analysis of these two types of verbs was accomplished in the Government and Binding theory (henceforth GB; e.g., Chomsky, 1981, 1986). In this framework, the sentences in (14) also contain distinct, phonetically null elements which are coreferential with the subject NP *Suki*; in (14a) that element is a trace of the raised NP *Suki*, while in (14b) that element is PRO. Thus, the surface similarity of these sentences belies their underlying dissimilarity, as seen in (15).

(15) a. Suki$_i$ tends [t_i to eat meat] (raising)

b. Suki$_k$ wants [PRO$_k$ to eat meat] (control)

Importantly, the raising structure itself is claimed to have no matrix subject at D-structure, since the verb *tend* assigns no external θ-role; instead, the NP *Suki* receives its θ-role as the external argument of the embedded clause. However, since the untensed INFL in the embedded clause cannot assign Case to that NP, the Case filter forces the movement of that NP to the higher clause, where it can receive nominative Case. (This movement is permissible under the θ-Criterion, as *tend* assigns no θ-role to this position.) Meanwhile, the *t* forms an A-chain with the moved, c-commanding NP, which properly governs it, and all is well.[1] The class of English raising predicates includes such members as *seem*, *appear*, *tend*, and *is likely*.

Control structures, on the other hand, do assign a θ-role to their external argument; in (15b) the NP *Suki* is assumed to be base-generated in its surface position, where it is assigned a θ-role by the verb *want*. At first blush, this NP also appears to be carrying the θ-role of the verb in the embedded clause, but the θ-Criterion would not allow this. Instead, the coindexed, phonetically null pronoun PRO carries the θ-role assigned by the lower verb while further satisfying the Extended Projection Principle, which requires that each clause have a subject. Importantly, though, unlike raising, control involves no movement and no A-chain. The class of control predicates in English includes members like *want*, *try*, and *expect*.

The sentences in (14) and (15) illustrate one linear environment in which both raising and control predicates can appear, namely, raising-to-subject and subject control.

[1]This analysis is supported by two further pieces of evidence. First, sentences like that in (15a) can alternate with "unraised" counterparts, dependent upon the raising verb in question. While *tend* does not allow this alternation, *seem* does; cf. *Suki seems to like meat* and *It seems that Suki likes meat* (cf. **It wants that Suki likes meat*). Second, idioms can grammatically be split around raising verbs, indicating that one part of the idiom has raised and forms a chain with the other part, e.g., *The cat seems to be out of the bag* (cf. **The cat wants to be out of the bag*, on the idiomatic reading).

However, raising and control appear to overlap in a second linear environment: raising-to-object and object control. The sentences in (16) illustrate this second match.

(16) a. Suki believes Louise$_i$ [t_i to eat meat] (raising)

b. Suki tells Louise$_k$ [PRO$_k$ to eat meat] (control)

Chomsky (1981) argues that the empty categories of trace and PRO differ in several key respects.[2] A trace must be governed, its antecedent may not appear in a θ-position, and the antecedent-trace relationship must satisfy the subjacency condition. On the other hand, PRO may not be governed, any antecedent[3] must have a θ-role independent of PRO's, and subjacency need not be satisfied by the antecedent-PRO relationship. Furthermore, traces may appear via NP-movement, movement to COMP, or extraposition, while PRO appears obligatorily in ungoverned positions where an NP is required but no Case is assigned.[4] In short, the two empty categories appear in perfect complementary distribution.

3.1.2 Subject vs. Object Control

While cases in which the matrix object serves as a controller for PRO are common (17a), matrix subjects may also control PRO (17b).

(17) a. Neil$_i$ expected/reminded Louise$_j$ [PRO$_{*i/j}$ to make coffee]. (object control)

b. Neil$_i$ called/kissed Louise$_j$ [PRO$_{i/*j}$ before making coffee]. (subject control)

Chomsky (1981, pp. 78-79) notes that a number of different factors, including "structural configurations, intrinsic properties of verbs, other semantic and pragmatic

[2] These properties are determined by the interactions of bounding theory, control theory, Case theory, and binding theory.

[3] If one does exist. This is not required in the case of arbitrary PRO, e.g., *PRO Drinking coffee is exhilarating.*

[4] In light of the fact that PRO must move from a non-Case position (e.g., *we$_i$ never expected PRO$_i$ to be found t_i*) and is barred from moving from a Case-marked position (e.g., **it is unfair [PRO$_i$ to talk about t_i]*), Chomsky and Lasnik (1993) propose that PRO is assigned null Case by the infinitival, rather than bearing no Case at all.

considerations," are involved in the coreferencing of PRO, but a generalization that accounts for many instances states that the controller (and coreferent) of PRO will be the next c-commanding NP. While this rule of thumb does not account for indirect questions, complement clauses of prepositions and nouns (Cairns et al., 1994), or verbs like *promise*, it does correctly account for the facts that (a) single-NP sentences will have subject control (15b), (b) complement clauses—attached at VP—will generally be controlled by the matrix object (17a), and (c) temporal adverbials—attached above VP—will be controlled by the matrix subject (17b).[5]

3.1.3 Raising-to-Object and Exceptional Case Marking

The process of accounting for the underlying structure of sentences like (18) has been fraught with conflict.

(18) John believes [Tom to be a fool]

Such sentences are alternately referred to as raising-to-object or exceptional case marking structures, depending upon a researcher's personal theoretical leanings. Here I will briefly discuss several accounts of these sentences.

Postal (1974) provided an early raising-to-object (RO) account of sentences like (18) which argued that in certain constructions, the subject of an embedded infinitival clause could raise to become the object of the matrix verb. As two (of the many) pieces of support for this analysis, he showed first that Right Node Raising (19a) is ungrammatical for an embedded infinitival clause (19b), indicating that it is not a constituent in itself.

(19) a. I think, but no one else does, that peppermint ice cream is yummy

b. * John believes, but no one else does, Tom to be a fool

Second, adverbs may grammatically appear between verbs and complement sentences (20a), but not between verbs and objects or embedded infinitivals (20b).

[5]Among the first to document such an effect was Rosenbaum (1967), who formulated a M(inimal) D(istance) P(rinciple) that governed the erasure of an embedded complement subject. Many researchers have since adopted the term MDP to refer to this PRO coreference effect.

(20) a. I believe adamantly that you are up to no good

b. * I love adamantly you / I believe adamantly Tom to be a fool

Thus, the NP subject of the embedded infinitival must have raised to object position in the matrix clause.

However, movement of an NP from the subject of an embedded infinitival into the object (i.e., verbal complement) position of the matrix verb violates the θ-Criterion, since such movement would result in the NP bearing two θ-roles; movement into θ-marked positions is therefore barred (Chomsky, 1981). As an alternative to the RO account, Chomsky (Chomsky, 1981, 1986; Chomsky and Lasnik, 1993) proposes a process of exceptional case marking (ECM), according to which a verb may "exceptionally" assign Case to the NP subject of an embedded infinitival clause.[6] This account allows Chomsky to maintain the θ-Criterion and the projection principle in their strongest forms, such that there are no subjectless infinitives at any point in a derivation.

Postal and Pullum (1988) note that Chomsky's ECM account depends crucially on the assumption that expletive elements cannot appear in subcategorized (i.e., θ-marked) positions (e.g., **John saw there/it*, where *there/it* are nonreferential); they then proceed to argue against this assumption by providing what appears to be evidence of expletives in subcategorized positions, including objects of verbs (21a) and prepositions (21b) and what they refer to as "unlinked expletives" (21c).

(21) a. The Lord stopped it from raining

The mayor prevented there from being a riot

[6] Chomsky (1981) initially posits that ECM results from a marked rule of S'-deletion which deletes the barrier to government of an infinitival subject NP by the verb, while he later proposes that ECM verbs simply select for an S (not S' – nor CP, on more current assumptions) complement (Chomsky, 1986). Chomsky and Lasnik (1993) are basically mute on the issue. Accepting the Chomsky (1981) version, the structure of such ECM sentences is as in (i); this contrasts with the structure of an embedded finite clause (ii).

i. John [$_{VP}$ believes [$_{S}$ Tom to be a fool]]

ii. John [$_{VP}$ believes [$_{S}$' that [$_{S}$ Tom is a fool]]]

b. John can depend on it that Bill will come

c. dish it out, have it out with, keep it up

Postal and Pullum argue that, given this data, the claim that expletives may not appear in θ-marked positions—and thereby the basic objection to an RO analysis of sentences like *John believes Tom to be a fool*—can no longer be maintained.[7]

LASNIK AND SAITO (1991) are also sympathetic to an RO analysis for sentences like (18), but argue that POSTAL AND PULLUM's argumentation is ineffectual, considering the fact that there is little correlation between verbs that will accept an expletive object and those that take infinitival complements with overt subjects, as illustrated in (22).

(22) a. i. I dislike it that he is so cruel

ii. * I dislike him to be so cruel

b. i. I regret it that we could not hire Tom

ii. * I regret us not to have hired Tom

On the other hand, they note, the stereotypical examples of "B(elieve)-raising" verbs[8] do not appear to accept expletive objects (23).

[7]The argument that expletive *it* appears in θ-marked positions is less impressive when we consider CHOMSKY (1981)'s suggestion that this lexeme actual does carry a θ-role, namely the "#" θ-role of a *quasi-argument*. However, this line of reasoning does little to explain away examples such as *The mayor prevented there from being a riot*, since *there* is always considered a full expletive, rather than an argument or quasi-argument.

[8]As POSTAL (1974) notes, the B(elieve)-verbs contrast with the W(ant)-verbs, whose inclusion in the class of RO verbs is somewhat questionable. Note, for instance, the contrast between active and passive forms of B-verbs (i) and W-verbs (ii). W-verbs may in fact prove to constitute a class of their own, apart from other RO verbs.

i. Neil believes Suki to be a coffee-drinker / Suki is believed to be a coffee-drinker

ii. Neil wants Suki to be a coffee-drinker / *Suki is wanted to be a coffee-drinker

(23) a. I believe (??it) that John left

b. I will prove (?*it) that Mary is the culprit

c. They have found (*it) that there is a prime number greater than 17

Lasnik and Saito provide a different type of evidence for an RO analysis by illustrating that the subject of each infinitival behaves just like a regular complement as far as binding facts are concerned (Lasnik and Uriagereka, 2005). They show that antecedents of reciprocals and anaphors (24a), c-commanding negative elements (24b), and binomial 'each' antecedents (24c) may grammatically appear in such an embedded clause when the element that must be c-commanded is in an adjunct clause.

(24) a. The DA proved [the defendants to be guilty] during each other's trials

b. The DA accused [none of the defendants to be guilty] during any of the trials

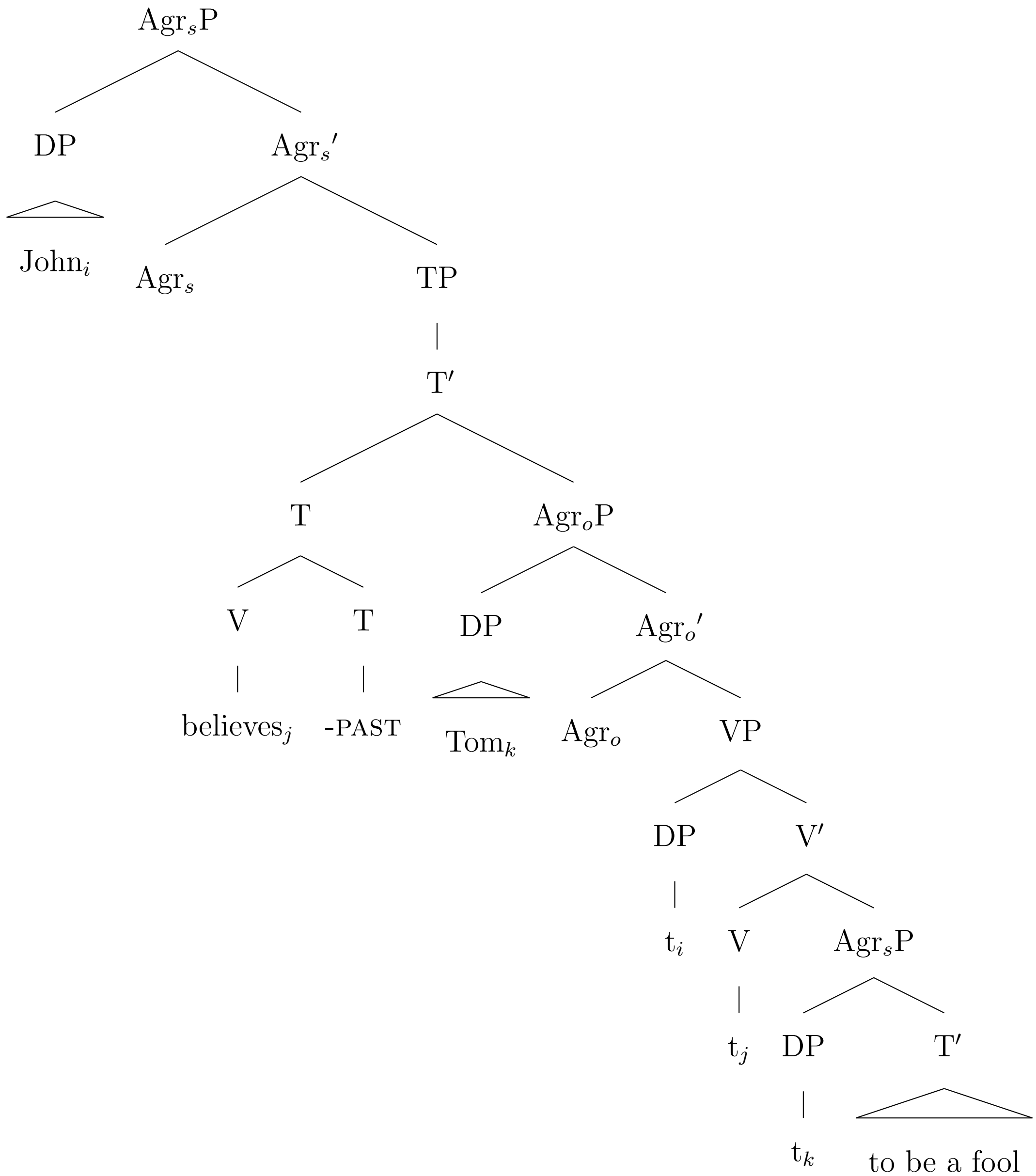
c. Jones proved [the defendants to be guilty] with one accusation each

The grammaticality of these sentences indicates that the c-commanding element must raise to the object of the matrix verb, leaving it high enough to c-command into the adjunct. On the basis of these facts, the authors argue that raising of the embedded subject to object position must happen prior to S-structure, as proposed in Postal (1974).

Minimalism (Chomsky, 1995) is able to evade this issue somewhat by interpreting ECM as raising of an embedded infinitival subject to [Spec, AgrO]. This analysis thus allows for subjects to move to a position where objects, too, are hypothesized to raise. However, only Case features (and not θ-role features) are checked in [Spec, AgrO] (25) (see also Lasnik and Uriagereka, 2005).[9]

[9] The triangle under the DPs containing the names "John" and "Tim" is for expository convenience. See Longobardi (1994) for more details on proper names and DPs.

(25)



The Minimalist view of these constructions thus seems to be a marriage of what were previously diametrically opposed RO and ECM accounts.

In the interest of brevity, I will gloss over this controversy in the coming chapters by continuing to refer to such constructions as raising-to-object (RO) constructions. In the interest of clarity (and so as to not drown the reader in unnecessary functional projections), I will also primarily present the utterances in question in bracketed, rather than tree, form.

However, the experimental results presented here bear strongly on this controversy, as will be clear in later chapters. I will ultimately return to this issue by discussing the data that I believe may instead force us in the direction of the ECM analysis. At that point, I will present what I believe to be the correct syntactic representation of these constructions.

3.1.4 Raising and Control Unified?

As Davies and Dubinsky (2004) note, a large number of non-GB theories (including Generalized Phrase Structure Grammar, Head-Driven Phrase Structure Grammar, and Categorial Grammar) do not distinguish structurally between raising and control; thus, the syntactic differences posited in (15) and (16) above are not assumed to hold. Instead, raising and control are separated by the semantic properties of the predicates involved.

A more recent argument against the GB raising/control distinction has been raised by Hornstein (1999) within the Minimalist framework. As a minimalist-style critique, Hornstein proposes that the assumption of PRO complicates the grammar by increasing the inventory of empty categories and bringing with it theoretical complications, including theoretical modifications to account for its distribution (i.e., that it must be ungoverned) and interpretation (i.e., that obligatory control (ObC)[10] contrasts with nonobligatory control (NObC)). As an alternative, Hornstein suggests that PRO bears Case just like an overt NP,[11] but that it is actually an ambiguous morpheme, functioning as an anaphor when it appears in ObC structures and as a pronominal (namely, *pro*) when it appears in NObC structures. Interpretive differences follow as a result of the semantic properties which differentiate anaphors from pronouns, and the control module can be eliminated

[10] I am departing from Hornstein's (1999) choice of "OC" as an abbreviation here, for (obvious) reasons of clarity.

[11] Once again, I reference my laxness here in regards to the terms DP and NP. However, Hornstein (1999) also shows this lack of theoretical commitment, sometimes referring to "D/NP" and sometimes simply to "NP." For the sake of continuity with Hornstein's discussion of "NP-trace," I will continue to use NP in this section.

from the grammar entirely.

Once ObC PRO has been defined as an anaphor, there is nothing to distinguish it from NP-trace, as generated by movement in raising constructions. In fact, Hornstein goes on to propose that PRO is the residue of movement (or copying) conforming to Greed.[12] In this way, both control and raising structures are characterized by movement, which is licensed in control in order to check θ-roles and D-features on predicates. Hornstein notes that the one distinguishing characteristic between an <NP, PRO> pair and an <NP, *t*> pair is that the former carries two θ-roles[13] (since the target of movement is a θ-position) while the latter carries only one (since raising predicates project no external θ-role). In short, having multiple θ-roles is what distinguishes NPs in control structures from those in raising structures, under this hypothesis (Davies and Dubinsky, 2004).

Culicover and Jackendoff (2001) respond positively to Hornstein's attempt to simplify the grammar by unifying raising and control, but then deny that a purely syntactic account (especially one based on movement) will work in this unification attempt. Instead, they argue for a more strongly semantic account of these constructions, according to which the choice between subject control and object control is decided on the thematic structure of the particular verb. On this account, differences in ObC and NObC stem from the existence of distinct classes of semantically similar predicates which evince idiosyncratic patterns of thematic control. Culicover and Jackendoff instead seem more sympathetic to an LFG/HPSG-style unification of raising and control, in which the subject argument of both verb classes is projected downward into the argument structure of a complement VP in order to fill a missing external argument there. As in both Hornstein's proposal and the GB account, though, the subjects of control but not raising

[12]The principle of *Greed* is defined by Chomsky (1995, p. 201) as "self-serving Last Resort." Movement is motivated by Greed when it will satisfy the morphological properties of the moved element α, not some different element β.

[13]Note that these proposals require (a) the treatment of θ-roles as features that must be checked, as well as (b) a relaxation of the θ-Criterion; Hornstein (1999, p. 93) espouses both of these "departures from orthodoxy."

predicates are assigned an independent θ-role.

It should be explicitly noted at this point that both of these alternate approaches still differentiate between raising and control constructions; Hornstein (1999, p. 71) himself states that "What is not at issue is that control and raising sentences manifest different properties." Furthermore, both proposals posit a difference between the two verb classes that is related to θ-roles. For Hornstein, the difference is a matter of the number of θ-roles a moved NP carries; for Culicover and Jackendoff, the distinction is whether the verb in question projects an independent θ-role to its subject. In short, the major distinction between the two proposals is whether or not syntactic movement is involved.

Responding to these unification efforts, Davies and Dubinsky (2004) present several pieces of empirical evidence which support the notion of keeping raising and control constructions theoretically separate; namely, raising and control structures differ with respect to θ-role assignment (26), embedded passives (27), selectional restrictions on the embedded clause (28), pleonastic subjects (29), and idiom chunks (30) (from Davies and Dubinsky, 2004, pp. 333–334).

(26) Thematic role assignment: one role for raising NP, two for control NP

a. Barnett believed *the doctor* to have examined Tilman (agent only)

b. Barnett persuaded *the doctor* to examine Tilman (agent and persuadee)

(27) a. Barnett believed Tilman to have been examined by the doctor (= (26a))

b. Barnett persuaded Tilman to be examined by the doctor (≠ (26b)

(28) a. Barnett believed the rock to be granite

b. # Barnett believed the rock to understand the issues of the day

c. # Barnett persuaded the rock to be granite

d. # Barnett persuaded the rock to understand the issues of the day

(29) a. Barnett believed there to be a unicorn in the garden

b. * Barnett persuaded there to be a unicorn in the garden

(30) a. Tina believed the cat to be out of the bag by now

b. ? Tina persuaded the cat to be out of the bag

The authors further note that the infinitival complement of a subject control verb, but not of a raising-to-subject verb, may be specified for the "unrealized future" (this term from Bresnan, 1972; cited in Davies and Dubinsky, 2004). This distinction is illustrated in (31).

(31) a. Suki seems to eat steak often ($\neq$ unrealized future)

b. Suki hopes to eat steak often (= unrealized future)

Second, while raising verbs like *seem* crosslinguistically appear to pattern with unaccusatives, control verbs like *try* do not. Third, while there appears to be a phenomenon of "partial control" (e.g., *The chair*$_1$ *preferred [PRO*$_{1+}$ *to meet at 6]*), there is no such thing as "partial raising" (**The chair*$_1$ *seemed/tended [t*$_{1+}$ *to meet at 6]*).

Davies and Dubinsky note that any analysis of raising and control must take all such empirical evidence into account. It may prove impossible to ever unify the two theoretically, and until such time as a theory is able to account for these differences, it seems wise to consider the two constructions unique. In short, a "different until proven same" approach seems the wisest, in light of the available facts.

Finally, it should be noted that an ambiguous class of verbs exist which sometimes act as control verbs and sometimes as raising; a prime example is *begin* (cf. *It began to rain* and *Suki began to eat the steak*). A successful syntactic account of the pure raising and pure control verbs should also consider this ambiguous class (Becker, 2005, 2006).

3.1.5 Typology of Raising and Control

Typologically, Noonan (1985) notes that raising is crosslinguistically less common than control, and that many languages have no type of raising whatsoever (e.g., Warlpiri: HALE, 1983; and possibly Basque: EGUZKITZA, 1987). Furthermore, Obj-Subj raising (e.g., *Steak*$_i$ *is good to eat t*$_i$) is likely the most common type of raising (NOONAN, 1985). This verb class is beyond the scope of this dissertation, but see C. CHOMSKY (1969) for some information on the acquisition of these so-called "tough-movement" constructions (e.g., *The doll*$_i$ *is hard/tough to see t*$_i$).

Crosslinguistically, control constructions vary as to whether the subject or object of the verb in question controls the embedded PRO; some languages allow only subject control (e.g., Lango: NOONAN, 1985), while English allows both. While control appears fairly commonly across languages, some make only very restricted use of this construction (e.g., Albanian: NOONAN, 1985).

HORNSTEIN (1999) argues that the Minimal Distance Principle (which he reduces to the Minimal Link Condition) universally predicts that the closest c-commanding potential antecedent be the controller of PRO;[14] thus, intransitive verbs will have subject control (*Neil*$_i$ *decided PRO*$_i$ *to drink coffee*), while transitive verbs will have object control (*Neil*$_i$ *told Suki*$_j$ *PRO*$_{*i/j}$ *to drink coffee*). This indicates that transitive subject control verbs like *promise* are highly marked, a hypothesis which gains support from data in first (CHOMSKY, 1969) and second language acquisition (Courtenay, 1998; cited in DAVIES AND DUBINSKY, 2004) that indicates that subject control for verbs like *promise* is late to be acquired, if ever.[15]

Now that I have considered the syntax of raising and control and some theoretical issues surrounding them, I will turn to A-movement at large, a phenomenon of which raising is only one example. The main issue of concern here is what we know about the acquisition of A-movement in early child language.

[14] See also ROSENBAUM (1967).

[15] See also section 3.2.3.1, "Control in Child Language," below.

3.2 A-Movement in Child Language

Three types of A-movement (passive constructions, unaccusative verbs, and raising constructions) have been studied in child language. I will discuss each of these in turn.

3.2.1 Passives

3.2.1.1 Syntactic and Typological Description

In the GB framework, passive sentences such as (32b) below are generally assumed to derive from their active counterparts as in (32a).

(32) a. Suki ate the steak

b. The steak was eaten (by Suki)

Chomsky (1981) proposes that formation of the passive involves the following characteristics: [NP, S] does not receive a θ-role, and [NP, VP] does not receive Case within the VP. Jaeggli (1986) expands this description by arguing that the passive suffix *-en* absorbs[16] the external θ-role of the verb, such that this θ-role can no longer be assigned to the [NP, S] position. The passive suffix *-en* is also assigned the object Case of the verb, so that movement of [NP, VP] is actually forced by Case theory: the object NP must raise to get Case from tensed INFL. Promotion of the lower NP into that position is possible with respect to the θ-Criterion, since [Spec, TP] is no longer a θ-position. This means that the structure of (32b) is that in (33).

(33) a. The steak$_i$ was eaten t_i

b. e[-θ_{subj}, +Case] was eaten [+θ_{subj}, -Case] the steak$_i$

Jaeggli's account furthermore correctly predicts that clausal complements, which do not require Case in English, may appear in their unraised position with a concomitant expletive subject in passives, such as in (34).

(34) It was believed that Suki was a bad vegetarian

[16] Jaeggli defines the notion of absorption in the following way: a "passive suffix 'absorbs' the external θ-role of a predicate simply by being assigned that θ-role. Nothing more is involved."

3.2.1.2 Typology of Passives

KEENAN (1985) notes that passives play a more essential role in some grammars than in others, and that other languages lack passives entirely; furthermore, given that a language does have the passive, there appears to be a markedness hierarchy of what kind of passives appear. The most widespread are basic passives (e.g., *The espresso was drunk*): these have no agent (i.e., *by*-) phrase and are formed from a transitive main verb which (in the active) takes an agent subject and patient object. If a language has any passives at all, they will include basic passives. The following entailment relationships obtain: if a language has passives with agent phrases, they will have them without; if it has passives of stative verbs, it will have passives of activity verbs; and if it has passives of intransitive verbs, it will have passives of transitive verbs. Complex (i.e., non-basic) passives include passives of internally complex transitive verb phrases (35A), passives of non-transitive verbs (including the subjectless "impersonal passives," (35B)), passives of ditransitive verb phrases (in which the recipient or the location is passived, (35C)), and passives with non-patient subjects (35D) (examples from KEENAN, 1985).

(35) a. John was believed to be an imposter

(*believe to be an imposter* = TVP)

b. Es wurde gestern getanzt
It became yesterday danced
'There was dancing yesterday' (*German*)

c. Fred was given the book

d. Nanasan-DRasoa ny lamb any savony
washed-with-by-Rasoa the clothes the soap
'The soap was washed the clothes with, by Rasoa' (*Malagasy*)

3.2.1.3 Passives in Child Language

Of all the types of A-movement, the passive has been the most extensively studied in first language acquisition. As KEENAN (1985) implies, the passive is a marked construction in many adult languages; correspondingly, much of the initial research indicated that the passive was also late to be acquired. Naturalistic data from English (Horgan, 1978), French (Sinclair, Sinclair, and Marcellue, 1971; cited in Suzman, 1985), German (Mills, 1985), and Hebrew (Berman, 1985) has indicated that spontaneous full passives (that is, those with a by-phrase) are quite rare in child language until 4;0 at the very earliest (English, German), if not much later (e.g., 8;0 in Hebrew).

This relatively late acquisition prompted Borer and Wexler (1987, 1992)[17] to propose the *linguistic maturation hypothesis*;[18] according to this hypothesis, certain linguistic constructions in UG (including those involving A-chains, such as the passive) are not immediately available to the child, but rather mature over time, just as do secondary sex characteristics. Structures relevant to the passive are assumed to mature around the age of 4;0; before this age, the *A-Chain Deficit Hypothesis* (ACDH) posits that A-chains are ungrammatical for the child, and predicts that passives will therefore not appear in spontaneous speech. Data from a number of other studies, including experimental ones, have also been interpreted by various researchers as support for the maturation hypothesis (e.g., Horgan, 1978; Mills, 1985; Pierce, 1992a).

However, other researchers have suggested alternative accounts for the data which do not appeal to linguistic maturation. Specifically, a number of authors have proposed that naturalistic data may have been incorrectly interpreted. For instance, several authors (e.g., Crain and Fodor, 1993; Pinker et al., 1987) have pointed out that the corresponding scarcity of full passives in naturalistic adult speech is never interpreted as

[17]The earlier of these two papers (Borer and Wexler, 1987) proposes that pre-mature children have trouble forming A-chains of any kind. However, the widely accepted *VP-internal subject hypothesis* (among others, Koopman and Sportiche, 1991) – according to which all subjects are generated in [Spec, VP] and then raise to [Spec, TP], forming an A-chain – proved problematic for this formulation of Borer and Wexler's idea, since children seem to have no trouble with this type of subject raising (see also Fox and Grodzinsky, 1998; Köppe, 1994). Borer and Wexler (1992) relax their approach by claiming that the only problematic A-chains are those relating two potential θ-positions. These are the so-called "(subject, object)" (Babyonyshev et al., 2001) or "nontrivial" (Chomsky, 1995; Guasti, 2002) A-chains.

[18]This approach contrasts most noticeably with the *continuity hypothesis* of Pinker (1984).

a lack of grammatical knowledge, but instead as evidence that the passive is a marked construction. Furthermore, some experimental studies indicating late access to passives have suffered from methodological flaws.

Crain and Fodor (1993) suggest that in many cases, the actual cause for children's errors on experimental tasks is not a lack of linguistic maturity but rather the result of nonlinguistic cognitive demands, including sentence parsing, the planning of responses, and pragmatic presuppositions. This *nonlinguistic maturation hypothesis* proposes that experimental linguistic performance improves over time due to the maturation of these other cognitive abilities. Indeed, results from a number of other experiments have indicated at least partial, if not full, mastery of the passive by children younger than age 4. These results come from experimental designs that minimize nonlinguistic cognitive demands, provide felicitous pragmatic contexts for use of the passive, or even examine a language with a passive distinct in its characteristics from the English construction.

For instance, Borer and Wexler (1987) had specifically claimed that any passives which did appear in English-acquiring children's speech at this young age were not verbal (syntactic) passives, as described above, but instead adjectival (lexical) passives; the two are homophonous in English, but the latter involve no A-chain. Grimm (1973; cited in Mills, 1985) found evidence that seemed to support this proposal. Although German verbal passives differ from adjectival passives in their choice of auxiliary (i.e., *werden* vs. *sein*, respectively) and are thus not entirely homophonous, Grimm found that a common error in a repetition experiment was to replace *werden* with *sein*, which suggests that children perceive the two as similar, if not identical; this could be taken as support for Borer and Wexler's adjectival-passive hypothesis. However, Demuth (1989) reports acquisition of the passive by age 2;8 in Sesotho, a Bantu language in the Niger-Congo language family, which has verbal but no adjectival passive. Moreover, Eisenbeiss (1993) reports for German that in a picture identification task, children ages 2;0 and older chose the correct picture 90% of the time for verbal passives, and there was even a strong tendency (70%) for 2-year-olds to incorrectly interpret adjectival passives as verbal passives. Likewise, in an elicited production task, even children younger than 4 produced verbal passives. In light of these facts, it seems unlikely that all early passives are lexical rather than syntactic, and it may prove that experimental design is to blame for the discrepancy between Eisenbeiss's study and earlier claims about late acquisition of the passive in German. For instance, a sentence-imitation task like that used by Grimm may introduce non-linguistic cognitive demands of the sort discussed by Crain and Fodor, while a picture-identification task reduces the cognitive load. In short, extra cognitive demands may in the past have masked German-speaking children's true linguistic competence. Eisenbeiss's data, however, does indicate that the distinction between *sein* and *werden* passives is not fully adultlike at this young age, as the 2-year-olds showed a tendency to misinterpret adjectival passives as verbal passives in the picture-ID task. This result is especially noteworthy as it directly contradicts Borer and Wexler's claims that early passives are adjectival rather than verbal.[19]

The English passive has a second form, depending on its choice of auxiliary; *get* can replace *be* (cf. *The steak got eaten by Suki*). It has long been acknowledged that children produce *get*-passives before *be*-passives; experimental data (Crain, Thornton, and Murasagi, 1987; cited in Crain and Fodor, 1993) has indicated production of full get-passives by age 3, and naturalistic data (Snyder and Stromswold, 1997) shows spontaneous production of these passives without a by-phrase as early as 1;9. Fox and Grodzinsky (1998) convincingly argue that *get*-passives also include an A-chain and therefore provide evidence against the maturation hypothesis.

Production of the full passive including an agent *by*-phrase has been taken by many as the hallmark of total passive mastery on the part of children since Horgan (1978), and has in the past been assumed to be the last stage in passive acquisition. However,

[19]As a side note, Borer and Wexler (1987) did not conduct an experiment of their own, but rather reported on naturalistic production (e.g., Berman and Sagi, 1981, cited therein, for Hebrew) and experimental data collected by other researchers (e.g., for English, Maratsos et al., 1985; Horgan, 1978).

empirical results bearing on this issue have been mixed. As noted above, by manipulating the discourse context such that the most felicitous response was a passive including a *by*-phrase, Crain et al. (1987, cited in Crain and Fodor, 1993) were able to elicit such verbal passives from 29 out of 32 children as young as 3;4. In contrast, Fox and Grodzinsky (1998) tested children ages 3;6-5;5 using a truth-value judgment task, and found divided comprehension of full passives; children performed perfectly on actional *get*- and *be*-passives (*John got/was pushed by Mary*) and nonactional truncated (i.e., "short") passives (*The bear is seen*), but only at chance on nonactional full passives (*The boy is seen by the horse*).[20] The authors interpret these results not as a general problem with the passive, but instead as a problem interpreting the *by*-phrase itself. They propose that children have trouble with θ-transmission, the process by which a verb assigns an otherwise implicit, thematically unlimited θ-role through the passive *by*-phrase. In actional passives, the θ-role assigned by the verb is something akin to "affector," which the homophonous (non-passive) preposition *by* can itself also assign; children are able to interpret this prepositionally assigned θ-role. Meanwhile, in nonactional truncated passives, there is no *by*-phrase to interpret. However, when the θ-role assigned by the passive verb and transmitted via the *by*-phrase must be something other than "affector"—as, for example, in nonactional full passives—, the resulting interpretation by children is incoherent, and children's semantic interpretations of the sentence fail.

Other researchers have claimed that the lexical semantics of verbs are the cause of children's problems with the passive. Maratsos et al. (1985) used "who did it?" questions and a picture identification task to examine children's comprehension of physical action and mental state passives and found that children performed uniformly better on action passives (*Donald Duck is kicked by Batman*) than on mental passives (*Donald Duck is remembered by Batman*). The authors suggest that difficulty with mental verb passives stems from a general semantic constraint on children's analysis of the pas-

[20]Fox and Grodzinsky (1998) note that this same performance pattern was found in Maratsos et al. (1985).

sive, and they hypothesize that children may be using a gradient of semantic transitivity to determine which verbs may grammatically passivize. In an open-ended spontaneous production task, Pinker et al. (1987) likewise note that children robustly passivized canonical action verbs (those with agent subjects and patient objects), but were less willing to passivize "anticanonical" action verbs (those with agent objects and theme subjects).[21] Furthermore, children passivized nonactional verbs (*see*) less than actional verbs, and verbs of spatial relations (*suspend, contain*) were split, such that passivization of verbs with location subjects[22] occurred more often than of those with theme subjects. The authors propose that English verbs comprise three distinct groups: *canonical action* (universally passivizable), *anticanonical action* (universally nonpassivizable), and *non-actional* (passivizable by individual language, on a class by class basis). Children are sensitive to the group of "affectedness" constraints which define whether or not a nonactional can be passivized. Once they have picked up the thematic core of the passive, then canonical action verbs should be trouble-free, but nonactionals must be learned—class by class—based on positive evidence.

A significant majority of the aforementioned data has come from languages in the Indo-European family, but a growing body of evidence culled from children acquiring non-Indo-European languages indicates that much of the previously documented performance on passives is not a result of maturation (linguistic or nonlinguistic), but rather dependent on language-specific factors. As mentioned above, children acquiring Sesotho use full, short, and impersonal passives as early as 2;8. These alternate with active uses of the same verbs, indicating that the forms are not simply memorized (Demuth, 1989). Similarly, examining naturalistic production in child Zulu, Suzman (1985) found that

[21]None of these anticanonical action verbs exist in English, nor do Pinker et al. (1987) mention any language in which they do exist. Pinker et al. (following Marantz, 1982; cited therein) created and taught children artificial verbs for this category (e.g., *The dog floosed the giraffe*, meaning 'the giraffe leapfrogged over the dog').

[22]Both of these types of spatial relation verbs (location subject and theme subject) were, like the anticanonical action verbs, created by the researchers.

children produced routinized passive-form answers to passive-form questions shortly after age 2, and that children ages 2;7–3;2 used adversitive[23] passive forms not directly tied to adult input (although these were relatively rare). Likewise, although children acquiring Quiche Mayan use mostly active-voice sentences, they begin using both the passive and the antipassive[24] at age 2 (Pye and Poz, 1988). Interestingly, in a comparison with Pinker et al.'s (1987) data, Quiche children were shown to spontaneously produce at least 8 times as many passive forms compared to English children; these forms included nonactional and full passives (Pye and Poz, 1988). Moreover, in a picture-identification task testing 4- and 5-year-olds on comprehension of the active, passive, and agentive voices, Quiche children responded at chance to active sentences, which English children have no trouble with. Finally, Quiche children showed no effect of semantics on their comprehension of the passive; they performed equally well on both actional and nonactional passives. As a last example, spontaneous productive use of the passive, including both basic and complex passives, can be observed in child Inuktitut from 2;0 onwards (Allen and Crago, 1996).

The passive construction in each of these languages (Sesotho, Zulu, Quiche, and Inuktitut) is formally akin to that in English and other Indo-European languages; that is, each involves A-movement operating under similar morphosyntactic demands. As a result, it cannot be argued that Inuktitut- or Mayan-speaking children acquire the passive earlier due to the relative simplicity of the construction in their language (i.e., if there were no passive A-chain involved). Likewise, if children acquiring these languages show mastery of these forms at such a young age, it cannot be the case that A-movement only biologically matures after the age of 4.

What previously appeared to be a "delay" in passive acquisition by English-

[23] Suzman (1985, p. 135) describes these as "passives in which… someone… had something bad happen to them"; e.g., *iyanqunywa* 'it was slaughtered.'

[24] In Pye and Poz's (1988) words, "Antipassive constructions provide a means of emphasizing the role of the subject. In an antipassive the object is demoted to an oblique position or remains unexpressed" (p. 73).

acquiring children instead begins to look more like an artifact of the relative scarcity of the construction in the language-specific input; when the passive appears more often (as is the case in the non-Indo-European languages just considered), the acquisitional delay disappears. The implication here is that all children, given enough exemplars of the construction, have the potential to produce and comprehend passive constructions from a very early age, but that this ability is masked in the acquisition of languages in which exemplars of the construction are fewer and further between (see Newport et al., 1977, for a discussion of how input affects acquisition).

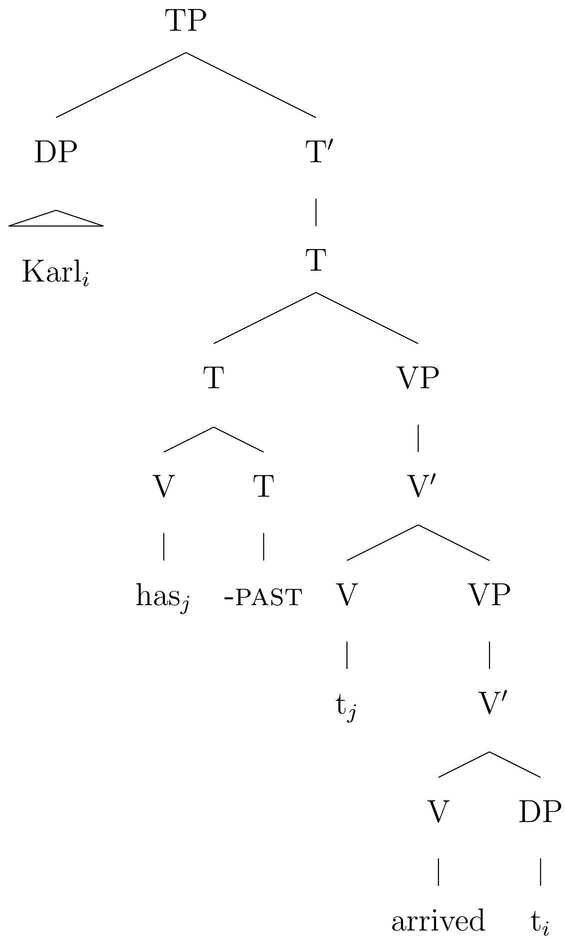
3.2.2 Unaccusatives

3.2.2.1 Syntactic Description

Unaccusative verbs are those intransitive verbs which assign only an internal θ-role; the argument generated in this object position then raises for Case reasons to [Spec, TP], where it is assigned nominative Case and acts as the subject of a sentence, including triggering agreement with the verb. Thus, a sentence like (36a) has a representation as in (36b) (Guasti, 2002).

(36) a. Karl$_i$ has arrived t_i

b.



Importantly, this promotion of the NP to [Spec, TP] involves the same type of A-chain as that found in passives. Unaccusative verbs in English include *arrive, come, go, remain, descend, climb, run, fall* (Burzio, 1986; cited in Guasti, 2002).[25]

3.2.2.2 Unaccusatives in Child Language

Unaccusatives provide a fertile testing ground for whether young children are able to perform A-movement; interestingly, these verbs appear to be acquired quite early. Snyder and Stromswold (1997) examined the CHILDES files for 12 children and found that the age of acquisition for unaccusative verbs (including *break, come, fall, go, grow,* and

[25]Unaccusative verbs contrast with unergative verbs, a second type of intransitive. Unergatives, which include such agentive verbs as *talk, shout, hide*, and *think*, differ from unaccusatives in that they project only an external θ-role and—crucially—involve no A-chain (Pierce, 1992b).

leave) ranged from 1;6–2;7 (mean age 2;1.3). Furthermore, all 12 children examined used unaccusative verbs before the passive.

As Guasti (2002) notes, if children do not form A-chains, they should either systematically avoid using unaccusatives in their speech, or else they should produce utterances in which unaccusative verbs appear with postverbal subjects and no subject-verb agreement (e.g., producing *run a dog* instead of *a dog runs*).[26] Snyder and Stromswold's data indicates that very young children do not avoid these verbs, and Guasti did not find the prediction of postverbal subjects to hold; her examination of Sarah's transcripts (ages 2;3–2;6) in CHILDES yielded 50 active declarative sentences with unaccusative verbs, and in 100% of the cases, the internal argument appeared in preverbal position.

Some children do appear to produce verb-subject (VS) utterances with unaccusative verbs (e.g., *come car, fall pants*), although this does not occur systematically within any child's grammar; moreover, postverbal subjects in child English are fairly rare overall, constituting less than 1% of utterances and apparently confined to a subset of verbs (Pierce, 1992b). Examining naturalistic data, Pierce (Pierce, 1992b; Déprez and Pierce, 1993) found that the overwhelming majority (61/76, or 80.3%, cited in Pierce, 1992b; 90% cited in Déprez and Pierce, 1993) of declarative VS utterances in child English occur with unaccusatives. Though the numbers are small, these occurrences do constitute evidence that (at least) English-acquiring children are analyzing unaccusatives in an adultlike fashion.

A further diagnostic for unaccusativity exists in the past-perfect tense auxiliary selection of certain languages. In these languages (including French, Italian, Dutch, and German), the general pattern is that auxiliary *be* occurs with unaccusatives, while *have*

[26]On the surface, Guasti's (2002) suggestion might be more plausible for a language like Italian, which allows post-verbal subjects. However, if we take the psychological reality of base-generation at face value, I see no reason to not expect similar constructions in child English.

occurs with unergatives.[27] Evidence also indicates that reflexive (but not non-reflexive) clitic constructions in French and Italian are unaccusatives; as a consequence, the auxiliary *be* must co-occur with reflexive clitics. Snyder et al. (1993) examined naturalistic, longitudinal data from CHILDES from one French- (2;1–3;3) and three Italian-acquiring (1;7–2;11) children for auxiliary choice with reflexive and non-reflexive clitics. None of the children overextended use of *be* to non-reflexive clitics, and all four children only very rarely overextended use of *have* to reflexive clitic constructions. If it is indeed A-movement which triggers use of auxiliary *be* in these participle constructions, then this data could indicate a very early mastery of A-movement with unaccusative verbs.

Similarly, Van Hout, Randall, and Weissenborn (1992; cited in Snyder et al., 1993), examined auxiliary selection in spontaneous speech for 2 children, one acquiring German, and one acquiring French, and found a pattern akin to that found by Snyder et al.; while the children initially overextended *have* to unaccusatives requiring *be*, they rarely overextended *be* to verbs that were not unaccusatives. Furthermore, the German child (1;9-4;0) used the correct auxiliary in more than 80% of the cases.

However, Babyonyshev et al. (2001) argue that linguistically pre-mature children using unaccusatives at early ages actually assign these verbs an unergative analysis. The authors tested this hypothesis with Russian-acquiring children (3;0–6;6) by using the Russian "genitive of negation" (GN) construction, in which the genitive case is preferred for nonspecific, indefinite direct objects (including unaccusative "objects" in subject position) appearing within the scope of negation; GN is also obligatory with a class of semantically bleached unaccusative verbs (e.g., existential *be*).[28] All other direct objects appear in the accusative case. The authors predicted that if A-chains are ungrammatical for children younger than 4, then GN used with unaccusative verbs should cause trouble

[27] French, German, and Italian are not completely isomorphic in this respect. For instance, while German and Italian use auxiliary *be* with the verbs *be* and *grow*, French uses *have*: cf. German *ich bin gewesen/gewachsen* 'I was/grew', Italian *sono stato/cresciuto*, but French *j'ai été/cru*.

[28] Other such verbs include those which similarly assert "existence, nonexistence, or presence at a location" (Babyonyshev et al., 2001, p. 14).

for them. The results from a sentence-completion paradigm were taken to confirm the authors' predictions; even children who correctly used GN in transitive contexts failed to produce it with unaccusative verbs at a greater than chance level. Furthermore, the older the child, the more likely they were to use GN with an unaccusative verb, and correct use of GN with unaccusatives generally entailed correct use of GN with other verb types. The authors took this as support both for the ACDH and for the hypothesis that children analyze unaccusatives as unergatives until A-chains mature.

It should be noted, however, that Babyonyshev et al.'s analysis of the data conflicts with Pierce's (1992b) observations of unaccusative subjects in their unraised, postverbal position, which indicate that young children do, in fact, analyze unaccusatives as such. Further research is needed to determine whether data that suggests that children maintain an unergative analysis for unaccusatives is language-specific or perhaps simply an artifact of experimental design.

3.2.3 Raising and Control

3.2.3.1 Control in Child Language

Guasti (2002) notes that the acquisition of control entails assembling several pieces of lexical and syntactic knowledge. The requisite lexical information includes the argument structure associated with a verb and which argument that verb selects to be the controller of PRO, while the necessary syntactic information includes the distinction between finite and nonfinite clauses, the relation of c-command, and the properties of pronominal elements. Different sets of data gathered on the acquisition of control in child language bear on distinct pieces of this lexical and syntactic knowledge.

In the first study of its kind, C. Chomsky (1969) provided evidence to support the hypothesis that some aspects of control might be acquisitionally delayed. Using an act-out task, C. Chomsky tested 40 children ages 5–10 to probe subject and object control on sentences with *tell* and *promise*. Stimuli sentences took the form of *Bozo tells/promises Donald to do a somersault; make him do it.* On the basis of response patterns, C. Chomsky posited the developmental stages in (37).

(37) *Stages in the acquisition of control* (C. Chomsky, 1969)

Stage 1: Child exhibits correct (object) control for PRO in *tell* sentences, but incorrect (object) control for PRO in *promise* sentences.

Stage 2: Child exhibits mixed (subject/object) control for PRO in both *tell* and *promise* sentences.

Stage 3: Child exhibits correct (object) control for PRO in *tell* sentences, but mixed (subject/object) control for PRO in *promise* sentences

Stage 4: Child exhibits adultlike control for PRO in both kinds of sentences (i.e., object control for *tell*, subject control for *promise*)

C. Chomsky explained the occurrence of these stages by arguing that the child knows the Minimal Distance Principle (Rosenbaum, 1967) in the first stage but does not know that *promise* is an exception to this principle. In the second (transitional) stage, the child realizes that there are exceptions to the MDP; this realization causes a breakdown in the previous uniformity of *tell*-type sentences. In the third stage, the child's uncertainty is reduced and the child returns to adultlike control in *tell* sentences while lacking consistency in *promise* sentences. Finally, in the fourth stage, adultlike compentence is reached across the board. C. Chomsky further notes that adultlike compentence did not appear to be linked to age, since children reached Stage 4 between the ages of 5;2 and 10;0.

A number of studies since C. Chomsky's initial experiment have probed the acquisition of control, and three noteworthy hypotheses attempt to explain the data. Guasti (2002) refers to these hypotheses as the *structure-changing hypothesis*, the *maturation hypothesis*, and the *lexical-syntactic integration hypothesis*; I will discuss each one in turn.

McDaniel et al. (1991) and Cairns et al. (1994) (hereafter MCH for both papers) propose that developmental changes in the acquisition of control are linked to a changing structural representation for embedded complement and adjunct clauses. The authors used both act-out and grammaticality judgment tasks (both cross-sectionally and longitudinally) to test children on their interpretations of the coreferent of PRO in control sentences. Given their experimental results, they argue for a sequence of developmental stages reminiscent of C. Chomsky's, as discussed above. MCH identified the G(rammar) T(ypes) in (38).

(38) *Stages in the acquisition of control* (McDaniel et al., 1991; Cairns et al., 1994)

GT IA: Children allow arbitrary (subject, object, or external) control for PRO

GT IB: Children have adultlike (object) control in complements but arbitrary control in adverbial adjuncts[29,30]

GT II: Children exhibit obligatory object control for adverbials

GT III: Children allow object or subject control for adverbials

GT IV: Children exhibit adultlike competence throughout (i.e., object control in complements, subject control in adverbials)[31]

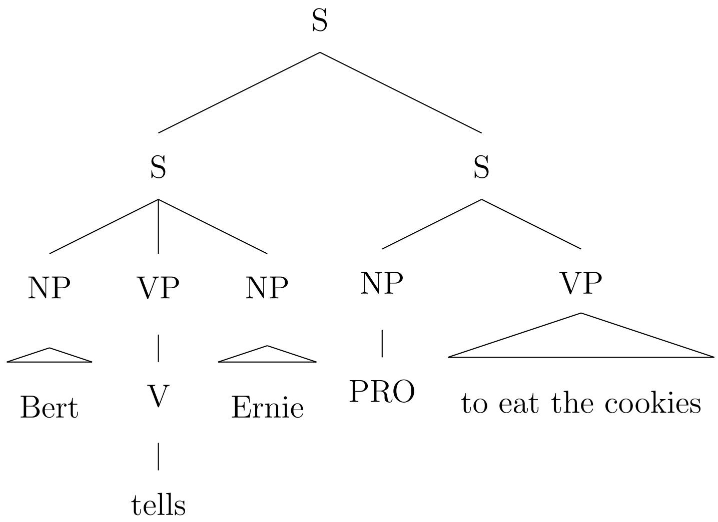
MCH claim that the data can be explained by assuming that PRO and the control principle are always present (consistent with Pinker's (1984) Strong Continuity Hypothesis), but that embedded clauses are initially coordinated, rather than subordinated. That is, in contrast with the adult structure for a sentence like *Bert tells Ernie to eat the cookies*, children represent the sentence as in (39) below (from McDaniel et al., 1991).

[29]Complements include structures like *Bert tells Ernie [PRO to eat the cookies]*, while adverbials include those like *Bert pats Ernie [before PRO eating the cookies]*.

[30]Adultlike competence in complements is maintained throughout the remaining GTs.

[31]McDaniel et al. (1991); Cairns et al. (1994) also indicate the possible existence of a GT IV', in which adultlike competence is exhibited in all adverbials save those beginning with *in order to*.

(39)



Since such a structure includes no c-commanding NP which could possibly control PRO, reference is arbitrary, and the controller can be either internal or external to the sentence itself. The child moves from GT IA to IB by beginning to subordinate complements and attach them at VP; in GT II adverbials are subordinated but mistakenly attached at VP, like complements, rather than at S, as in the adult representation. GT III is assumed to be a transitional stage, in which adverbials are attached alternately at VP or at S, and at GT IV the adult attachment site for adverbials is consistently represented.

Wexler (1992; also Broihier and Wexler, 1995) argues against MCH's developmental stages account, instead positing that only two stages—free interpretation of PRO and adultlike control—exist in acquisition, due to the fact that PRO is subject to UG-Constrained Maturation. During the free interpretation stage, PRO is unavailable to the child; Wexler follows Carlson (1988; cited in Wexler, 1992) in assuming that during this stage, the child instead assigns a nominalization representation to embedded clauses, such that a sentence like *The children enjoyed [PRO singing the songs]* is instead represented as *The children enjoyed [the singing of the songs].* Since a nominalization involves no control, children are free to interpret the "subject" of the embedded clause as any sentence-internal or -external referent. Wexler argues that the nominalization account is supported both theoretically, since it adheres more closely to Strong Continuity, and empirically, since children will extract out of a matrix clause, as in *Who*$_i$ *does Ernie tell* t_i *to jump over the fence* (which would be impossible given a coordinated structure).

If PRO is subject to maturation, then why does adultlike control in complements appear before that in adjuncts? Wexler proposes that young children also lack the type of empty temporal operators which must appear in *before* and *after* adjuncts to obtain temporal information from the matrix clause; this deficit is hypothesized to be part of a larger *Constraint on Transference* of features to an A'-position (for details, see Wexler, 1992). As a result of this deficit, the nominalization of adjuncts persists even after clausal representations have been assigned to complements, and adultlike competence for control in adjuncts will appear once these temporal operators have themselves matured.

Broihier and Wexler (1995) provide some experimental support for the claims made in Wexler (1992). The authors used a truth-value judgment task with 14 children (ages 3;10–5;5) and explicitly probed for the existence of an obligatory object control phase—the existence of which would support MCH's account over their own. However, while they found some object control among the 8 non-adultlike responders, they did not find any greater preference for this above subject control, nor any uniform rejection of subject control, contra C. Chomsky's (1969) initial results. Moreover, object and sentence-external control were roughly equal among subjects, with 4 of the 8 children showing a preference for external control. The authors argued that this data supports the existence of a free interpretation pattern, and therefore only two grammar types: non-adult and adult.

Cohen Sherman and Lust (1993) provide an account for the acquisition of control which hinges crucially on the integration of a complex of lexical and syntactic properties, including constrained distribution and interpretation, and locality/minimality. The authors object to the fact that previous studies indicating children's poor performance on control structures have only focused on one aspect of control knowledge, namely the choice of an antecedent in the interpretation of PRO. More important, they argue, are the syntactic (rather than semantic/interpretive) aspects of control, since these are hypothesized to be determined by UG.

Cohen Sherman and Lust present the results of two experiments (from Sherman, 1983; cited therein) with children ages 3;0–7;11, which bear on the modular components of the knowledge of complement control. An elicited imitation task indicated that children knew the distribution of PRO and the embedding (i.e., subordination) properties of control sentences; nearly all changes from a lexical pronoun in the target sentence to PRO in the child-produced sentence were accompanied by changes from tensed to untensed verbs, and vice versa. In contrast, 62% of errors in the imitation of coordinate sentences involved changes in the proform type alone (that is, changes between a lexical pronoun and null argument) and not the tense marking. Furthermore, while children made more errors on *promise* infinitivals than on *remind/tell* ones, they made fewer errors on *promise* finite complements than *remind/tell* ones, indicating a distinction in the lexicon (even if only a nascent one) between these verbs.

An act-out task allowed a test of minimality vs. linear interpretation strategies in PRO structures by contrasting children's tendency to choose the matrix object as the controller of PRO with their tendency to choose the matrix object as the antecedent of pronouns in finite embedded complements. When a pragmatic lead like *This is a story about John/Tom* was given, even the youngest children more frequently picked an antecedent related to the lead as the referent for ambiguous lexical pronouns like *John told Tom that [he] will leave*; however, such a lead did not bias the children's interpretation of PRO (for which they more frequently chose the object as antecedent; e.g., *John told Tom [PRO] to leave*). These results indicate a structure-dependent principle for the interpretation of PRO. Furthermore, while children did sometimes give evidence of object control for *promise*, all children also showed some subject control for this verb; subject control for *promise* reached statistical significance after age 7.

Cohen Sherman and Lust propose that children's problems with control lie not in lexical or syntactic shortcomings, but instead in the ability to integrate these developmentally independent modular components of control-relevant knowledge. Syntactic constraints (e.g., minimality) may occasionally override lexical knowledge (e.g., the fact that *promise* exhibits subject control), when in fact the opposite needs to happen. Integration of these two components in accord with language-specific properties may simply take time, especially when lexical and syntactic principles conflict.

Using naturalistic rather than experimental data, Goro (2004) found that subject control desiderative predicates (e.g., *Neil wants to go*) were frequent even for very young children. Goro also discovered that children dropped the infinitival *to* more often when the embedded clause had an overt subject (i.e., object control: *Neil wants Louise to go*) than when it had an empty subject (i.e., subject control: *Neil wants PRO to go*); this type of omission disappears around age 3. The author suggests that these young children had a French-type grammar, in which ECM is only allowed into small clauses. Thus, English-acquiring children of this age are hypothesized to have a small clause structure for sentences like *Neil wants [$_{SC}$Louise (to) go].*

3.2.3.2 Subject Raising in Child Language

In contrast with the wealth of investigations into the acquisition of control, very little work has been done to examine the acquisition of raising-to-subject constructions in child language, and the vast majority of the work that has been done has been limited to child English.

Hirsch and Wexler (2007) analyzed the naturalistic child-directed speech in the files of 1051 children in CHILDES and—based on 448 analyzable, non-repetitive utterances containing the raising verb *seem*—calculated that a child hears a unique sentence with seem every 1700 utterances.[32] At this rate, the child will have heard 4500

[32] This should be considered in light of the fact that children hear an average of 7000 utterances per day (Cameron-Faulkner, Lieven, and Tomasello, 2003; cited in Hirsch and Wexler, 2007).

sentences with *seem* by age 3. Of the adult utterances examined, 87% occurred with raised, non-expletive subjects. In contrast, young children themselves rarely produced similar sentences; 66% of the 33 total, non-repetitive utterances including *seem* found by Hirsch and Wexler were produced by children older than 5 years of age, and only 64% of those utterances (i.e., about 21) had raised subjects. All utterances from children younger than 6 involve small-clause adjectival complements (e.g., *Suki seems thirsty*), while 8 of the 9 utterances produced by children older than 6 had verbal complements (*Suki seems to like coffee*).

To investigate the acquisition of raising, Hirsch and Wexler (2007) gave children ages 3 to 9 a picture choice task for transitive-active sentences, sentences with *think* and a finite clausal complement, sentences with *seem* and an expletive subject (i.e., "unraised" structures), and sentences with *seem* and a raised subject. The authors found that children had little trouble with *think*- and unraised *seem*-sentences but failed on raised *seem*-sentences by systematically selecting the picture in which both the experiencer and the agent had been reversed; this trend only declined after age 7. Hirsch and Wexler concluded that children analyze the verb in raised *seem* sentences to mean *think*; they take this as support for the *Universal Phase Requirement* (i.e., "*v* defines a phase, whether or not *v* is defective"), which, they posit, holds of linguistically pre-mature children until age 7.[33]

Based on the syntactic distribution of expletive subjects, Icelandic quirky case marking, and passivization of embedded objects, Wurmbrand (1999, 2001) argues that in Germanic (specifically German, but English to some extent as well), both epistemic and deontic modal constructions[34] are raising constructions, a proposal which contrasts with

[33]The notion of phases will come into play again, though in a very different way, when we consider children's performance on the embedded passive task presented in Chapter 5 and on the sentence judgment tasks presented in Chapter 7.

[34]To sum up the distinction: epistemic modality expresses how the speaker perceives the world to *currently* be, while deontic modality indicates how the speaker believes the world *should* be.

the traditional assumption that deontic modals are control constructions. As evidence, she illustrates (1) that modals can co-occur with expletive subjects, (2) that they do not block the assignment of quirky case to a subject from an embedded verb, (3) that their subjects show a high/low scope ambiguity, and (4) that embedded objects can take scope over their surface subjects. Furthermore, (5) in German, only verbs that assign an external θ-role (i.e., transitives and unergatives) may be passivized; the fact that modals may not grammatically passivize indicates that they do not assign an external θ-role. Finally, (6) when a verb embedded under a modal is passivized, that verb's object becomes the surface subject of the modal; this transformation is not allowed by control verbs. If Wurmbrand's analysis is correct, and if there were some evidence that German-acquiring children produced modal verbs at a young age, then this might constitute evidence on the timing of acquisition of raising constructions.

Indeed, some such evidence does exist. First, Becker (1998) examined the spontaneous production of six German-acquiring children during the root infinitive (RI) stage (ages 1;11 to 2;9, depending on the child), and found that all of the children produced deontic (but not epistemic) modals during this stage, from as young as age 2;2. Clahsen et al. (1993/1994) also examined naturalistic data from 7 children (1;8–2;9) acquiring German and found that 5 of the children produced finite modal verbs by Stage I (MLU ≤ 1.75, the earliest stage of syntactic development), and that all 7 used them by Stage II (MLU > 1.75). While this data does not directly bear on the acquisition of raising verbs like *scheinen* ('seem'), it is still evidence worth considering.[35] Further research might examine the acquisition of these modals by English-acquiring children to see if they parallel German children in the early production of these putative raising verbs.

In contrast with Hirsch and Wexler's conclusions from spontaneous production, Becker (2005, 2006) found in a truth-value judgment task that children ages 3 and

[35] Pinker (1984) likewise groups the modal verbs in with other raising-to-subject predicates, including auxiliaries and catenatives (i.e., verbs capable of linking with a following dependent verb, e.g., "go [shopping]").

4 correctly interpret raising sentences like *The dog seems to be purple.* In fact, children actually seem willing—if not biased—to assume a raising as opposed to a control structure given an ambiguous syntactic frame that could accommodate either (e.g., *Janine gorps to eat sushi*).

Based on experiments with adult English speakers, Becker posits that rather than a single trigger, a cluster of probabilistic cues may be responsible for the assignment of a verb to a particular category, or for the analysis of a given string as a raising or control structure. Results indicate that animacy of the subject and eventivity of the lower predicate tend to bias speakers towards a control interpretation of a novel verb in an ambiguous string, while expletive subjects distinguish pure raising and ambiguous verbs from pure control verbs. On the other hand, monoclausal frames separate pure control and ambiguous verbs from pure raising verbs. Becker notes that the learning strategy she proposes does not detract from the argument from the poverty of the stimulus; in order to make use of these cues, learners must still bring UG knowledge (including the assumptions of (a) the θ-Criterion and (b) empty categories like NP-trace and PRO) to the acquisition task.

3.2.3.3 Raising-to-Object in Child Language

The acquisition of raising-to-object constructions has been as ignored in the literature as much as (and possibly more so than) the acquisition of raising-to-subject structures. Goro (2004) examined the naturalistic speech of three English-speaking children ages 2;3–3;2 in the CHILDES database (Adam and Sarah, in Brown, 1973; Abe, in Kuczaj, 1976), and reported finding no ECM complements of the type *John believes Bill to be a genius.* Further evaluation (both naturalistic and experimental) is clearly necessary to determine how children handle RO/ECM structures during acquisition.

3.3 Introductory Conclusions

In short, more research in the area of acquisition of raising is necessary, especially to contrast the acquisition of RO structures with that of OC.

The evidence to date—though certainly not free from controversy—suggests that even very young children have no trouble with A-movement *per se*. This would lead us to predict that they should have no trouble with the raising in RO constructions, though they might be stumped by other issues (e.g., processing and working memory issues related to a long utterance length and/or number of NPs/θ-roles). Meanwhile, the data on the acquisition of control (and in particular, of OC) indicates that children have relatively little difficulty with this construction.

But the question remains as to how children deal with RO and OC as separate verb classes which share a surface string. How and when are children able to distinguish between these two surface-identical strings? How do children assign a novel (ambiguous) verb to one class or the other? And what can this data tell us about (1) verb learning in general, and (2) the debates on innateness and modularity?

Chapter 4

Experiment 1: Spontaneous Data

To my knowledge, spontaneous production of RO and OC verbs in English has not been examined in either adult or child speech. This state of affairs leaves a number of questions unanswered. How do speakers use these verbs? What does caretaker input look like? Do children use these verbs as well? And if so, how do children's productions compare or contrast with those of adult speakers?

4.1 Data Collection

In order to assess the usage of RO and OC verbs in spontaneous production, all English (USA) corpora in the CHILDES database (MacWhinney and Snow, 1985) were searched for uses of *want*, *need*, *ask*, and *tell*. These four verbs were chosen for several reasons. First, they were relatively likely to have made up part of the input accessible to young children, especially when compared to RO verbs like *believe* and *presume* (*Neil believed/presumed Louise to drink coffee*), and OC verbs like *expect* and *persuade* (*Neil expected/persuaded Louise to drink coffee*). Second, as noted in Section 3.1.3 above, W-verbs may not participate in the full range of behaviors that B-verbs do, and therefore may not be the best exemplars of raising predicates. However, *want* patterns with the raising predicates in all the behaviors that I planned to test in the experimental portion of this research.

Because I searched for only these four verbs, though, it is impossible to know how many other RO and OC utterances may have been excluded from the searches detailed below because they contained other RO/OC verbs. Future research should examine the spontaneous production of other RO and OC predicates.

I performed CLAN searches to isolate these four verbs appearing in the frame "VERB * to" (where * is a "wild card" search term which returns any number of lexical items, including zero). Child and adult speaker tiers were searched and analyzed separately.

Utterances returned by this search were then examined by hand and discarded if they fit any of the following criteria:

(40) a. Contained a subject raising or subjct control construction (*I want to play this one* (gina))

b. Contained a different infinitival-*to* construction: e.g., purpose constructions (*you need more blocks to make the building?* (nina36)), reduced relatives (*go ask Princess Leia what to do* (boys40)), other (*I want some tops to it* (adam23), *I want something to eat* (abe057))

c. Contained unintelligible elements which were related to (and thus obscured) the RO/OC construction (*I want the daddy to xxx* (peter20))

d. Questioned the embedded subject (*who do you want to win?* (boo))

e. Otherwise did not match the form of canonical, declarative RO/OC constructions (*I don't want to you do on your toes* (abe013), *(be)cause they want napkins # napkins to waters* (nina55), *you have to tell # to open* (cottont))

Those utterances which contained an elided embedded clause (*I don't want him to* (nina44)) were not included in this analysis, although they were examined separately.

All remaining child utterances for all four verbs, as well as adult utterances for *need, ask,* and *tell*, were retained for analysis. However, as the original search returned over 6000 adult utterances for the verb *want*, these items were also selectively culled. Utterances appearing on the MOTher, FATher, and INVestigator tiers were pulled from the original search (2987 total utterances), and then every 10^{th} utterance was selected for examination. Henceforth, the utterances returned from the original search will be referred to as the *full corpus*, whereas those utterances selected for analysis as just described (i.e., all child utterances, and all adult *need, ask, tell* plus the selected *want* utterances) will be referred to as the *reduced corpus.*

4.2 Corpus Size

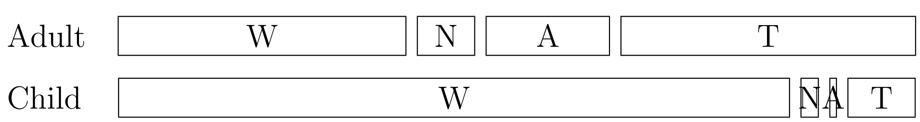
After culling the original search output as described above, the remaining data yielded a reduced corpus of the following size and shape:

Table 4.1: "Reduced" Corpus: Tokens by Speaker and Verb

Speaker	*want*	*need*	*ask*	*tell*	Total
Adult	297*	60	128	304	789
Child	689	19	9	70	787

*Reduced from 2987 in full corpus

Table 4.2: "Reduced" Corpus: Proportion by Verb



W(ant) – N(eed) – A(sk) – T(ell)

Notice that the total number of utterances for each speaker group is remarkably similar, although the utterances are distributed across verbs very differently for the child and adult groups.

In terms of the full corpus, the verbs from most to least frequent are *want, tell, ask, need* for adults and *want, tell, need, ask* for children.

4.3 Analysis

Since no previous corpus studies have been conducted to examine the spontaneous use of RO and OC verbs, it is impossible to know what form these utterances tend to take. To get the most out of an experimental research agenda like the one presented in later chapters here, the test stimuli must be crafted with an eye to the normal uses of such verbs.

With this eventual goal in mind, utterances in the reduced corpus were coded for each of the following:

(41)
a. Matrix subject type (lexical NP, pronoun,[1] name, null)
b. Embedded subject type (lexical NP, pronoun, name)
c. Question (*Do you want me to smash it down?*)
d. Imperative (*Ask me to spell another word*)
e. Null subject/aux (*Want mommy to write your name?* or *Ask Mommy to read it*): includes questions and imperatives
f. *I* or *you* matrix subject (*I/you want Mommy to read it*)
g. Matrix negation (*We don't need you to rattle our cages*)
h. Embedded passive (*I didn't want my hand to be holded*)
i. Embedded expletive (*I want it to snow and I sled*)
j. Full lexical NP embedded object (*Would you ask Mommy to give me [some juice]?*)
k. Past tense (e.g., *wanted, didn't need, asked, did tell*)

Examining these utterances for things such as subject type, cooccurrence with negation, and appearance in questions, imperatives, or the past tense gives us an idea of the forms that make up children's input. Moreover, since RO and OC behave differently in terms of their syntactic and semantic restrictions on the embedded clause, it was important to examine whether (and to what extent) embedded passives and embedded expletives appear in the input.

[1]Pronouns include personal pronouns, demonstratives, and words like *some[body], any[thing],* etc.

4.4 Results

Some usage trends are evident in both adult and child utterances containing the verbs in question. All the verbs are used primarily with pronoun subjects (both matrix and embedded), appear overwhelmingly in present tense (86.7–100% by verb and speaker) appear in questions and with matrix negation, and only very rarely appear with embedded passives or embedded expletives.

4.4.1 Comparative Results Across Age Groups

Several interesting comparisons and contrasts between the adult and child data results can be made. The following tables represent percent use of each feature in the reduced corpus for each verb, by speaker type (i.e., adult vs. child).

Table 4.3 shows the appearance of features appearing in RO utterances, separated by verb (*want, need*) and speaker type.

Table 4.3: Percent Use of Features by Verb and Speaker: RO Verbs

Verb	*want*	(Tokens)	*need*	(Tokens)
Feature	Ad (297)	Chi (689)	Ad (60)	Chi (19)
Matrix subj pron	83.8	86.9	91.7	100.0
Question	71.4	27.7	16.7	5.3
*Imperative	–	–	–	–
Null subj/aux	14.8	11.0	1.7	–
Matrix *I* subj	18.9	64.4	38.3	78.9
Matrix *you* subj	61.6	18.6	28.3	–
Matrix negation	15.5	19.4	46.7	36.8
Embedded passive	1.0	1.6	–	–
Embedded expletive	–	0.4	–	–
Embedded NP obj	35.4	31.6	30.0	10.5
Past tense	1.3	3.6	–	10.5

Note that RO verbs cannot grammatically appear in imperatives (**want/need her to make dinner!*). As we can see in Table 4.3, both adults and children respect this restriction.

Table 4.4 shows the appearance of the same features appearing in OC utterances, separated by verb (*ask, tell*) and speaker type.

Table 4.4: Percent Use of Features by Verb and Speaker: OC Verbs

Verb	*ask*	(Tokens)	*tell*	(Tokens)
Feature	Ad (128)	Chi (9)	Ad (304)	Chi (70)
Matrix subj pron	71.9	66.7	45.4	44.3
Question	27.3	22.2	22.7	7.1
Imperative	19.5	11.1	47.4	45.7
Null subj/aux	22.7	22.2	49.3	41.4
Matrix *I* subj	30.5	55.6	14.5	18.6
Matrix *you* subj	46.1	11.1	20.7	17.1
Matrix negation	7.8	11.1	10.9	17.1
Embedded passive	–	–	–	–
*Embedded expletive	–	–	–	–
Embedded NP obj	35.2	66.7	28.6	35.7
Past tense	13.3	11.1	11.5	12.9

Recall that OC verbs cannot grammatically embed expletives (**she asked/told there to be a knock at the door*). As we can see in Table 4.4, both adults and children respect this restriction.

As noted, both similarities and differences can be seen between adult and child speakers. Both adults and children produce utterances with roughly the same percentages of matrix subject pronouns, null subject/aux (i.e., question or imperative), matrix negation, and past tense for all verbs. In fact, the appearance of these features often fell within the same 5% range for both adults and children. Likewise, all verbs appeared in declaratives, questions, with negation, and with embedded lexical NP objects, for both adults and children. Pronoun matrix subjects were extremely common overall, while embedded passives and expletives were very rare, and only appeared under *want*.[2] Finally, both adults and children respected limitations on RO verbs in imperatives and OC verbs with embedded expletives: these constructions were not produced by either group.

However, there were a few differences between the adult reduced and child corpora. First, children used far more matrix *I* subjects than adults, while adults had far more

[2]This phenomenon may be due to the comparatively large number of *want* utterances in the data.

you subjects than children. This effect is likely a simple reflection of parents' child-focus and children's 'egotism' (in the colloquial, and not the Piagetian, sense). This same phenomenon is probably also the reason that adults were seen to produce more questions than children, especially with *want, need* and *tell*. Another difference is that children used more embedded passives than adults, contrary to what might be expected, given the complexity (and as a result, the markedness) of such a construction.

Embedded expletives were rare overall. Children produced all the embedded expletives appearing in the reduced corpus, and there were only 3 such utterances produced by adults in the full corpus. All 3 expletives were embedded under the RO verb *want*.

It should be explicitly noted that children's productions of *need* and *tell* were few and far between in the corpus. Any results found here should be interpreted with this scarcity in mind.

4.4.2 Rare Constructions: Embedded Passives

Data from this section were taken from the full corpus.

It was noted above that embedded passives and expletives were extremely rare in the full corpus in both children's and adults' speech, and that all those that were produced were embedded below *want*.

Adults' embedded passives included both *get* and *be* passives, although *get* passives were much more frequent (11/13 utterances). There were relatively few of these constructions overall; all embedded passives produced in the full corpus appear in (42).

(42) Adults' embedded passives (filename)

a. *you want him to be fired?* (07a)

b. *we don't want you to get burned* (abe011)

c. *we don't want you to get cut* (abe073)

d. *we don't want the bed to get broken* (abe076)

e. *because I don't want it to get lost* (abe112)

f. *I don't want you to get hurt* (april05)

g. *I don't want you to get sunburned* (boys60)

h. *we don't want him to get hurt (be)cause he's one of our friends* (boys70)

i. *I don't want you to get hurt, babe* (f1-1206)

j. *and she doesn't want you to get bit, by a snake* (george)

k. *want it to be covered?* (ref)

l. *she doesn't want you to get hurt* (s1-1029)

m. *we don't ### want you to get your fingers caught* (t1-1016)

The rarity of this construction in adult speech is even more pronounced when we consider that *get hurt* may be an idiom rather than an actual grammatical passive. Over a quarter (4/13) of the above utterances include *get hurt*.

Children's embedded passives similarly included both *get* and *be* passives, with *get* passives only slightly more common (6/11).

(43) Children's embedded passives (filename, age)

a. *I didn't want my hand to be holded* (abe060, 2;11.30)

b. *I don't want this to be cut* (abe105; 3;5.29)

c. *I don't want this to be thrown away* (abe112, 3;6.22)

d. *I don't want the bird to get eated* (adam34, 3;7.07)

e. *I don't want my stick to be hit* (boys31, 2;11)

f. *I don't want Marky to get spanked* (boys55, 4;9.20)

g. *Mark do you ever want us to get this things to get done* (boys69, 6;0.02)

h. *I don't want you to get hurt either* (chj, 4;6–5;0)

i. *I want uhm [:them] to be pulled [!]* (gas, 4;6–5;0)

j. *I want the story to get listened to* (mig, 4;6–5;0)

k. *hey do you want her to get fired from her job* (third, 8;0)

Although embedded passives are rare in child speech, children's productions make use of some unusual kinds, when we consider KEENAN's (1985) typological work. For instance, while basic passives are the most common, we also see a passive into an oblique (43J).

Similarly, non-adultlike forms like (43D) suggest that children do actively form passives syntactically, rather than adjectivally, as BORER AND WEXLER (1987) has suggested.

Full *be*-passives (i.e., those including a *by*-phrase) embedded under verbs other than *want, need, ask*, and *tell* were also examined in the full corpus. These were identified by a CLAN search for "be * by", and were then examined by hand; utterances which met the search criteria but were not passives were discarded (e.g., *but I (woul)d like it to be right there by you* (21_1a)). Finally, the utterances were separated into two groups: adult (i.e., speakers ages 6;0[3] and over), and child.

Adults' other embedded passives appear in (44). For those produced by children ages 6;0 and over, the age of the speaker is included. Children's embedded passives appear in (45). Those passives that were read aloud/sung (rather than creatively generated) are marked with an asterisk.

(44) Adults' other embedded passives (filename[, age])

a. *I do n(o)t like to be jerked around by you* (24_3c)

b. *I command Mark to be hypnotized by me* (boys70; 6;0.27)

c. *and he wanted to be called by Rescue nine-one-one* (inamt5, 7;5.08)

d. *I wanna be loved by you but not only you** (j1-1115)

e. *I wanna be loved by you but** (j1-1115)

f. *would I like to be blood sucked by a bat?* (kao)

g. *I certainly would not like my blood to be sucked by a bat* (kao)

[3] This age was chosen as a cut-off point, as most research has indicated that English-acquiring children have mastered the passive construction by this point. See Section 3.2.1.3 above for details.

h. *now the dishes have to be done by all those under twenty* (mim)

i. *I wouldn't like to be stepped on by an elephant* (nina39)

(45) Children's other embedded passives (filename, age)

a. *I wish that Joey would be beat up by Mister T* (boys90, 5;6.24)

b. *would you like your blood to be sucked by a bat?* (kao, 4;6–5;0)

c. *you wanta be bit by a snake?* (nedima, 5;2)

It should be noted that several of these include either subject control *want* (*and he wanted to be called by Rescue nine-one-one*, *you wanta be bit by a snake?*) or RO *like* (*would you like your blood to be sucked by a bat?*); thus, these utterances form part of the input that children are likely to exploit in their acquisition of the verb classes under consideration in this research.

4.4.3 Rare Constructions: Matrix Passives

Data from this section were taken from the full corpus.

To serve as a point of comparison for embedded passives, both children's and adults' productions of full matrix *be*-passives (i.e., those including an agent *by*-phrase) were examined.

These utterances were collected using the same technique described in Section 4.4.2, with the exception that the original CLAN searches were conducted to select utterances containing "am/are/is/was/were/be * by" (with a separate search conducted for each verb form). Matrix passives included passives in all tenses, as well as those co-occurring with a modal (e.g., *could be broken, going to be written*).

Utterances were discarded if they met any of the following criteria: the utterance was a fragment (*and your cat is frightened by your +...*, *was eaten by a mouse*); the utterance contained unintelligible elements which were related to (and thus obscured) the passive construction (*and the other one was kissed by xxx*); the passive was read, sung, or immediately imitated by the child (*the magic spell of sleeping death could be* *broken only by love's first kiss*); the passive was obviously adjectival (*Piglet was entirely surrounded by water*) or idiomatic (*when I was taken by surprise*[4]).

Adults' matrix passives, while still fairly rare, are too numerous to list here; these appear in Appendix A. Children's matrix passives appear in (46).

(46) Children's matrix passives (filename, age)

a. *no a monarch butterfly was killed by a bird* (abe118, 3;7.21)

b. *I heared that man say he was never bitten by that snake* (abe128, 3;8.23)

c. *the dinosaur was eaten by the alligator* (abe130, 3;9.0)

d. *Elsa could have been shotten by the hunter right?* (abe190, 4;8.0)

e. *no but a lot of the buildings are surrounded by mice* (abe193, 4;8.14)

f. *your father was killed by a trecher of mine* (boys47, 3;11.30)

g. *Artoo and Three-Pee-O were soon picked up by Jawas* (boys47, 3;11.30)

h. *I'm putting my bike in here so it won't be taken by the burglars* (boys53, 4;6.01)

i. *the candy was eaten by the ewok* (boys77, 4;8.02)

j. *the cat was chased by the dog* (boys77, 4;8.02)

k. *silly putty is made by eggs* (ded, 4;6–5;0

l. *his horse is killed by men* (ethmt3, 5;7.02)

4.4.4 Rare Constructions: Embedded Expletives

Data from this section were taken from the full corpus.

Embedded expletives were even rarer in spontaneous production than were embedded passives. There were only 3 adult utterances in the full corpus which included an unambiguous embedded expletive, and these comprised only weather predicates.

[4] This criterion excluded one passive that was obviously actively generated by the child, since it was nonadultlike: *I was tooken by surprise* (jub, 4;6–5;0).

(47) Adults' embedded expletives (filename)

a. *you do want it to snow?* (abe030)

b. *that's why you want it to snow?* (abe030)

c. *could [//] maybe you could shut that window though because I don't want it to be too cold* (davtp2)

Children's embedded expletives were similarly rare, and included only weather predicates. It is also important to note that no child incorrectly embedded an expletive under *ask* or *tell*.

(48) Children's embedded expletives (filename, age)

a. *I want it to be warm* (nina50, 3;2.04)

b. *I don't want it to be hot # so open up your window* (boys43, 3;7.03)

c. *I want it to snow and I sled* (abe030, 2,8.14)

In short, embedded passives and expletives, though produced rarely by both child and adult speakers, are only (correctly) produced with RO verbs, and never under OC verbs, which would be ungrammatical.[5]

4.5 Other Constructions of Interest

Several constructions found in the full corpus but not included in the main analysis are worthy of note.

4.5.1 Ellided Constructions

Ellided constructions (*I don't want you to*) were present in the full corpus but rarer than the unellided constructions. Furthermore, adults and children produced similar numbers of tokens of these ellided constructions for each verb, as seen in Table 4.5.

[5]It should be explicitly noted that 3 of the passives and 1 expletive were produced by the same (precocious?) child, Abe (Kuczaj, 1976). This is not entirely surprising when we see that 4 of the adult passives and 2 of the adult expletives were produced by Abe's parents. As Newport et al. (1977) found for children's development of the auxiliary, frequencies in parental input seem to correlate highly with children's own productions.

Table 4.5: Tokens of Ellided Constructions by Verb: Full Corpus

Speaker	*want*	*need*	*ask*	*tell*
Adult	60	0	5	11
Child	44	0	0	9

Although *need* can also grammatically appear in such an ellided construction (*I don't need you to*), no such utterances were produced by child or adult speakers.

4.5.2 Complementizer *for*

Although *want*, *need*, and *ask* can all felicitously appear with the complementizer *for*, only 2 utterances containing this construction appeared in the full corpus—one produced by an adult speaker, and one by a child.

(49) Constructions containing complementizer *for*

a. Child: *I want for Mommy to do it* (boys45)

b. Adult: *I swear I was gonna ask for Gregory to hit you* (zoe)

Thus, no child incorrectly produced an utterance including **tell for*.

4.5.3 Non-Adultlike Utterances

Children occasionally used these RO and OC verbs in novel constructions in which they treated the embedded *to* in non-adultlike ways, either through omission or double inclusion. The utterances in (50) are examples in which a child omits the embedded *to*.

(50) Children's productions with deleted *to*

a. *want me give it to you?* (sarah085, 3;11.16)

b. *when you ask me do anything I'm not gonna do* (brd, 4;6–5;0)

As mentioned above, this deletion pattern was also found by Goro (2004).

The examples here do not constitute an exhaustive list of such utterances. Recall that the original search returned only those utterances which included "VERB * to". This means that only those utterances in which the RO/OC verb was followed by another *to*[6]—one unrelated to the RO/OC construction—were returned by this search string. Thus, the search in Experiment 1 does not present a clear and complete picture of how often children omit the embedded *to* in RO and OC constructions. However, it may be that some children pattern their RO constructions with *want* on those adultlike causative utterances including the main verb *make* (cf. *make me give it to you*; *when you make me do anything I'm not gonna do*). Future research might explore to what extent children's mental grammars conflate these two constructions.

As a side note, RADFORD (1988) likewise found that young children (ages 19–25 months) produced complement clauses without complementizer *for* or infinitival *to*. Of interest to the current study are his examples containing the verb *want*.[7]

(51) Children's productions with deleted *to* (from RADFORD, 1988, p. 15)

a. Want [teddy drink] (Daniel 19)

b. Want [dolly talk] (Daniel 21)

c. Want [mummy come] (Jem 21)

d. Want [lady open it] (Daniel 22)

e. Want [this go up] (Angharad 22)

f. Jem want [Mummy take it out] (Jem 24)

In the current experiment, children also produced non-adultlike *want*-RO utterances with a contracted *wanna* followed by *to*, as seen in (52).

(52) Children's use of *wanna...to*

a. *don't wanna clothes to get dirty* (april05)

b. *I wann(a) i(t) to ha(v)e Coke* (j_mot04)

[6] Or, as in (50B), a contracted modal + *to* element like "wanna" or "gonna."

[7] RADFORD (1988, p. 15) notes a similar pattern of *to*-deletion in subject control uses of *want* (e.g., *Want [have money]*).

c. *enmeh [: wanna] Leah have to stay home* (nath02)

d. *eh wanna [: want to] Baaee [= Mommy] go around de +...* (nath04)

e. *eh nene [: want to] bumps de other trolley down de dis down de* (nath07)

To be fair, this is probably not a widespread phenenomenon, since over half of these examples come from one child, Nathan—and from his early files, at that. Moreover, Nathan's uses are not very clear lexically.[8]

4.6 Conclusions and Directions from Experiment 1

Spontaneous production cannot give us the full picture of the state of a child's mental grammar, but Experiment 1 does provide some useful foundational information about both children's input and use of RO and OC constructions.

After this initial search, it is clear that both children and adults use RO/OC verbs like *want, ask, need,* and *tell* in spontaneous speech, although these verbs are not equally common in production. Moreover, they appear more commonly in conjunction with some elements (e.g., matrix pronoun subjects) than with others (e.g., embedded passives/expletives), and *want* is by far the most commonly used verb. Also, the ratios among token frequencies of the verbs is different for adult speakers than it is for children, and the cause for this is not entirely clear, but other distinctions between children and adult productions—such as the relative occurrence of RO/OC verbs in questions—may have a functional/social-pragmatic explanation.

However, children do on the whole produce many adultlike utterances and avoid many possible non-adultlike utterances (e.g., RO verbs in imperatives, OC verbs with an embedded expletive) when using these verbs.

Possibly the most important lesson to take away from this experiment, however, is that RO and OC verbs constitute an excellent testing ground for differentiating between top-down and bottom-up learning. These verbs require complex syntactic constructions,

[8]However, this data does bear on the hypothesis that children initially use the contracted *wanna* (and perhaps also *gonna*) form as an unanalyzed (frozen) form. Examples such as those in (52) suggest that this hypothesis is on the right track.

including silent arguments, and exhibit a range of distinguishing behaviors as a result. This allows for the possibility that children might learn some of these verbs' allowed and/or restricted behaviors before others. Moreover, the different rates seen in spontaneous productions of these verbs presents a number of areas in which top-down and bottom-up learning make distinct predictions and can thus be teased apart.

Because *want* and *need* belong to the class of RO verbs, and *ask* and *tell* to the category of OC, but since these verbs are not equally common in production, it is possible that there are distinctions in how children treat them. If top-down learning is a strong guiding force in the acquisition of these verbs, children should treat the uncommon verbs exactly as they do the common ones. If, on the other hand, bottom-up learning plays a larger role, children may exhibit an adultlike performance on the more commonly used verbs before they do so on the rarer ones.

Similarly, we may also tease apart top-down and bottom-up learning given children's performance within a verb class on a single specialized construction. Embedding expletives under RO verbs is grammatical, but embedded existentials are vanishingly rare in spontaneous production; thus, if bottom-up learning is at play, we might see a difference in how children's grammars treat the two types of embedded expletive constructions; they may allow embedded weather predicates but reject embedded existentials. However, top-down learning would predict that children would accept both if they accept either. Likewise, *need* allows embedded expletives, but none appeared in the full corpus. Children should accept expletives embedded under *need* if and only if they are operating under the effects of top-down learning.

However, in order to test these predictions, it is necessary to make use of comprehension data. In the following chapters, the results from a number of tests of children's comprehension and restrictions on RO and OC verbs are reported. These experiments were designed after careful consideration of the spontaneous production data. For instance, very few (if any) spontaneously produced RO/OC utterances contained 3 full lexical NPs (e.g., *The farmer asked the nurse to feed the dog*); instead, pronouns were much more common. Thus, test items in the following experiments do not use 3 full NPs, since this cognitive load may act as a performance limitation confound, clouding children's true understanding of how these verbs function (Goodluck and Tavakolian, 1982). Likewise, verb + *for* constructions are so rare in spontaneous production that they are not tested at all.

The desired outcome for the following experiments is that they will allow us to ascertain what other grammatical knowledge young children possess about RO/OC constructions, and what roles top-down and bottom-up learning play in the process of achieving full adultlike competence. If adultlike competence is acquired bit-by-bit, with more frequent verbs and more frequent constructions treated in an adultlike manner before less frequent ones, then we have good evidence that bottom-up learning is at work. On the other hand, if competence is all-or-nothing on a verb or a verb class, regardless of input frequencies, then the syntax behind these constructions must be acquired via top-down learning. Regardless of the learning strategy and whether it approaches the input in a top-down or bottom-up fashion, patterns on a given verb (across constructions or subcategorization frames), on a given verb class (within the same construction or subcategorization frame), or which resemble other phenomena not being tested here will serve as strong evidence for UG-guided—and thus domain-specific—acquisition, rather than domain-general processes being at work.

In the scope of inquiry of this dissertation, the data from the following experiments will hopefully also shed some light on the issue of how children acquire the syntax of multiclausal verbs, and what this process can tell us about the innateness and modularity of human language.

Chapter 5

Experiments 2–4:

Active RO/OC, Passives, and Embedded Passives

We have seen in Chapter 3 that RO and OC structures differ in adult language in terms of their allowable behaviors, as a result of the distinct silent element present in each construction—namely, t in the case of RO, and PRO in the case of OC. This distinction manifests itself in a number of ways, including the assignment of a θ-role to the verb's NP complement (yes for OC, no for RO), active/passive synonymy for embedded clauses (yes for RO, no for OC), the mirroring of selectional restrictions of the embedded verb (yes for RO, no for OC), and grammaticality of embedded expletive subjects (yes for RO, no for OC), among others.

Furthermore, we have seen in Experiment 1 that in spontaneous speech, young children are well on their way to using RO and OC verbs in an adultlike way. On the other hand, though, it is also clear that the spectrum of syntactic and semantic distinctions between RO and OC verbs is not always manifested in spontaneous speech—neither by adults, nor by children. Thus, experimental—and specifically *comprehension*—data must be brought to bear on the question of when (and how) children acquire these predicates.

However, because these structures have not yet been examined in child language, it is unclear at what point learners acquire and maintain an adultlike distinction between these two verb classes. Even if young children comprehend and/or produce RO and OC constructions in certain situations, we do not yet know if the underlying syntactic structures for these predicate types in child language mirror those in adult language. One way to test whether children "have" these two verb classes (in the way that adults do) is to explore whether they make different judgments about the two types with respect to the syntactic distinctions listed above.

Investigating the acquisition of RO and OC constructions will clarify a number of issues related to how children learn the meanings of abstract verbs, including how children handle A-movement, how they come to distinguish empty categories (if they do not do so from the very start), and how they relate those empty categories to their syntactic consequences. Furthermore, such an examination will reveal whether children acquire the adultlike distinctions between the two predicate types all at one time, via top-down learning, or whether differences between the two types are created more slowly over development, via bottom-up learning.

In the larger picture, data on how children acquire two verb classes that differ as a result of their respective silent elements will bear on the issues of (linguistic) modularity and innateness in cognition. Since t and PRO are domain-specific constructs, evidence that children respect the behaviors that trickle down from the syntactic inclusion of one versus the other would support the notion that the language faculty constitutes a mental module. Furthermore, since silent elements cannot (by definition) be observed in the input, evidence that children treat these verb classes differently from the start would support the hypothesis that children bring the assumption of such language-specific structure to the language-learning task; this, in turn, would weigh on the side of innateness in cognition and development.

Thus the question: What is the trajectory of acquisition of full, adultlike knowledge of RO and OC verbs? Are the acquisition sequences for these two types of structures related, such that they are initially treated as one class by children and only differentiated later? (If so, how quickly do children differentiate the two classes in all ways that adults do—instantaneously, or only very slowly?) Do the acquisition sequences of these verb types instead proceed along parallel (but unrelated) paths, such that children acquire the two classes simultaneously but maintain a syntactic distinction between the two from the very beginning? Or are they completely unlinked and acquired at separate times? And where does acquisition of the passive fit in—does it pattern with acquisition of raising constructions, as a type of A-movement (as Wexler has argued), or is it independently acquired?

These questions seem like pressing ones to confront, for several reasons. First, both control (e.g., C. Chomsky, 1969) and raising structures (e.g., Hirsch and Wexler 2007) have been claimed to be late acquisitions; likewise, the passive has notorious late-acquisition status (at least in IE languages). Even if these claims prove false, and improvements in methodology allow us to observe all three constructions at a younger age than previously shown, naturalistic data still suggests that they are, at the very least, uncommon in very early spontaneous speech (Hirsch and Wexler, 2007; Goro, 2004, as well as the results from Experiment 1 here).

Secondly, passives, raising constructions, and control constructions all involve empty categories: t in the case of passive and raising, and PRO in the case of control. Such empty categories are only interpretable given long distance relationships of co-indexing and/or binding.

Clearly these constructions overlap in several significant characteristics. However, relevant studies that have been conducted to date have not examined the three jointly. A significant body of work has examined only the acquisition of control, rather than comparing it to that of raising. (The body of work examining only raising—and not control—is much smaller, perhaps comprising only Hirsch and Wexler, 2007.) To my knowledge, no single study has yet tested children on passives, control, *and* raising constructions. Wexler (1992) points out that such within-subjects data would be useful in determining if A-movement in general were implicated in development; if this did not prove to be the case, within-subjects data would still shed light on acquisition of the common elements and mechanisms mentioned above.

As a last point, while the acquisition of subject raising and subject control has been examined in at least one set of studies (Becker, 2005, 2006), RO and OC have not been compared, and the acquisition of RO has not been experimentally investigated whatsoever.

To remedy this situation, I undertook a number of experiments to determine the path that children's acquisition of RO and OC verbs take. These experiments not only explored the age at which children comprehend these structures, but also tested whether young children make different judgments on these two predicate types with respect to the assignment of θ-roles (i.e., licensing of an embedded pleonastic subject), active/passive synonymy, and selectional properties. The experiments are detailed below.

5.1 Participants

Two groups of subjects (one child group, one adult group) were included in the experiments described below. The adult group will be described in the following chapter.

The child group included 32 English-acquiring children, ages 4–5 (16 children per age), from the Chapel Hill, NC, area. The 4-year-old group contained 8 boys and 8 girls and had a mean age of 4;6 (range: 4;1.15–4;11.12); the 5-year-old group contained 7 boys and 9 girls, and had a mean age of 5;5 (range: 5;0.18–5;11.15). These children were recruited in several ways: from a large database of families who had previously consented to being contacted for studies on language development, from area preschools, and by word-of-mouth. To be eligible for inclusion in the study, children had to be monolingual speakers of English with no known linguistic (speech or hearing) impairment or other cognitive or developmental delays. Every effort was made to include equal numbers of boys and girls, and to recruit children from a variety of socioeconomic and racial backgrounds. Children who participated in the study received a small token gift at the end of each of two sessions.

To facilitate analysis of how the acquisition of RO and OC verbs proceeds within a single mental grammar, each child was invited to take part in each of the experimental tasks detailed below, so that a within-subjects examination of the data could yield a robust picture of the interaction between raising, control, and passive constructions in each child's grammar. However, upon admission to the study, each child was pseudo-randomly assigned to one of two groups:[1] the "want/ask" group, or the "need/tell" group.[2] Thus, each child completed each of the tasks for one RO verb (either *want* or *need*) and one OC verb (either *ask* or *tell*).[3] To control for any possible order effects, children within each group were also pseudo-randomly assigned to an order of stimuli presentation: either forwards or backwards.

In total, 6 other children took part, but were excluded from the study for the following reasons: failure to correctly answer requisite filler items (1), experimenter error (2), suspected language delay (1), parent withdrawal from the study (1), parental tardiness (1).

5.2 Materials and Experimental Design

5.2.1 Child Group

5.2.1.1 Tasks

The child group took part in 3 truth-value judgment tasks (TVJ; Crain and McKee 1985; Gordon 1996) and 2 sentence judgment tasks (McDaniel and Cairns,

[1] In order to maintain an equal number of children in all of the groups, the assignment to a condition could not be truly random.

[2] It might be argued that *want* and *need* are not the best verbs for examining raising-to-object structures, due to their "W-verb" status. That is, raising verbs comprise B(elieve)-raising and W(ant)-raising verbs (Postal, 1974), and the inclusion of the latter in the class of RO verbs has been contested. Note, for instance, the constrast between active and passive forms of B-verbs (a) and W-verbs (b).

a. Neil believes Suki to have a job / Suki is believed to have a job

b. Neil wants Suki to have a job / *Suki is wanted to have a job

However, both verbs still pass the diagnostics for raising verbs used by Davies and Dubinsky (2004; see examples (26)–(30) in Chapter 3). More importantly, both verbs are perfectly acceptable in the RO utterances that will be used as stimuli for the current experiment.

[3] A pilot study in which children received test items from each of the 4 verbs indicated that 4- and 5-year-old children do not have the attention span necessary to complete all test and filler items necessary for all 4 verbs.

1996). The TVJ tasks are described in detail below; the sentence judgment tasks will be presented in Chapter 7.

For the TVJ tasks, children heard stories and saw them acted out with small figurines. For the sentence judgment tasks, children were shown pictures and heard a small descriptive vignette related to each picture.

After each story or vignette, the child listened to a puppet make a comment about the story or picture. For both types of tasks, the child was asked to reward the puppet for his correct (or grammatical/semantically felicitous) comments, and to punish him (i.e., provide him with a less attractive reward) for his incorrect (or ungrammatical/semantically anomalous) comments. The child rewarded the puppet by "feeding" him a plastic orange, and punished him by "feeding" him a plastic piece of lettuce.

5.2.1.2 Test Items

Both the "want/ask" group and the "need/tell" group received the same number of test items. Within each task, half the test items had a target positive answer, while the other half had a target negative answer. Children received a total of 6 test items for each task (half RO and half OC).[4] Test items appear in the Appendices.

Both humans and animals were presented as characters in the test items for Experiments 2–4. However, the animals that appeared were portrayed as having human qualities (e.g., talking, doing homework, running errands, etc.).

In both tasks, children were asked to support their negative responses by explaining why the puppet was wrong, and in the sentence judgment tasks, they were also asked to provide a "better" (grammatical or semantically felicitous) version of utterances that they labeled bad/silly (ungrammatical or anomalous).

[4]The one exception to this rule was the passive test (Experiment 3), in which children received 3 test items total.

5.2.1.3 Fillers

Both "want/ask" and "need/tell" groups received the same set of filler items for each task. Fillers were used in the data analysis to check for a positive or negative response bias. Although the story or vignette for each filler item remained the same, the child was presented with the filler prompt with a target answer different from their last given answer (that is, if they had previously answered "right"/"okay", the next filler would have a target answer of "wrong"/"silly", and vice versa).

Fillers also served as a check that children were paying attention to the task. Since fillers were "easier" than test items—and should thus be no trouble to the children taking part in the experiment—children who got an excessive number of fillers incorrect were likely either not to have been paying attention to the task, or not to have understood it.

Children received a total of 5 filler items for each task.[5] Any child who got 3 out of 5 fillers wrong on more than one task was excluded from the analysis; however, out of all the child participants, only 1 child got 1 of the fillers wrong; all others performed perfectly on filler items.

Filler items appear in the Appendices.

5.2.1.4 Experimental Sessions

For the most part, children took part in the 5 experimental tasks during two sessions. For some participants ($N = 7$),[6] these sessions were separated by a week or more, but for the majority of subjects ($N = 25$), both sessions took place on the same day, with a short break between them. A handful of exceptional subjects within these 25 did not seem to tire or lose interest in the tasks, and thus took part in all 5 tasks during one long block session.

[5] Once again, the passive test (Experiment 3) was an exception to this rule: children received 2 fillers items in this task. A child would have been excluded from the study if they got both fillers wrong.

[6] The numbers reported here only reflect those participants included in the final analysis.

Before the first TVJ task and the first sentence judgment task, children were provided with 4–5 warm-up/practice items, to act as a training session. For those children who completed both sessions on different days, the second TVJ and sentence judgment task were also preceded by such a warm-up. However, for those children who completed both sessions on the same day, I simply asked children what they should do when the puppet "got something wrong" and when he "got something right," to make sure they remembered how the task worked.

To maintain focus and interest on the part of the subjects, experimental tasks were alternated, such that a TVJ task was followed by a sentence judgment task. Children always received a TVJ task first, on the assumption that learning the reward/punishment task would be easier when not compounded by the difficulty of learning how to give sentence judgments. Experiments 2 (basic active RO and OC) and 5 (semantic anomaly) always took place during the same session, as did Experiments 4 (embedded passive) and 7 (grammaticality judgment), but the order in which each subject participated in these two sessions was pseudo-randomly assigned. Experiment 3 (matrix passive) always took place during the first session, in order to complete the "longer half" first, and maintain children's attention during the second session.

Children seemed to have no difficulty alternating between TVJ and sentence judgment tasks, though some did express a preference for the TVJ tasks (e.g., "I like the stories better!").

All experimental sessions with children were video-taped for later analysis.

5.3 Experiment 2: Basic (Active) RO/OC

To establish a baseline of comprehension on RO and OC constructions, Experiment 2 tested children's comprehension of basic RO and OC sentences.

5.3.1 Method

To determine if, and at what age, young children understand adultlike sentences containing RO and OC constructions, 32 children ages 4–5 participated in a TVJ task containing active RO/OC test items.[7]

Recall from Experiment 1 that many spontaneous RO and OC utterances made use of pronouns in both the matrix and embedded subject spots. To reduce processing load, test items in Experiment 2 had a pronoun matrix subject and a lexical NP as the embedded subject and object.

(53) Example stories: Basic (Active) RO and OC

a. RO: Tigger talked to Winnie the Pooh and said, "Patrick is having a really bad day and you should cheer him up. I think a kiss would make him happy, but I don't want to kiss him. Will you go give him a kiss?"

   Experimenter: *What did Tigger do?*

   Puppet: *He wanted Winnie the Pooh to kiss Patrick (T)*

b. OC: The farmer had lots of animals to take care of. He was really busy! One day, he asked his friend the policeman, "I'm really busy. Can you help me go comb the horse's hair?" The policeman said, "Sure. How do I do it?" The farmer said, "It's easy. Just comb out the tangles in his tail."

   Experimenter: *What did the policeman do?*

   Puppet: *He asked the farmer to comb the horse (F)*

The test items included the following (separated by group):

(54) RO and OC test items: "want/ask" group

a. He wanted Winnie the Pooh to kiss Patrick

b. She wanted the policeman to stop the dog

c. He wanted the hippo to rub the lion

d. He asked the farmer to comb the horse

e. She asked the sheep to call the zebra

[7] All TVJ warm-up items and pre-stimulus vignettes appear in Appendix B.

f. He asked Dora to visit the doctor

(55) RO and OC test items: "need/tell" group

a. He needed Clifford to feed the cat

b. He needed the giraffe to see the doctor

c. He needed the cat to bite the dog

d. He told Elmo to draw the pig

e. He told the pig to chase the goat

f. He told Kermit to walk Clifford

All test items and pre-stimulus vignettes appear in Appendix C.

5.3.2 Results

The outcome of Experiment 2 was that both 4- and 5-year-olds performed significantly above chance in their interpretations of basic RO and OC utterances.

The results are given in Table 5.1.

Table 5.1: Child Performance on Basic RO/OC Utterances

	Percent Correct	
Age	RO	OC
4	87.5*	81.3*
5	91.2*	91.2*

*$p < 0.01$

The data was analyzed by age group (4, 5) as well as by verb type (RO, OC). Using the generalized estimating equations, logistic regressions (with the standard error adjusted for multiple observations within subjects) were performed[8] to compare the number of correct (adultlike) responses per age group to a chance level of performance (i.e., 50%, since the choice of response was binary: *yes* or *no*). A test of the null hypothesis that each group's performance did not differ from chance level performance was rejected;

[8]Throughout this dissertation, the same type of model was used in the analysis of each set of results.

both 4- and 5-year-olds performed significantly above chance on both RO and OC verbs (4-RO: $z = 4.26$, $p < 0.0001$; 5-RO: $z = 5.08$, $p < 0.0001$; 4-OC: $z = 3.4$, $p = 0.0007$; 5-OC: $z = 3.93$, $p < 0.0001$). However, a similar test of logistic regressions indicated that 5-year-olds did not perform significantly better than 4-year-olds on either verb type (RO: $z = -0.69$, $p = 0.4915$; OC: $z = -1.25$, $p = 0.2123$).

Although children performed significantly above chance on both verb types, 4-year-olds performed slightly better on RO verbs than on OC verbs. However, this trend did not reach significance ($\chi^2 = 1.12$, $df = 1$, $p = 0.2902$).

Moreover, a number of child participants in both age groups produced adultlike RO and OC utterances over the course of the experimental tasks. A number of these appear in (56) below.

(56) Children's spontaneous RO and OC utterances

a. He told Elmo to draw the goat (MB, 4;1.15)

b. He told the bear to ride on top of the horse (CO, 4;4.4)

c. She asked the zebra to call the sheep (4;4.18)

d. He really asked Elmo to draw the goat, not the pig, Marvin (LJ, 4;6.25)

e. Really the giraffe told the hippopotamus that he needed to go to the doctor (LJ, 4;6.25)

f. He told Tigger to call Elmo, not Elmo to call Tigger (AT, 4;11.12)

g. Dora really wanted Elmo to photo Cookie Monster (KC, 5;0.18)

h. Winnie the Pooh told Tigger to call Elmo for a play date (KC, 5;0.18)

i. The lion told the bear to get a ride from the horse (JS, 5;0.27)

j. She told the policeman to see if the dog could smell him (JS, 5;0.27)

k. He didn't want him to see him (JC, 5;3.7)

l. The girl told the daddy to put carrots in it (SP, 5;7.20)

m. The nurse asked the cat to lick the dog (KO, 5;11.15)

Notable here is that a number of these utterances include 3 full lexical NPs (e.g., *The girl told the daddy to put carrots in it, The nurse asked the cat to lick the dog*), if not 4 (e.g., *Winnie the Pooh told Tigger to call Elmo for a play date, The lion told the bear to get a ride from the horse*).

Several of the children (some of whom did not spontaneously produce any full RO or OC utterances) also produced "bare" RO and/or OC VPs, or other "partial" RO/OC utterances. Most of these were produced as responses to the Experimenter's question, "What did [the character] really do?" Examples appear in (57).

(57) a. Told the cat to scratch the dog (MB, 4;1.15)
b. Asked the bear to ride on the horse (DU, 4;1.19)
c. Patrick to draw Clifford (AS, 4;3.13)
d. Wanted the cow to wash the goat (AS, 4;3.13)
e. Told the cat to scratch the dog (SA, 4;4.1)
f. Told him to call Elmo (CO, 4;4.4)
g. Tell the zebra to call the sheep (DS, 4;10.29)
h. Asked Cookie Monster to give Dora a hug (HI, 4;11.9)
i. The zebra asked Dora to call [points to the sheep] (DW, 5;1.30)
j. Tell the cat to kiss it (LJ, 5;3.3)

On the other hand, a number of utterances produced by children over the course of the experiment indicated that in a situation where an adult would likely use an RO/OC construction, children (when given the choice) may opt for a different utterance type, often one with *said*. These utterances were clever and interesting "work-arounds" that children appeared to use as alternatives to adultlike RO and OC utterances. Examples of these appear in (58).

(58) Children's avoidance of RO and OC utterances via alternative phrasing

a. Because Ernie didn't like it, and said "Stop the music, Bert!" (AS, 4;3.13)

b. The policeman's wife said to the policeman to try not to sniff the dog (SP, 5;7.20)

c. Because Kermit said Shrek needs to feed Clifford (SP, 5;7.20)

d. He really said… Tigger, he would call Elmo (GH, 4;7.4)

e. She made the cat lick the dog (MC, 4;2.16)

f. The policeman said, "You have to kiss him" (SA, 4;4.1)

g. Said the cat should lick the dog (DS, 4;10.29)

h. Tigger had to call Elmo (MS, 5;1.15)

i. Made sure that the policeman didn't get sniffed by the dog (MS, 5;1.15)[9]

j. He said, "Cat, don't bite the dog" (MS, 5;1.15)

k. For him to kiss him, not bite, bite, bite (AT, 4;11.12)

l. He really said that the cat kiss the dog, not to bite the dog (LJ, 4;6.25)

m. She asked him… the dog stop barking (DW, 5;1.30)

It should be noted that the use of alternative construction types does not *necessarily* indicate a lack of productive facility with RO and OC constructions. Some of the children whose comments are represented above also spontaneously produced adultlike RO and OC utterances at other points in the experimental sessions; for instance, one of the youngest children quoted above (AS, 4;3.13) also spontaneously produced "Wanted the cow to wash the goat." There are so many ways to use language to express a particular thought (Chomsky, 1959) that sheer absence of a construction does not necessarily correlate with a nonadultlike language faculty (Kirby and Becker, 2007).

[9]Note this use of an embedded "get" passive! This underscores the notion that avoidance of a particular construction (e.g., RO/OC) does not necessarily mean that the child has a less sophisticated grammar, as noted in the main text below.

In general, though, the data from Experiment 2 indicates that at the very least, basic comprehension (if not adultlike production) of RO and OC verbs is in place by the ages under consideration. However, this result does not necessarily tell us whether 4- and 5-year-olds possess adultlike knowledge of the full range of behaviors of these verbs.

Future work should explore younger children's comprehension of these structures, to determine the youngest age at which children begin to understand the way these verbs function in their most basic syntactic frames.

5.4 Experiment 3: Matrix Passives

In Experiment 3, children's comprehension of full matrix passives (i.e., those including an agent *by*-phrase) was tested. Recall that there has been significant debate over the age at which children acquire adultlike use of the full passive, which requires A-movement—more specifically, the kind of A-movement that requires the nontrivial "subject, object" A-chains that Borer and Wexler (1992) have argued are subject to maturation. Experiment 3 aimed to assess whether the children in the current study had acquired this construction.

5.4.1 Method

The TVJ task has not previously been widely used (if at all) in tests of children's comprehension of the passive construction. However, as Crain (1991) has shown, using the TVJ often allows researchers to create a pragmatically felicitous situation for the test item in question; this in turn often uncovers linguistic competence on a construction at ages younger than previously claimed.

Because these items did not involve RO or OC verbs, children in both the "want/ask" and the "need/tell" groups received the same test items, which included only reversible passives.[10]

[10]Data from a number of researchers (Bever, 1970; Maratsos, 1974; Mills, 1985) indicate that children initially use a word-order strategy (NVN = *agent–action–patient*) for interpreting passives, and that irreversible passives are the first to be comprehended in an adultlike fashion. In short, children treat reversible passives as though they were active sentences. In order to test true adultlike comprehension of the passive, only reversible passives were included in Experiment 3.

Test items in Experiment 3 contained two full lexical NPs.

(59) Example story: Passive

This woman wanted to draw a picture of someone. The nurse was busy, and she had already drawn a picture of farmer, so she decided to draw the policeman.

Experimenter: *What happened?*

Puppet: *The woman was drawn by the policeman (F)*

All passive test items appear below.

(60) Passive test items

a. The pig was sent by the farmer

b. The woman was drawn by the policeman

c. The farmer was picked by the sheep

All test items and pre-stimulus vignettes appear in Appendix D.

5.4.2 Results

The outcome of Experiment 3 was that only 5-year-olds performed significantly above chance in their interpretations of basic (non-embedded) passive utterances.

The results are given in Table 5.2.

Table 5.2: Child Performance on Matrix Passives

Age	Percent Correct
4	64.6
5	79.2*
	$*p < 0.01$

The data was analyzed by age group (4, 5). As in Experiment 2, logistic regressions (with the standard error adjusted for multiple observations within subjects) were performed to compare the number of correct (adultlike) responses per age group to a chance level of performance. The test of the hypothesis that children performed at a chance level on matrix passive constructions was rejected for 5-year-olds ($z = 3.08$, $p = 0.0020$), but not for 4-year-olds, who did not perform above chance ($z = 1.83$, $p = 0.0667$).

Some children also spontaneously produced passives in their responses to test items. Examples appear in (61); these include truncated (i.e., no agent *by*-phrase) and full passives, and *be*- and *get*-passives.

(61) Children's spontaneous matrix passive utterances

a. The policeman got drawed (SA, 4;4.1)

b. The policeman was drawn by the woman (LJ, 4;6.25)

c. No, not drawn by the policeman—the woman drawed the policeman (DS, 4;10.29)

d. Made sure that the policeman didn't get sniffed by the dog (MS, 5;1.15)[11]

These results are in line with the current received wisdom on matrix passive acquisition: namely, that English-speaking children do not seem to have adultlike knowledge on this construction until about 5 years of age. Until now, many researchers (especially Wexler and colleagues) have considered this phenomenon to be related in some way to some syntactic difficulty with A-movement.

However, evidence for a different explanation is suggested by children's performance on passives embedded under RO and OC verbs. See Section 5.6.3 below for information on this, as well as for comparisons between their performance on the two tasks considered together.

5.5 Experiment 4: Embedded Passives

In Experiment 4, children's comprehension of passives embedded under RO and OC verbs was tested. Recall that when a passive is embedded under an RO verb, the entire sentence maintains the same truth conditions as its embedded-active counterpart (e.g., *Suki wanted Neil to make the espresso* = *Suki wanted the espresso to be made by*

[11] This utterance was produced in response to a test item in Experiment 2.

Neil). However, a passive embedded under an OC verb has different truth-conditions from its embedded-active counterpart (e.g., *Suki asked Neil to kiss Louise* ≠ *Suki asked Louise to be kissed by Neil*). Experiment 4 aimed to determine whether children maintain this distinction between passives embedded under RO and OC verbs.

5.5.1 Method

Administering this test to children who fail the passive pre-test will allow me to test Wexler's hypothesis that it is specifically the non-trivial (object-subject) A-chain in the matrix passive construction that stumps children. The subjects of passives embedded in a RO construction (e.g., *Suki wanted* <u>*Neil*$_i$</u> *[*t_i *to be kissed* t_i *by Louise]*) form object-subject-object A-chains; as a result, on Wexler's hypothesis that non-trivial A-chains are difficult for pre-mature children, they should prove problematic. On the other hand, if children have less trouble with embedded than with matrix passives, some other aspect of the passive must be causing the difficulty in the case of matrix passives.

As in Experiment 2, test items in Experiment 4 had a pronoun matrix subject and a lexical NP embedded subject and object.

(62) Example stories: Embedded passives

a. RO: Winnie the Pooh said to Tigger, "Somebody should call Elmo and invite him over to play with us. Do you have his telephone number? Can you call him up?" Tigger said, "Yes, I can call Elmo," and he went to call him and invite him over.

Experimenter: *What did Winnie the Pooh do?*

Puppet: *He needed Tigger to be called by Elmo (F)*

b. OC: One day, the policeman used some new soap when he was taking a bath. When he got out of the bathtub, he asked his wife, "Do you like how my new soap makes me smell?" His wife said, "I can't smell anything different. You should go have the dog smell you, he has a much better nose than I do. Just be careful and try not to sniff him, since he smells like a dirty dog these days."

Experimenter: *What did the policeman's wife do?*

Puppet: *She told the policeman to be sniffed by the dog (T)*

(63) Embedded passives test items: "want/ask" group

a. She wanted the tiger to be tickled by the bear

b. She wanted Clifford to be drawn by Patrick

c. He wanted the horse to be seen by the farmer

d. He asked Dora to be hugged by Cookie Monster

e. She asked the cat to be licked by the dog

f. He asked the goat to be washed by the cow

(64) Embedded passives test items: "need/tell" group

a. He needed Clifford to be fed by Shrek

b. He needed Tigger to be called by Elmo

c. She needed Cookie Monster to be photographed by Elmo

d. He told the horse to be ridden by the bear

e. She told the policeman to be sniffed by the dog

f. He told the cat to be scratched by the dog

All test items and pre-stimulus vignettes appear in Appendix E.

5.5.2 Results

The outcome of Experiment 4 was that both 4- and 5-year-olds performed significantly above chance in their interpretations of passives embedded under RO verbs, but that only 5-year-olds performed above chance on embedded passive (EP) OC utterances. This means that all children correctly interpreted sentences like *She wanted the tiger to be tickled by the bear*, but that only 5-year-olds correctly interpreted sentences like *He told the cat to be scratched by the dog*.

The results are given in Table 5.3.

Table 5.3: Child Performance on Embedded Passives

	Percent Correct	
Age	RO	OC
4	75*	50
5	79.2*	64.6*
	*$p < 0.01$	

The data was analyzed by age group (4, 5) as well as by verb type (RO, OC). Again, logistic regressions were performed to compare the number of correct responses per age group to a chance level of performance. The test of the hypothesis that children performed at a chance level on RO-EP utterances was rejected for both age groups: both 4- and 5-year-olds' performance on RO-EP utterances was significantly above chance (4: $z = 3.30$, $p = 0.0010$; 5: $z = 4.41$, $p < 0.0001$). However, 5-year-olds' performance on OC-EPs, while still above chance, was not as good ($z = 1.99$, $p = 0.0461$), and 4-year-olds' performance on OC-EPs was at chance ($z = 0.00$, $p = 1.0000$). Moreover, when children's performance on RO and OC verbs is compared in this task, both age groups performed significantly better on RO-EPs than on OC-EPs (4: $\chi^2 = 5.55$, $df = 1$, $p = 0.0185$, 5: $\chi^2 = 4.22$, $df = 1$, $p = 0.0400$).

Perhaps surprisingly, considering their relative syntactic complexity, children spontaneously produced some EPs in this experiment. Examples appear in (65).

(65) Children's spontaneous embedded passive utterances

a. He didn't want him to be seen (LD, 4;4.18)

b. He needed Elmo to be called by Tigger (LJ, 4;6.25)

c. Dora said, "I don't really want my picture to be drawn today" (AS, 4;7.20)

d. He didn't want him to be seen by the farmer (KO, 5;0.15)

e. He didn't want the horse to be seen by the farmer (RR, 5;9.18)

The results of Experiment 4 are particularly intriguing in light of the results of Experiment 3; although 4-year-olds did not seem to have mastered matrix passive constructions, they performed well on RO-EPs. This casts doubt on non-trivial A-chain maturation as an explanation for 4-year-olds' failure on matrix passives in Experiment 3. I will return to the issue of maturation in Chapter 9 below.

5.6 Comparative Results Across Tasks

5.6.1 Passives vs. Embedded Passives

As noted above, the results from the matrix passive test are unsurprising given previously existing evidence about development of the passive in speakers of Indo-European languages. However, it is precisely this context which makes the current findings on EP performance so interesting: namely, that 4-year-olds, who fail to comprehend matrix passives at above-chance rates, do perform at above-chance levels on their comprehension of RO-EPs.

For ease of reference, children's performance on passives and embedded passives are summarized in Table 5.4.

Table 5.4: Child Performance (% Correct) by Construction Type

Age	RO-EP	OC-EP	Passive
4	75**	50	65
5	79**	65*	79**

$^{*}p < 0.05$, $^{**}p < 0.01$

A series of logistic regressions (with adjustments made for multiple observations within subjects) were performed on the number of correct responses, using a model that included both effects for construction type and age group. No main effect was found for age ($\chi^2 = 2.28$, $df = 1$, $p = 0.1307$).

When performed under a model which considered possible effects of age, the test of the hypothesis that children performed equally well on RO-EPs and matrix passives was not rejected ($\chi^2 = 0.83$, $df = 1$, $p = 0.3616$). However, a similar test of the hypothesis that children performed equally well on OC-EPs and matrix passives was rejected ($\chi^2 = 6.81$, $df = 1$, $p = 0.0090$), indicating that children performed better on matrix passives than on OC-EPs.

When 4-year-olds' and 5-year-olds' performance was considered separately, each group manifested a strong trend towards better performance on matrix passives than on OC-EPs. However, this trend did not quite reach significance (4: $\chi^2 = 3.49$, $df = 1$, $p = 0.0616$, 5: $\chi^2 = 3.17$, $df = 1$, $p = 0.0748$).

It should be noted here that the fact that children perform better on RO-EPs than on matrix passives suggests that processing load issues as traditionally defined (e.g., utterance length and/or transformational complexity) do not necessarily play a more significant role in performance here than grammatical issues (e.g., the syntax-semantics interface).

The comparative evidence from the matrix and embedded passive tasks allows us to evaluate Wexler's claims that it is the non-trivial (i.e., subject-object) A-chain which results in linguistically non-mature children's poor performance on passives. If Wexler's claim is right, we would expect children to perform just as poorly—if not worse—on all embedded passives (which include either a simple non-trivial A-chain, in the case of OC-EPs, or a double non-trivial A-chain, as in RO-EPs) as they do on matrix passives. Indeed, children do perform relatively poorly on OC-EPs, which would seem to support Wexler's approach. However, the results on children's comprehension of RO-EPs clearly refute the maturation approach. Thus, non-trivial A-chains do not appear to be the determining factor in children's poor performance on the passive.

For some more reasoning regarding why processing load cannot automatically be assumed to be the determining factor in children's poorer performance on EP than active RO/OC constructions, see Section 5.6.3 below.

5.6.2 Basic (Active) RO/OC vs. Embedded Passives

Children performed extremely well overall in the basic RO/OC task, and somewhat less well with the EP task. However, for both RO and OC verbs, children performed significantly better on the RO/OC task than on the EP task (RO: $\chi^2 = 9.94$, $df = 1$, $p = 0.0016$; OC: $\chi^2 = 19.02$, $df = 1$, $p < 0.0001$).

There are several possible explanations for this pattern of performance. One is that children comprehend active RO/OC utterances better than EPs due to the basic fact that the latter contain a passive construction. However, this would not explain why 4-year-olds fail at the basic passive task but succeed at passives embedded under RO verbs.

A second possible explanation is that there is some higher processing load associated with passives than with actives embedded under RO and OC verbs. Once again, though, this fails to explain the split pattern of performance by 4-year-olds on passives embedded under RO vs under OC verbs. One possibility for salvaging a processing load explanation, however, is that RO verbs might allow a kind of phasal processing (à la CHOMSKY, 2001), in which the matrix clause is processed separately from the lower clause.

In Minimalist theory, *phases* are "semantically complete" units[12] containing a verb, its arguments, and C "as the domain of force plus proposition" (WEXLER, 2004, p. 164). CHOMSKY (2001) suggests that the derivation of any given expression proceeds phase by

[12] CHOMSKY (2001) cites other evidence supporting the notion of derivation by phase, namely that phases are reconstruction sites, and that they have some measure of phonetic independence.

phase. The idea here is that each phase is placed individually in active/working memory, where features are deleted as necessary; afterwards, it is routed to the phonological component, where deleted features are removed from the narrow syntax so the derivation can converge at LF. Importantly, though, once a phase has been through the derivation cycle, no further changes can occur within the phase; only the "edges" of the phase (usually specifiers) are available to other operations.[13]

While I will not spend too much time on the idea, it is worth nothing that we might make use of the concept of phases here to reflect the fact that the matrix object in an RO utterance actually comprises the edge (the specifier) of the phase of the embedded clause. The matrix object in an OC utterance, in contrast, would not; instead, the PRO subject of the embedded clause would mark the edge of the phasal boundary. To successfully interpret the reference for that PRO, children would be required to process both the matrix and the embedded clause at once (i.e., two phases together). As a result, phasal processing of the most compartmental kind might be allowed in RO-EP but not OC-EP constructions, since the latter (but not the former) involve θ-role assignment between the upper predicate and embedded subject.[14] In short, RO utterances, including RO-EPs, might allow for shorter phasal processing units than do OC utterances; these shorter parsing units would predictably result in better performance by children.

Wexler (2004) also makes use of the notion of phases in acquisition. He acknowledges problems with his previously proposed ACDH (Borer and Wexler, 1987, 1992; Babyonyshev et al., 2001) and instead suggests that children's pattern of performance on passives can be explained by the *Universal Phase Requirement*, which

[13] Wexler (2004, p. 164) summarizes this *Phase Impenetrability Condition* in the following way: "When working at a phase, only the edge (the head and spec(s)) of the next lower phase are available for analysis, and nothing lower than the edge. In particular the complement isn't available."

[14] This hypothesis might find support in the pattern of poorer performance seen on RO verbs in the semantic anomaly task by both 4- and 5-year-olds: namely, that they appear to be evaluating the semantics of the lower clause only (and not the entire sentence) with respect to the story context. See Chapter 7 below for more details.

is hypothesized to hold until about age 5. The UPR dictates that v defines a phase, whether it is "defective" (i.e., doesn't select an external argument, as is the case in verbal passives and unaccusatives) or not. In short, "a child takes a light verb that doesn't head a phase in the adult to actually head a phase" (p. 175). The phasehood of defective v causes a problem for the child when it results in a lack of convergence at LF due to uninterpretable ϕ and EPP features surfacing unchecked.

Wexler assumes that there is a covert A-chain for the embedded subject in an ECM utterance; because the ACDH predicts delays in covert as well as overt A-chains, it predicts delays in ECM structures. In contrast, because movement in an ECM construction is thought to take place within a phase, even linguistically pre-mature children will be able to construct and parse these utterances.[15]

One difficulty in assessing children's poorer performance on EP constructions relates to the nature of the test items themselves. EP test items with target false answers differed among themselves with regard to how they were structured. Some of these items were constructed with the violation occurring as a result of the θ-role assignment of the matrix OC verb; i.e., while the semantics of the embedded passive matched the story context, the embedded subject was not actually the character who was *asked* or *told*. For example, there was one vignette in which a lion told a bear to ride a horse. Given the test item *[The lion] told the horse to be ridden by the bear*, the embedded clause *the horse to be ridden by the bear* would be felicitous, but the target answer would still be *false*, since it was *the bear*, and not *the horse*, who was the "tellee." Thus, in order to succeed on such items, children would have to understand both the passive construction and the OC verbs' pattern of θ-role assignment.

[15] WEXLER (2004) argues that "to the extent that ECM structures are indeed not delayed in children, not only do they provide evidence for UPR, but they provide evidence against ACDH" (p. 176). While I do not subscribe to a maturation account of acquisition, the data presented in this dissertation will likely be of interest to those who do. However, it is difficult to know what conclusions maturationists would draw from the patterns seen here, since—as we will see in the next chapter—children who perform above chance in their interpretations of active ECM/RO utterances may still perform at chance on semantic anomaly and grammaticality judgments of these constructions. The question for all researchers would obviously be at what point we can claim that children "have" a particular construction.

In contrast, other test items violated only the passive construction; i.e., the agent and patient were swapped, such that children who relied on a word-order strategy for interpretation of the passive would incorrectly accept such items. For example, in one vignette Winnie the Pooh asked Tigger to call Elmo. The test item appearing after this vignette, *[Pooh] needed Tigger to be called by Elmo*, thus switched the roles of agent and patient in the embedded clause.

There was one test item which did not fall into into either of these categories; this item (*[The policeman] wanted the horse to be seen by the farmer*) followed a vignette in which the policeman was described as *not* wanting anyone to see the horse, and thus would have been true if the matrix verb been negated.

However, an item-by-item analysis indicated that children's poor performance did not cluster around one particular item type. Instead, children seemed to have a random pattern of correct and incorrect responses per item type. Children's performance on individual items appears in Table 5.5 below.

Table 5.5: Child Performance on Target-False Embedded Passives

Class	Verb	Item	Violation Type	% Correct
RO	want	...the horse to be seen by the farmer	Neither	87.50**
	need	...Tigger to be called by Elmo	Agent-theme	56.25
OC	ask	...Dora to be hugged by Cookie Monster	θ-role	31.25
		...the cat to be licked by the dog	θ-role	62.50
	tell	...the horse to be ridden by the bear	θ-role	75.00*
		...the cat to be scratched by the dog	Agent-theme	56.25

*$p < 0.05$, **$p < 0.01$

Several items are worthy of note here. First, as noted, there was one item that was wrong for neither of these reasons, specifically the test prompt *The policeman wanted the horse to be seen by the farmer*. This was the item that children performed best on (87.50% correct; $\chi^2 = 9.00$, $df = 1$, $p = 0.0027$). This should not be too surprising, considering that this was also the item that could successfully be parsed without any understanding of θ-assignment (or in this case, lack thereof) by a matrix verb to its embedded subject complement or correct parsing of the embedded expletive. That is to say, assuming the worst case scenario—namely, that children are only parsing the embedded clause, and doing so as if it were an active clause—children could still compare "the horse. . . see. . . the farmer" to the vignette, and come up with the target "false" answer.

Second, in this small data set there is no clear pattern that emerges to indicate whether it is the embedded passive alone, or instead the θ-role assignment between the matrix verb and the embedded subject, which is causing children trouble. As an example, notice that the only single-violation item which children performed above chance on (*He told the horse to be ridden by the bear*; 75% correct; $\chi^2 = 4.00$, $df = 1$, $p = 0.0455$) represented a θ-role assignment violation, but that children did *not* perform above chance on the other two items which had such a violation. If anything, it appears that children's poor performance may (at the very least) be related to issues of θ-assignment, since they did not perform above chance on any of the items which had agents and patients switched, with regard to the pre-item vignette. With such a small sample, however, it is hard to draw any firm conclusions.

Moreover, some mysteries in this data remain. For one thing, both target-false *ask* EPs involved θ-role incongruities, but children performed much better on *the cat to be licked by the dog* than they did on *Dora to be hugged by Cookie Monster*.[16] One possible mechanism behind this distinction is the fact that the former contains two common (definite) NP descriptions (*the cat, the dog*), while the latter contains two proper names (*Dora, Cookie Monster*). There is some support in the literature for the notion that these two types of NPs are processed differently (e.g., Gordon et al., 2001, 2002; Warren and Gibson, 2002; Gordon et al., 2004), although the effects are complicated and

[16]Neither level of performance is statistically different from a chance level. However, children's performance on *asked Dora to be hugged by Cookie Monster* came much closer to being significantly *below* chance (31.25% correct, $p = 0.1336$) than their performance on *asked the cat to be licked by the dog* came to being *above* it (62.5% correct, $p = 0.3173$).

interact with other linguistic phenomena.[17]

Ideally, future work would focus on these constructions by including a number of target items of one type and then the other, to tease out the effects of θ-role assignment from the matrix verb from effects due to basic trouble with the passive, including relying on a word-order interpretation strategy. Such work should also control more carefully for effects of NP type (i.e., description vs. name).

5.6.3 Discussion

In the embedded passive task, children were asked to comprehend passives embedded under RO and OC verbs. 5-year-olds performed at above-chance levels on both RO and OC verbs in this task. However, 4-year-olds only performed above chance on RO-EPs, and were at chance for OC verbs.

As mentioned in Section 5.5.2 above, these results are particularly interesting in light of the claim that children's trouble with matrix passives stems from an inability to form (non-trivial) A-chains, since RO-EPs hinge on chains that are *exceedingly* non-trivial: an underlying object is moved to subject position in the embedded clause, and then raised again to object position in the matrix clause, in essence forming an object-subject-object A-chain (66).

(66) Suki wanted Neil$_i$ [t_i to be kissed t_i by Louise]

Despite the presence of a double non-trivial A-chain, however, even 4-year-olds who have not yet mastered matrix passives are able to comprehend these sentences at above-chance levels.

In an OC-EP, on the other hand, the matrix object is coindexed with a PRO in the embedded clause, which is itself generated as the object of the embedded verb but

[17]Much of the aforecited literature found at least a small advantage for names, since descriptions demand processing resources for establishing a new discourse referent. This is counter to the effect found here, where children performed more poorly on the item with names than the item with descriptions. Clearly, further research is necessary to establish the precise mechanisms at work here.

has moved to [Spec,TP] of the embedded clause for Case reasons.[18]

(67) Suki asked Neil$_i$ [PRO$_i$ to be kissed t_i by Louise]

So why do children—in particular, 4-year-olds—seem to have more difficulty with OC-EPs than RO-EPs? There are several possible reasons for this.

First, the difference in children's performance may relate to θ-assignment: there are more θ-roles assigned in OC-EPs than in RO-EPs (Davies and Dubinsky, 2004), and the presence of more θ-roles has been linked to a greater processing load, at least in adults (e.g., Ahrens and Swinney, 1995). This analysis of the data is essentially based on the assumption of a difference in processing load between the two constructions: more θ-roles will equate to a higher processing load for OC-EPs, which may ultimately overtax young children's processing power. Such a hypothesis would also predict that children should have more difficulty with basic (active) OCs than with basic ROs. While there *is* a small difference in 4-year-olds' (but not 5-year-olds') performance on active RO and OC constructions, the advantage for RO utterances is rather slight (RO: 87.5% correct; OC: 81.3% correct). With the present data, it seems unlikely that we can discern whether the load introduced by θ-assignment is responsible for children's differentiated performance on RO-EPs and OC-EPs.

A second possibility for differences in children's performance on the two constructions relates to the canonical placement of the silent element PRO. In an OC-EP, PRO in the embedded clause begins in an object position, where it receives its θ-role. However, for PRO to originate in a non-subject position is fairly unusual; as Chomsky (1986, p. 104) himself says, PRO is "an empty category with a restricted distribution. . . it appears in. . . subject position." Thus, it seems reasonable to assume that the non-canonical placement of OC-EP PRO could itself have an effect in the comprehension or acquisition of the construction.

[18]Other versions of GB assume that PRO raises in the embedded clause to satisfy the EPP or avoid government. Regardless of the details of the particular analysis chosen, the basic issues for acquisition remain the same.

A third possibility has to do with the felicity of RO-EPs versus OC-EPs. While RO-EPs involve *wanting* or *needing* a particular state of affairs (that is, an entire proposition), OC-EPs involve *asking* or *telling* someone to undergo a process—that is, to be the *patient* of an action. More likely, it seems, would be to ask or tell someone to be the *agent* of an action.[19] Thus, it may be the unconventional nature of the cognitive semantics inherent in this situation that causes children some trouble in the comprehension of OC-EPs.

However, while marked semantics may play a strong role in children's poor performance on these constructions, the matter may be better explained in terms of the canonical subject/object distinction in general, a possibility that will be discussed in Section 6.3 below. In short, an OC-EP contains an embedded subject-object A-chain involving a raised PRO (68) which is akin to that in a matrix passive (69); this state of affairs results in a noncanonical alignment of grammatical and thematic roles.

(68) Suki asked Neil$_i$ [PRO$_i$ to be kissed t_i by Louise]

(69) Neil$_i$ was kissed t_i by Louise

In the next chapter, I will present an analysis of children's performance on active RO/OC utterances, matrix passives, and embedded passives which draws strongly on this notion of canonical alignment in argument mapping: the *semantic scaffolding hypothesis*.

[19]This same issue might bear on the distinction seen in children's performance on *get*-passives versus *be*-passives. See Chapter 6 below, for more details.

Chapter 6

The Semantic Scaffolding Hypothesis

6.1 Canonical Alignment in Syntax and Semantics

Both the semantic bootstrapping hypothesis (Bowerman, 1973; Grimshaw, 1981; Pinker, 1984) and the Canonical Alignment Hypothesis (Hyams et al., 2006) propose that children have default expectations about how the assignment of θ-roles will proceed, and as a result, about the shape that sentential frames will take. These expectations are actually interrelated: first, the child is hypothesized to assume that agents will map onto subjects and patients/themes will map onto objects. However, this hypothesis also entails default assumptions about what an "agent" or "patient/theme" looks like, and thus what makes a good *subject* or *object*. I will argue that both of these expectations are encompassed by the notion of "semantic scaffolding," which I will introduce below, and furthermore, that we can see the effects of semantic scaffolding in the experiments conducted here, as well as other current literature on acquisition.

Before presenting my analysis of the data currently under consideration, however, I will characterize the notion of scaffolding as it has been utilized by other researchers in child development and child language.

6.2 Scaffolding in L1A: A Vygotskyan Grammar?

An innate grammar drives and guides the acquisition of a first language, given the information available in the child's (positive) input. But how does it stretch beyond its current boundaries to the next level? How does this process of *acquiring* proceed? Like the hypotheses of semantic and syntactic bootstrapping, semantic scaffolding suggests that there is an internal framework for exploiting one area of innate knowledge in the service of another, ultimately allowing the child to stretch past the current level of grammatical knowledge to the next higher level, increasingly working towards adultlike competence in their native language.

At any given point in development, a child's abilities are best characterized as a range, rather than a static point or level. VYGOTSKY (1978) coined the term *zone of proximal development*[1] to describe this phenomenon, and defined it in this way: "It is the distance between the actual developmental level as determined by independent problem-solving and the level of potential development as determined through problem-solving under adult guidance or in collaboration with more capable peers" (p. 86), a description of the range of developmental level that can be verbalized in terms of "actual" vs. "potential."[2] Later researchers (but interestingly not Vygotsky himself, who never used this term) extended this concept to its pragmatic applications in development and education: "scaffolding" (WOOD ET AL., 1976). The idea here is that adults (or other "experts") provide an external support for children in a given task, thus allowing children to reach past their "actual" towards their "potential." This support may take many different forms, but it often comes via linguistic channels: for instance, in the context of some problem the child must solve, the adult may encourage the child, redirect her attention to a different aspect of or approach to the task, or ask questions to help her clarify the process at hand. Many researchers in the Vygotskyan tradition have claimed language's importance as a tool for thinking and reasoning, as well as non-linguistic cognitive development, in precisely this fashion. Ultimately, as the child gains more

[1]The semantic scaffolding hypothesis draws cognizantly and purposefully on VYGOTSKY's (1978) formulation of the "zone of proximal development" and its later applications in education, but should *not* be confused with a claim that language (or any other cognition) is necessarily socially constructed (à la Tomasello), nor with others of Vygotsky's claims.

[2]Without getting too far afield, it should be noted that even this definition fails to acknowledge the range of the child's own "independent problem-solving," given performance factors such as fatigue, distraction, etc. The basic issue is the same, though: children are not automatons operating at the same level of performance in every situation.

experience operating on the potential level of development given these experiences of scaffolded learning, the potential level can be internalized as the actual, and the child will advance in cognitive maturity.

While I do not in the slightest wish to espouse a theory of acquisition in which the parent "coaches" the child,[3] I have deliberately made use of the concept of "scaffolding" in this dissertation to describe a related (but distinct) situation: namely, the concept that a child may be able to support a "median" level of *actual* grammatical development to comprehend more advanced syntactic structures, which exist in the realm of her grammatical *potential*. This type of scaffolding is in play while grammatical knowledge and processing power have not yet reached adult levels, and comprises a number of strategies that essentially reduce to relying strongly on the semantics of an utterance in its canonical shape, to decode its syntax.

I am not the first to use the concept of scaffolding in the realm of language acquisition; BRUNER (1983) in fact discusses it specifically. However, his conceptualization of the role that scaffolding plays is extremely different from what I am proposing. In short, Bruner denies an innate language ability and instead proposes that adults' carefully controlled input allows children to proceed along the language acquisition path. In contrast, I am proposing an internal correlate: the adult scaffolder proposed by Bruner is, in my formulation, a grammar-internal process.

Thus, the main difference between the idea of scaffolding as it originated (and as it continues to be used in the realm of developmental psychology) and my appropriation of it here is the *source* of the scaffolding: in educational psychology, the scaffold is created externally, by an adult or other expert; meanwhile, in semantic scaffolding as proposed here, the support comes from within—as a learning tool originating in UG, or, perhaps better described, as a product the intersection of UG with other domain-general learning

[3]Indeed, such theories have been largely debunked, since children are remarkably resistent to external language correction; for instance, see PINKER (1994) for examples from Braine (1971, 1976) supporting this claim.

processes.

To some extent, this hypothesis could be argued to find support in research such as that conducted by Shipley et al. (1969), who conducted an experiment to see how children at different levesl of syntactic sophistication responded to commands; the child participants were either preverbal, in the holophrastic stage, or producing 2-word utterances. The authors noted which children responded to the different commands by performing the requested action, and determined that children responded best to a level of linguistic sophistication that exceeded their own by one step on this ladder: that is, the preverbal children responded best to 1-word commands (*Ball!*), the holophrastic children to 2-word commands (*Throw ball!*), and the children in the 2-word stage to well-formed (full) phrases (*Throw me the ball!*). Thus, children seemed responsive to linguistic input that did not exactly *match* their own level of production, but instead exceeded it slightly. It is this precise scenario that might be considered a case of scaffolding, or at least comparable to it.

However, to my knowledge there are no claims in the psychological or educational scaffolding literature that children perform *better* at their potential level of development than at their actual level, simply that they *can* do so. As an alternative interpretation, the phenomenon observed by Shipley et al. may only be an instance of the familiar cognitive adage that "recognition memory is better than recall memory" (that is, implicit memory tends to outperform explicit memory; Schacter, 1987), or, as formulated in the language acquisition literature (both first and second), that "comprehension precedes production" (e.g., Smith, 1973)—but not by leaps and bounds. In a case like the ball-giving task in the Shipley et al. experiment, the child's cognitive ability and her linguistic ability must interact: given a linguistic command by an adult, the child must comprehend it, and then plan and execute a response.

A precarious balance must be struck between altering the level of linguistic expression to match the current state of the child's grammar, and not degrading that input below the level at which the communicative intent is lost. In other words, the adult's desire is best understood by the child when it is verbalized at the most sophisticated level that the child can *understand*—no higher, no lower. This phenomenon is relevant to the semantic scaffolding hypothesis proposed here, in that internal scaffolds provided by UG may allow the child to reach towards adultlike comprehension of input utterances, even though the child's median static ability (that is, the middle of the child's grammatical "range" of ability) may not in fact be that advanced.

Now I will begin to consider the specifics of how "scaffolding" may characterize the ways in which child participants behaved in the current experiments.

6.3 The Proposal: Semantic Scaffolding

In Chapter 2, I discussed the strategies of syntactic and semantic bootstrapping in the process of verb learning. The examination of syntactic frames—and especially of the constellation of NP arguments in relation to the verb in a given clause—can buy children quite a bit, in terms of deducing the meaning of a novel verb. However, I also noted that while this strategy may work quite well for (some) simple, single-clause utterances, it will not work so well with multi-clause structures like RO and OC utterances, in which one surface string (namely, *Suki gorped Neil to make her some espresso*) can be mapped onto multiple possible underlying structures. Moreover, with RO and OC verbs—which have abstract or mental state meanings—real world observation and the associated strategy of semantic bootstrapping may not provide children with any extra clues to the meaning, and as an extension the subcategorization requirements, of these verbs. To date, researchers have not sufficiently explored how children may come to master the syntax of such structures.

6.3.1 Points Along the Arc: Semantic Scaffolding

How, then, do we explain the current state of 4- and 5-year-olds' grammars with respect to these verbs? In short, it appears that children may be relying heavily on semantics (in particular, canonical argument semantics), and not just syntax, in their initial hypotheses about how the RO and OC verb classes behave.

I propose here that children are aided in the task of language acquisition by a number of related processes that I will refer to as *semantic scaffolding.* While this umbrella term is meant to cover several distinct phenomena, each is a case of the child using "canonical" semantics to support a syntactic representation. Specifically, the semantic scaffolding hypothesis is meant to capture the observation that in the absence of adultlike syntactic knowledge and/or processing power, children take recourse to various aspects of the semantics of an utterance to support their interpretations.

One of the major components of semantic scaffolding is the CAH, as detailed in Chapter 2 above. Importantly, children appear to expect that semantic agents will appear in sentential subject position. A second phenomenon described above, the semantic bootstrapping hypothesis, which suggests that semantic patients will map onto syntactic objects, can also be categorized under the semantic scaffolding heading. Thus, for a language like English, the default shape of an utterance, and the shape which a child is biased to expect, includes preverbal agent subjects and postverbal patient/theme objects. Semantic scaffolding predicts that sentences which do *not* conform to this template—for instance, matrix passive utterances—will prove problematic for children's grammars.

As discussed in Chapter 2, the learner has the tools of semantic and syntactic bootstrapping to aid in language acquisition. But each of these approaches certainly has its limitations: semantic bootstrapping tends to work best on utterances with unmarked word orders, whose lexical items closely match their "canonical structural realization" (e.g., objects are labeled with nouns, actions are labeled with verbs; Grimshaw, 1981) and whose real-world referents can be observed. And syntactic bootstrapping is most helpful in monoclausal utterances in which the verb's syntactic relationship to the surrounding NP arguments is highly transparent—and furthermore, perhaps only in those monoclausal utterances whose underlying syntactic structure can be unambiguously read off the surface string.[4]

These tools will only take children so far in the language-learning process, since the canonical, unmarked form of utterances—that is, the form of utterances in which there is a canonical match (or "alignment") between syntax and semantics, as detailed above—can be deformed in a number of ways. There are different ways for these syntax-semantics universals to be violated: the semantics of a verb may not include an action and/or may not subcategorize for agent and patient θ-roles; θ-roles may appear in atypical syntactic/structural positions; an overt NP may carry more or less than one θ-role; a structural argument spot may carry more or less than one θ-role;[5] and so on. And it is reasonable to assume that children might deal with each of these deviations from the norm in distinct ways as well, as a result of their default expectations about the match between syntax and semantics: for instance, as just one example, children might interpret matrix passive utterances, in which the canonical violation of thematic mapping is violated, as the corresponding active utterances, which conform to canonical alignment.

What I propose is that each of these non-adultlike approaches to interpretation is still, in fact, guided by UG, and that each strategy supports—or "scaffolds"—the child through the period in which the grammar has not yet reached the adult state. How does semantic scaffolding play out, then? In children's performance on RO and OC verbs as

[4] While there is, to my knowledge, no overt discussion in the literature of how semantic bootstrapping might fare against mono- versus multiclausal utterances, my sense is that it, too, would be more helpful in cases of the former, if not outright stymied by the latter. Why might this be so? If the youngest children assume a correspondence between particular actors in a real-world scene (as labelled by nouns) and particular syntactic positions, then it seems reasonable to assume, especially given the data on home sign systems (Feldman et al., 1978; Goldin-Meadow and Mylander, 1984, and see Chapter 2 above), that children will expect 1-, 2-, or (at the most) 3-place predicates—but not, I assume, multiple verbs and their concomitant clauses. This could result in linguistic input that overloads the ability of semantic bootstrapping to make any sense of an utterance, or else a child might deal with the input by selectively attending to some part of it. See Chapter 8 for more information on how such selective parsing might proceed.

[5] As I will discuss in Chapter 8 below, another violation of the canonical syntax-semantics form entails the inclusion of more than one subject and/or object in an utterance. Read on for details about how young children appear to deal with such a violation, which appears to entail restricting their interpretations of multiclausal sentences to parsing less than the complete utterance.

well as in their interpretation of matrix passives in the experiments detailed above, we can begin to see how semantic scaffolding works.

6.4 Semantic Scaffolding in the Interpretation of Passives

In the case of children's interpretation of matrix and embedded passives, we can see the effects of semantic scaffolding in a default preference for the canonical assignment (and/or alignment) of θ-roles. As Hyams et al. (2006) propose in their CAH, children assume that external arguments (in particular, agents) will map onto subject position, but matrix passives violate this expectation by swapping the canonical alignment of the agent and patient θ-roles: patients now appear as subjects, and agents (if they appear at all) surface as obliques/objects of prepositions. In contrast, though, in embedded passives—in particular, those passives appearing under RO verbs—underlying objects appear as surface objects, thereby circumventing violations of the CAH.[6] As observed, 4-year-old children, who fail in their interpretations of matrix passives, still perform at above-chance levels in their interpretation of RO-EPs, as predicted by both the CAH and the semantic scaffolding hypothesis.[7] In RO-EPs, D-structure objects surface as S-

[6]If children are biased to expect agent-subjects, why doesn't the passive mislead them more than it does? That is, why don't children perform significantly *below* chance, indicating a systematic interpretation of subjects as agents? I am suggesting here that children have default expectations about the alignment of syntax with semantics, which is not the same thing as proposing that they are not able to acquire syntax. Children at the age tested here are on the cusp of mastering the passive construction in their native language; since this type of knowledge is not acquired instantaneously, they must already have some knowledge of the syntax required. What I am claiming here is that, in the case of matrix passives, language-specific syntax and UG-defined semantics conflict in a crucial way; given that the demands of both cannot be satisfied, children may compensate by sometimes satisfying the requisites of one, and sometimes of the other. It is precisely this balancing act which results in "chance" levels of performance, or what looks like guessing. In fact, given children's level of syntactic sophistication—that is, the fact that they are *almost* there—we should instead be surprised to see them performing below chance on their interpretations of these structures.

[7]If RO-EPs are more canonical than matrix passives, we might ask why 5-year-old children did not perform better in the RO-EP task than they did on the matrix passive task (both: 79% correct, $p < 0.001$). I do not wish to claim that the passive transformation carries with it absolutely no cost, merely that the canonical alignment of thematic roles can serve a strong protective function for comprehension in the face of such transformational complexities. Embedded passives are indeed still passives, and beyond that they are also biclausal utterances. Both of these characteristics contribute to the formation of a more "complex" utterance for children to comprehend, and it may well be this issue which results in the 5-year-olds' pattern of performance in these two tasks.

structure objects, even though they pass through an external argument position between the two levels of representation. This fact indicates that the CAH acts as a kind of filter by only looking at the head and the tail of the chain, and not at the intermediate traces, which—in the case of RO-EPs—*would* violate the CAH.[8]

How does the semantic scaffolding account explain children's distinct performance on RO-EPs and OC-EPs? Recall that while RO-EPs and OC-EPs share a surface string, the two have distinct underlying syntax, as shown again here.

(70) RO-EP: Suki wanted/needed Neil$_i$ [t_i to be kissed t_i by Louise]

OC-EP: Suki asked/told Neil$_k$ [PRO$_k$ to be kissed t_k by Louise]

The matrix object in an OC-EP is generated and θ-marked in that position, and is furthermore co-indexed with a PRO subject in the embedded clause. This PRO, in turn, is generated as the object complement of the embedded passive verb, and receives its θ-role there, but promotes to the embedded subject position, either for (null) Case reasons or to satisfy the EPP (the exact details are irrelevant for the current discussion). Thus, the embedded PRO functions as the semantic object of *kiss*, but surfaces as its syntactic subject. In this sense, then, the embedded passive in an OC-EP construction is just like a matrix passive (for more detail, see the discussion of Jaeggli, 1986, in Chapter 3 above). Because OC-EPs contain a subject-object A-chain—namely, the one formed between the embedded PRO and its trace—both the semantic scaffolding approach as well as the ACDH/maturation account predict that children should do poorly on them. However, given the current range of data, the semantic scaffolding hypothesis is more

[8]Belletti (2008) found evidence of a similar phenomenon in her work on passive object relatives. Belletti discusses data indicating that Italian-speaking children will avoid object relatives (*the child that$_i$ the king kissed t_i*) by making use of particular "avoidance strategies." One of these avoidance strategies is the use of a passive in the relative (*the child that$_i$ was kissed t_i by the king*). Although the passive is intuitively more complex than the active, Belletti argues that the computation renders the overall derivation more local, and thus "easier," for the child. Relevant to our discussion here is the fact that the head and tail of the chain (namely, *that* in its initial generated object position, and in its raised C position) are objects, even though the intermediate trace is in subject position; this appears to constitute more evidence for the claim that canonical alignment may serve as an output filter, rather than a turnstile for intermediate points in the derivation.

strongly supported, since the same children who succeeded at the RO-EP task fail in their comprehension of OC-EPs.

Chomsky's (1986) formulation of the θ-criterion—and especially the projection principle—is highly relevant to the semantic scaffolding hypothesis, especially given the context of matrix passives and RO-EPs. He writes, "the projection principle…states that lexical structure must be represented categorically at every syntactic level…. A consequence of the projection principle is…that if some element is 'understood' in a particular position, then it is *there* in syntactic representation" (p. 84; emphasis his). This formulation of a UG precept suggests a system in which the learner would expect to find particular arguments in particular positions, and might perform in a non-adultlike fashion on those utterances which did *not* conform to this expectation. In light of the current study, it seems reasonable to extend this verbalization of the projection principle to complement the claims of semantic scaffolding, and particularly semantic bootstrapping and the CAH; that is, we should expect children to perform poorly on matrix passives and OC-EPs, both of which (as noted at the end of Chapter 5 above) contain a non-trivial subject-object A-chain and thus violate canonical alignment. In contrast, however, we should expect children to do well on RO-EPs, in which semantic objects also surface as syntactic objects. In a more general sense, though, given this formulation of the projection principle, we should not be surprised to find that children perform poorly when canonical syntactic structure is violated in any one of a number of ways.

Not only has the passive long been generally accepted as a late acquisition, but children's performance on interpreting and producing passives does seem to be strongly influenced (and even directed) by the semantics of the relevant utterances, as discussed in Section 3.2.1.3 above. Moreover, the semantic scaffolding approach may explain a puzzling distinction between children's performance on *be*-passives and *get*-passives: namely, that children who fail on tests of full matrix *be*-passives still sometimes perform in an adultlike way on *get*-passives (Crain et al., 1987; Crain and Fodor, 1989;

Crain, 1991; Fox and Grodzinsky, 1998). While Fox and Grodzinsky attempt to illustrate that the syntax in these constructions is identical, it could be argued that the comparison of *get*- and *be*-passives is not an entirely fair one, since there is a subtle semantic difference between the two. Specifically, the patient-subjects in *get*-passives are more "active" than those in *be*-passives, in terms of the role they each play.

To illustrate, compare the following *get*- and *be*-passives.

(71) BE: Suki was kissed

GET: Suki got kissed

In the *be*-version, it is possible that all that the patient-subject did was to hold still. However, in the *get*-version, the patient-subject may have played a much more active role in bringing the kiss about: namely, she may have flirted, tried to look cute, or even asked someone to kiss her. Now compare *Suki got kissed* with *Suki got herself kissed*; although the latter utterance is not completely synonymous with the non-reflexive *get*-passive, it is certainly congruent with the more active interpretation.

The distinction between the two passive types may further have to do with the fact that *be* is stative and *get* is eventive: thus, a *get*-passive will more closely match children's default expectations that the verb in a NVN sequence represents an action (see Bowerman, 1973; Grimshaw, 1981; Pinker, 1984, and the discussion of "semantic bootstrapping" in Section 6.3 below). In sum, there is just something much less "passive-y" about the *get*-passives, and it may be exactly this semantic distinction that allows children to master them before they master *be*-passives.

Recall that Fox and Grodzinsky (1998) likewise suggest a semantic explanation for children's more adultlike performance on *get*-passives; namely, they argue that children have trouble with "θ-transmission" (see also Section 3.2.1.3 above). Regardless of the exact details of the account, both analyses of the *get*-passive crucially assume a distinction in semantics hinging on agency and action which allows children to master this construction earlier than the related *be*-passives; this order of acquisition is exactly what semantic scaffolding would predict.

6.4.1 "Canonical" A-Chains: PRO vs. Trace

A final issue raised by the data presented here is the distribution of empty elements in A-chains. To rehash the discussion of t and PRO from Chapter 3 above, recall that Chomsky (1981) argues that the two empty categories differ in several key respects, as determined by the interactions of bounding theory, control theory, Case theory, and binding theory. He notes that t must be governed, its antecedent may not appear in a θ-position, and the antecedent-trace relationship must satisfy the subjacency condition. On the other hand, PRO may not be governed, any antecedent must carry a θ-role independent of that assigned to PRO, and subjacency need not be satisfied by the antecedent-PRO relationship. Furthermore, traces appear via NP-movement, movement to COMP, or extraposition, while PRO appears obligatorily in ungoverned positions where an NP is required but no Case is assigned. The upshot of these restrictions is that the two empty categories appear in complementary distribution.

The important point to note here concerns the distribution of t and PRO in embedded passive constructions. Since t appears in any position from which an overt NP has moved, it should surface in subject position (e.g., VP-internal subjects; *They$_i$ are both t_i drinking coffee*) and object position (e.g., unaccusative verbs; *Karl$_i$ arrived t_i*) alike, with roughly equal frequency. As has been extensively discussed in the literature, even very young children seem to have no trouble with either VP-internal subject raising (e.g., Borer and Wexler, 1992; Köppe, 1994; Fox and Grodzinsky, 1998) or unaccusative verbs (e.g., Snyder and Stromswold, 1997; Guasti, 2002).

In contrast, PRO must appear in a position which requires an NP, but which does not assign Case, a phenomenon which is typically limited to the external argument of an infinitival clause (cf. *We$_i$ expect [PRO$_i$ to eat shortly]*). However, the PRO which appears in OC-EPs is generated as the object of the embedded verb—a position which only meets the requirements on lack of Case assignment as a result of its having been passivized. At any rate, as far as the distribution of PRO is concerned, this situation is fairly atypical, and constitutes yet another way in which embedded passives—and specifically OC-EPs—may violate canonical syntax. As such, it should not come as any particular surprise that children have more difficulty with OC-EPs than with RO-EPs.

In sum, while OC-EPs and RO-EPs share a surface string, the two constructions differ in their underlying syntax and, by extension, in the comparative difficulty each poses for children who have not yet reached adult syntactic competence.

6.5 Benefits to the Semantic Scaffolding Hypothesis

The semantic scaffolding analysis presented here is attractive for a number of reasons. Apart from explaining the data at hand, it also relates a number of previously observed phenomena under one rubric: children's earliest grammars do rely strongly on semantics. For instance, the effects of semantic bootstrapping—one of the more obvious strategies to be subsumed under the label of semantic scaffolding—have been seen in many arenas, as discussed in Chapter 2 above. Furthermore, children's earliest productions seem to be stripped down to the barest of lexical categories: first words tend to be nouns (Gentner, 1982), and the earliest multi-word utterances also generally exclude functional categories. A number of researchers (e.g., Braine, 1963; Klima and Bellugi, 1966; Radford, 1988, 1995) have put forth variations on the hypothetical theme that children's earliest grammars lack some (or all) of the adult functional projects—in essence rendering their linguistic representations primarily semantic, rather than syntactic. While the current proposal instead assumes full competence (à la Poeppel and Wexler, 1993), it bears noting that the observations made by the researchers just mentioned, and the data to be explained here, do indeed dovetail. Identifying such disparate processes (for instance, the shape of children's earliest productions, their interpretations of passives, their performance on biclausal sentence judgment tasks, and so on) as belonging to (or stemming from) one larger cognitive phenomenon is always attractive to researchers seeking parsimony in their mechanistic explanations. Furthermore, the ability to see multiple processes as related in this way gives us a window into how language, itself a vertical faculty, may interface with other horizontal faculties, like attention and memory (Fodor, 1983), as well as with other non-linguistic cognitive modules, such as the conceptual-semantic module.

6.6 Thematic Alignment and "Processing Load"

A further benefit to the current analysis is that it provides a better, more refined definition for the concept of "processing load" than has previously been used—and furthermore, that it uses the concept of cognitive load without giving up on a grammatical account. As seen in the results on matrix and embedded passives detailed above, processing load does not appear to be monotonically correlated with sentence length, as some children who succeeded in comprehending the longer EPs failed on the shorter matrix passives.

Furthermore, when children's performance on RO- and OC-EPs in these tasks is compared to one another, rather than simply to chance levels of performance, another interesting pattern appears: both age groups performed significantly better on RO-EPs than on OC-EPs (4: $\chi^2 = 5.55$, $df = 1$, $p = 0.0185$, 5: $\chi^2 = 4.22$, $df = 1$, $p = 0.0400$). Thus, when the length of sentences is held constant, it appears that "processing load" does indeed increase with non-canonical semantic structuring.

In contrast with accounts that correlate processing load with the raw length of utterance, the semantic scaffolding analysis instead equates processing load with "novelty of construction," where "novel" constructions are precisely those utterances which do *not* match children's UG-given assumptions about the semantic configuration of utterances. Utterances can depart from the usual format in a variety of ways, and these may entail violations of the canonical assignment or placement of θ-roles. In short, utterances that violate children's default hypotheses about the syntax-semantics interface will result in a greater cognitive load than utterances which match those assumptions.[9] This mismatch results in the performance patterns seen above: children deal with various types of syntactic "strangeness" in ways that are non-adultlike, but still governed by the grammar. In short, this analysis has the added appeal of explaining how UG may still constrain and guide non-adultlike performance, even in the face of processing limitations.

Note that this formulation of semantic scaffolding predicts that *all* instances of non-canonical alignment of θ-roles (and not just passive constructions which violate canonical alignment) will prove problematic for children. Given the literature on both spontaneous production and the experimental data, this prediction seems to be on the right track. In naturalistic production, Pinker (1984) notes that verbs which violate these canonical "agent-subject, patient-object" mappings in English (e.g., *receive, please, strike as, undergo*) are almost nonexistent in children's spontaneous productions. Similarly, in the experimental literature, Marantz (1982) taught 3-, 4-, and 5-year-old English-speaking children to describe observed scenes with novel (made-up) verbs which differed in terms of their structural expressions of agents and patients: AP (agent-patient) verbs had preverbal agents and postverbal patients, while PA verbs had the opposite alignment. For instance, given a scene in which a man was pounding a book with his elbow, *Larry is moaking the book* would utilize an AP verb, while *The book is puming Larry* would make use of a PA verb. Marantz found that 3- and 4-year-olds had much less trouble learning the AP verbs than the PA verbs, since AP verbs display what he refers to as

[9] Hyams et al. (2006) suggest that their own *Canonical Alignment Hypothesis* might be

> part of a broader hypothesis about the architecture of the language faculty along the lines proposed in Williams' (2003) representation theory. Williams proposes that syntax economizes on 'shape-distortion', rather than 'distance minimalization'... In certain cases, as for example in the formation of passives, structural shape may be distorted at one level in order to satisfy mapping at a different level. Thus, the mapping between thematic and case levels in passives results in non-isomorphic structures because the mapping between the case domain and surface structure needs to be isomorphic. The absence of verbal passives in early language (and their occurrence in adult language) would suggest that children adhere more strictly to 'shape preservation' than adults, who have greater pragmatic and processing resources. (p. 1064)

This formulation is very close to what I am suggesting here.

"a dependence on grammatical rules which connect semantic relations directly to structural positions" (p. 32)—that is to say, AP verbs appear in utterances which display a canonical (non-deformed) alignment of thematic roles.[10] Although the verbs used in the experiment were nonce forms, both AP and PA verbs exist in English, although AP verbs are by far more common (Marantz, 1982):[11] for instance, *give* is an AP verb (*Louise gave Neil an espresso machine*), while *receive* is a PA verb (*Neil received an espresso machine from Louise*).[12] It is hard to determine direction of causality when children have difficulty with a verb type which utilizes a particular thematic alignment, but that alignment is confounded with the relative frequency of that verb type in the adult language. MacWhinney (1982) notes that in languages such as Japanese and Tagalog, in which no such tendency of preverbal agents is present in the adult language, there is only weak evidence (at best) for such an AP preference in child language. Meanwhile, in Hungarian and Turkish—which both allow the PA ordering in the adult language—there is no such tendency in the child language at all. MacWhinney notes that English is there-

[10] Marantz (1982) also tested AL (agent-location) and LA verbs (e.g., *Larry is dabing the chair* or *The chair is dabing Larry*, respectively, to describe a scene in which Larry is rolling his head while standing on a chair). He found that children performed equally well or better on verbs that expressed a patient (i.e., AP and PA verbs) than on those that expressed a location (AL and LA verbs), and that the most difficult type of verb to learn appeared to be the LA verbs. This suggests that the relative learnability among these verb types is AP > PA > AL > LA (or perhaps AP > PA/AL > LA).

While the AL/LA verbs are not as transparently relevant to our discussion here as the AP/PA verbs, children's performance on the former may in fact indicate default expectations not only about the alignment of θ-roles appearing in a particular utterance, but also simply the θ-roles that will appear in an utterance to begin with; that is, the child may well be biased to expect an agent and a patient, rather than any other constellation of thematic elements.

[11] This is of course yet another instantiation of the chicken-and-egg scenario regarding effects of input frequency versus effects of UG, as discussed in the section on semantic bootstrapping in Chapter 2 above. Are AP verbs more common in English because they are easier to understand, perhaps as a result of semantic scaffolding and canonical alignment (i.e., UG/acquisition drives the shape of adult language)? Or are these verbs easier to understand because they are more common in English (i.e., the shape of language influences acquisition)? Once again, the answer to this dichotomous choice may prove to be "yes"—that is, both phenomena may have occurred. Even if not, the two possible causalities will certainly prove difficult (if not impossible) to disentangle. Data from the acquisition of languages whose adult lexica—unlike English—do *not* show a preference for AP verbs will be vital in any such attempt.

[12] Note that the same giving event could be described using a passive, as in *Neil was given an espresso machine by Louise*, and that this would result in an identical alignment of arguments as in the PA (*receive*) utterance.

fore not a useful test case, and that data on comprehension and production from VOS languages like Tagalog will be more helpful in teasing apart the relative contributions of input frequency and UG biases.

To some extent, however, we can begin to tease out the distinct roles that UG and non-linguistic cognition on the one hand, and the input on the other (that is, "brain-internal" versus "brain-external" forces), might play, even in a language like English, when we examine the data on children's attentional biases, a topic which I will now turn to.

6.7 "Goodness" of Subjects, "Goodness" of Themes

If the semantic scaffolding hypothesis on the right track—and given the data discussed here so far, it appears to be—children have default biases about which thematic roles should appear in the syntactic positions of subject (i.e., agent) and object (patient/theme). As noted briefly in Chapter 2 above, these default expectations appear to translate, to a large extent, to similar typological patterns in adult languages, especially where subjects are concerned: DOWTY's (1991) formulation of the *proto-agent* thematic role indicates that agents make "good" subjects, and KEENAN's (1985) Subject Properties List confirms that across languages, subjects are commonly agents.

DOWTY (1991) in fact makes the claim that the panoply of thematic roles discussed in the literature can actually be reduced to two: "P(roto)-Agent"[13] and "P(roto)-Patient" (which he refers to as "P-roles"). The properties of a P-agent include (but are not limited to) the following:

(72) *Dowty's proto-agent properties*

a. volitional involvement in the event or state

b. sentience (and/or perception)

[13] DOWTY (1991) is certainly not the only researcher (nor the first) to propose a list of characteristics reflected in an agent (or agent-like) thematic role. For instance, MACWHINNEY (1982) suggests four "semantic vectors" that may influence a speaker's decision to treat a particular item as an "actor"; these include *potency* (i.e., animacy), *mobility*, *causation*, and *perspective*. The first three of these overlap to a significant (and transparent) extent with DOWTY's (1991) P-agent properties.

c. causing an event or change of state in another participant

d. movement (relative to the position of another participant)

e. exists independently of the event named by the verb

Meanwhile, properties of a P-patient include the following:

(73) *Dowty's proto-patient properties*

a. undergoes change of state

b. incremental theme

c. causally affected by another participant

d. stationary relative to movement of another participant

e. does not exist independently of the event, or not at all

Given these guidelines, Dowty's *Argument Selection Principle* states that when an utterance contains both a subject and an object, the argument with the most proto-agent characteristics will be lexicalized as the subject, and the argument with the most proto-patient properties will be lexicalized as the direct object.

Dowty himself asks whether there might be a psychological or practical reason why languages should have these selection principles at all, and suggests that such lexical patterns might make the task of language acquisition easier, by functioning as a type of semantic bootstrapping. If the theory of P-roles is sound, the child could deduce which of two NPs in any given sentence is the grammatical subject, and which the object, on the basis of how each aligns with the principles of the P-Roles. This process is obviously supported in situations in which independent clues to guessing (for instance, visual cues) are given. But once the child has adequate experience with canonical utterances (that is, *agent–verb–patient* sentences like *Suki ate steak*) and how grammatical relations are morphologically and syntactically coded, the child can then use this knowledge to correctly learn the lexicalization of other verbs which have semantic clues that are not so reliable.[14]

Dowty also proposes that the P-roles take the shape they do because "distinguishing these properties is on the one hand an ability with obvious advantages to human survival, and on the other, a well-studied cognitive ability that emerges at an early age" (p. 601). Furthermore, it is likely that in the process of first language acquisition, "it is easier to first single out the supercategories linguistically than the finer ones" (p. 602). Moreover, the P-roles could serve as defaults for meanings of individual verbs when the learning context itself does not provide enough information to determine such details. Like other formulations of the notion of semantic bootstrapping, Dowty hypothesizes that a learner may use "semantic default" as a principle in verb learning: that is, children may take for granted that the full complement of P-role entailments hold, unless the learning context contradicts this assumption explicitly.

Dowty is right to note that attention to such properties emerges at an early age; the salience[15] of these phenomena has been observed in distinct ways in a number of studies,

[14] Dowty (1991) claims that one benefit of his proposal over other bootstrapping proposals is that it naturally explains why certain θ-role-related entailments "are the relevant semantic categories for children to pay attention to for the initial step in order to learn the grammatical codings...thus, we need not merely stipulate them" as others have (p. 601).

[15] Like "[un]marked" and "canonical," the notion of "salience" suffers from a case of acute underoperationalization. It is often used to describe something that "stands out" or "demands attention," and many are satisfied with this formulation (or, in most cases, this *lack* of precise formulation). However, others (rightly) note that this is simply a restatement of the phenomenon rather than a mechanistic explanation; *why* does something that is salient stand out?

While I will not attempt anything resembling a detailed answer here, I will note two possible avenues of exploration that might prove fruitful. First, an object or phenomenon may be salient because it aligns with or corresponds to some other pre-existing cognitive construct or physiologically determined predisposition. Some examples of this type might include: integers (i.e., whole numbers), which correspond to human counting systems (e.g., $7.00 is a more "salient" price than $7.63); focal colors (and color terms; e.g., "red" is easier to remember as a color chip—or easier to learn as a novel color term—than, say, "burgundy"), which (appear to) correspond to the maximal spectral sensitivities of particular photopigments in the rods and cones of the human eye (Heider, 1971; Wooten and Miller, 1997; Regier et al., 2005); and the effects of primacy and recency in memory, which may correspond to the cognitive notions of "[ultimate] cause" and "[ultimate] effect."

Alternatively, salience may be a result of "familiarity," as defined by connectionist ideas of neural networks. These models of cognition propose interconnected networks of units (possibly neurons connected by synapses, concepts connected by semantic similarity, words connected by membership in a syntactic class, etc.) which change over time. Each time the connection between the two units in activated, given some input stimulus (for instance, the excitatory threshold is reached and the synapse fires; the concepts pattern together in the real world; or the words appear in a similar syntactic environment), both on language acquisition and otherwise. In particular, a wide range of experimental data indicates that children do seem to pay preferential attention to just those P-agent properties mentioned above.

- *volitional involvement in the event or state; sentience*

  Meltzoff (1995) found that 18-month-old children preferentially attended to adults' intentions (i.e., their volition), and not simply their surface behavior, in adults' completion of target acts; children later imitated the *intended* action, even when the adult failed in the attempt to fully complete that action. Likewise, Tomasello and Barton (1994) found that, given a context with both an intentional and an accidental action, children applied a novel label to the intentional action. (In the same study, children similarly applied a novel noun to a searched-for object, rather than rejected ones.) Finally, Woodward (1998) found that 9-month-olds (and to a certain extent, even 5-month-olds) distinguish between human action, which is volitional and sentient, from object motion, which is not goal-directed. For instance, children at this age were able to differentiate between a hand reaching for and grasping an object, and a hand-like claw performing the same actions.

- *causing an event or change of state in another participant*

  In a study on children's ability to deduce the meaning of a novel verb by utilizing multiple syntactic frames, Naigles (1996) found that 2-year-old children strongly preferred to watch a video of a causative action scene over an intransitive (non-causative) action scene. Likewise, in a study conducted to determine whether

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the "strength" of the connection between the units increases—as does the likelihood that the two units will be linked again in the future (Rumelhart and McClelland, 1986; Dawson, 1998). Thus, salience (or familiarity) may correlate with particularly strong connections in such a parallel distributed processor.

As in most dichotomous questions, though, it also possible (or even probable) that both the correspondence *and* familiarity mechanisms are at play—or perhaps even that the latter is actually a result of the former. On the other hand, what neither of these approaches can account for, however, is the fact that things that are *unusual* or *unexpected* are also highly salient. Clearly the issue is a complex one.

children can generalize event participants across scenes in a non-linguistic task, Bunger and Trueswell (2009) found that children were more likely to attend to the "causer" in the scene than to the affected.[16]

- *movement*

  A number of studies have found evidence that movement is particularly attention-grabbing for infants (e.g., Burnham and Day, 1979; Gibson, 1969; Slater, 1989; Thelen and Smith, 1994; all cited in Rakison and Poulin-Dubois, 2002). Rakison and Poulin-Dubois (2001) propose that infants have a perceptual system that distinguishes static and dynamic features, but which finds movement to be particularly salient.[17]

  Researchers in linguistics have made use of the effect of movement (even the motion of substances, rather than delineated objects) on infants' attention by using highly salient videos of substances in motion as "distractors" in the head-turn preference procedure (Hirsh-Pasek and Golinkoff, 1996). For instance, Woodward (1992, 1993) used videos of lava flow or dye diffusing through water as distractors in her tests on the effects of linguistic labels on children's attention to objects; these videos proved highly effective in commanding children's attentions. Given a choice between observing these substances in motion or a static object, 18- and 24-month-old children preferred to look at the dynamically moving substance, even

[16] This effect was confounded with a preferential attention to animacy; children preferred to attend to "people and what they were doing." The effect reported above was most markedly observable when the animacy of agents and patients matched (that is, both animate or both inanimate), but especially when both were inanimate.

[17] Rakison and Poulin-Dubois (2001) in fact hypothesize that the animate-inanimate (A-I) distinction in infancy arises from attention to distinct possibilities with regards to motion, specifically the following:

> (a) onset of motion (self-propelled vs. caused motion), (b) line of trajectory (smooth vs. irregular), (c) form of causal action (action at a distance vs. action from contact), (d) pattern of interaction (contingent vs. noncontingent), and (e) type of causal role (agent vs. recipient)... (f) purpose of action (goal-directed vs. without aim), and (g) influence of mental states (intentional vs. accidental). (p. 212)

in trials in which a linguistic label was provided.[18]

Finally, experiments by both Huttenlocher and Dewart (Huttenlocker et al., 1968; Huttenlockher and Strauss, 1968; Huttenlocher and Weiner, 1971; Dewart, 1972; all reported in MacWhinney, 1982) indicate that children ages 5–10 comprehend sentences most readily when the "actor" in the sentence is also mobile.[19]

- *exists independently of the event named by the verb*

  Since this property is formulated in linguistic terms, it is difficult to find extralinguistic evidence regarding children's relevant preferential attention biases.

  However, we might begin with an examination of children's attention to individuated objects over mass objects (e.g., *sand, milk, pudding*); the former are countable, delineated items "which maintain their boundaries through time" (Carey and Xu, 2001) and exist independently in the world. Insofar as children's attention to mass vs. count objects is concerned, there is evidence that individuated objects (which are defined as "coherent, spatially separate and separately movable, spatiotemporally continuous entities"; Carey and Xu, 2001) may command children's attention more strongly. Huntley-Fenner, Carey, and Salimando (2001; cited in Carey and Xu, 2001) found support for the notion that infants have an "object tracking system," where "objects" (or "Spelke objects") are defined as coherent and bounded three-dimensional items. The authors conducted a $1 + 1 = 2$ or 1 task involving either Spelke objects shaped like piles of sand ("sand-objects"), or actual piles of poured sand. In this paradigm, infants see items being placed behind screens, and thus out of view; afterwards, the screen is removed, revealing either

[18] The results in this experiment (Woodward, 1992, 1993) were relatively complicated and reminiscent of Naigles (1996). Without a label, children in both age groups preferred to look at the moving "distractor" display. The presence of a label increased looking towards the object screen for 18-month-old girls (not boys), but did not affect the looking pattern of the 24-month-olds, regardless of sex.

[19] MacWhinney (1982) uses this data in support of the notion that "mobility" is one of the innate "predispositions"; see Section 6.10.1 below for more on these.

an expected outcome (i.e., $1 + 1 = 2$) or an unexpected outcome (i.e., $1 + 1 = 1$). If infants are able to track objects, they should show surprise (that is, look longer) at the unexpected than at the expected outcome. Once the sand or sand-objects were resting on the stage, they were perceptually indistinguishable; however, the authors found that 8-month-olds showed surprised at the unexpected outcome *only* in the sand-object (and not in the poured sand pile) condition. That is, infants appeared to track the sand-objects, but not the piles of sand. This evidence supports the notion that infants may preferentially attend to (and track) individuated objects over mass objects; the former would "exist independently" in a way that the latter would not.

This object tracking system is posited to be available to children as young as 2.5 months, and to allow infants to establish mental representations of objects and track them across time—that is, to afford infants object permanence, in the Piagetian sense (CAREY AND XU, 2001). Spelke herself has even gone so far as to posit an innate system of "core knowledge" devoted entirely to objects, including spatio-temporal principles of cohesion, continuity, and contact (for an overview, see SPELKE AND KINZLER, 2007).

Turning again to language, this particular subject property might implicate gerunds (e.g., *running [is fun]; dancing [is good exercise]*), as well as weather predicates (e.g., the mass nouns *rain, snow, sleet*, etc., which imply the corresponding precipitation events). As a sort of inverse to preferential attention, there is evidence that children may be slow to acquire constructions involving gerunds (HARYU ET AL., 2005; IMAI ET AL., 2005) or weather predicates (KIRBY AND BECKER, 2007).

A number of studies have indicated that nouns—which often label objects that exist independently of events—are easier to learn than verbs. As noted above, nouns tend to predominate in early vocabularies (GENTNER, 1982); in fact, young children seem so skilled at noun-learning that a number of noun-learning constraints have been hypothesized to guide this process (e.g., Markman, 1990). Gentner (1982) hypothesizes that nouns are easier to learn for the exact reason that they (often) label objects which are themselves individuated and delineated in the natural world—thus, they maintain an existence independent of any action or event.

Experimental research has also indicated that learning novel verbs may be more difficult for children than learning novel nouns. Imai et al. (2005) performed a series of experiments (including forced-choice and yes-no tasks) with Japanese-speaking 3- and 5-year-olds. Japanese is considered a "verb-friendly" language, since argument-drop allows for the appearance of a verb alone with no accompanying subject or object. Despite this fact, the authors found that although the older children could generalize both novel nouns and verbs, the younger children could only correctly generalize nouns.

But this dispreference for learning the labels of events may extend to gerunds, as well, even though these function linguistically as nouns. In literature comparing noun learning and verb learning by Chinese-, Japanese-, and English-speaking preschoolers, Haryu et al. (2005) found evidence for a noun bias: that is, 3-year-old children acquiring all these languages (as well as 5-year-old children acquiring Chinese and English) appeared to find it easier to learn a bare noun labeling an actor (performing different actions) which remained constant across scenes, than to learn a bare verb (that is, one appearing with no arguments) labeling an action (performed by different actors) which remained constant across scenes. This finding is particularly notable when we consider that the verb label used in English (*Look, X-ing!*) is morphologically consistent with either a progressive verb or a gerund/noun interpretation, and that the label in Chinese was not morphologically marked at all. Thus, it would seem that an existance independent of the action or event labeled by the predicate (or even by the subject gerund) is a property which also has echoes in children's linguistic development, in terms of relative ease of acquisition.

As noted, this particular subject property also implicates weather predicates, which entail a mass noun related to the event (e.g., *rain, sleet, snow*, etc.). Kirby and Becker (2007) found that the subject expletive *it* in weather and time predicates (*it's raining; it's time for bed*) arose later in spontaneous production than expressions containing referential *it* (*it's a cat; it isn't mine*). This suggests that referentiality to an independently-existing object in the world takes precedence over situations in which a non-referential element only appears in conjunction with a particular predicate—even when the two cases involve homophonous morphemes appearing in an identical syntactic position and grammatical role.

Overall, then, it appears that the individual properties that characterize agents are particularly salient for children (and likely also for the adults that they grow to become). The linguistic phenomenon of topicalization is used to mark elements of high salience or cognitive importance; topics may or may not be morphologically marked, but always appears first in the linear order of the sentence (Li and Thompson, 1976) and are thus preverbal elements.[20] In short, it may be that children are biased to have agents as subjects (especially in an SVO language such as English) because agents are what children pay most attention to: that is, to the extent that agent-subjects are or may be "topics," there is a convenient match between the two.[21] Thus, semantic scaffolding,

[20] Li and Thompson (1976) establish a four-way distinction among languages that are *subject-prominent*, *topic-prominent*, both *subject-* and *topic-prominent*, and neither *subject-* nor *topic-prominent*. However, they note that regardless of the type of language or its surface coding of topic (that is, sentence position and/or morphological markers), all languages examined place topics in sentence-initial position. They explain this tendency in the following way: "Since speech involves serialization of the information to be communicated, it makes sense that the topic, which represents the discourse theme, should be introduced first. The subject, being a more sentence-oriented notion, need not receive any priority in the serialization process" (Li and Thompson, 1976, p. 465).

[21] This research is obviously biased towards *nominative-accusative* (NA) languages, in which the agent of a transitive verb and the single argument of an intransitive verb are treated alike as "subjects." This system contrasts with *ergative-absolutive* (EA) languages, which instead maintain an equivalence between objects of transitive verbs and single arguments of intransitive verbs. While I have no direct data bearing on the effects of semantic scaffolding in EA languages, the analysis here, which draws strongly

with its preference for aligning an agent with the subject of a sentence, appears to be the linguistic reflex for a tendency which has roots in nonlinguistic cognition.[22]

In adult English, nouns corresponding to actors usually appear preverbally; perhaps unsurprisingly, there is evidence that children learning English formulate an early *actor + action* pattern that surfaces in spontaneous and elicited productions as well as comprehension (as measured by both enactment and verification; MacWhinney, 1982). This pattern obviously extends to children's non-adultlike interpretation of the passive as instead being the corresponding active; in an act-out task involving passives with an inanimate theme-subject and an animate agent, Lempert (1978) found that 3- and 4-year-olds were even willing to attribute the agent role to a preverbal inanimate object! More convincingly, though, there is also evidence for a similar pattern in the speech of children learning languages which, unlike English, do *not* include the preverbal-agent pattern in the adult language (for instance, Samoan, which has VSO order; Kernan, 1969, cited in MacWhinney, 1982).

In fact, semantic scaffolding's effects may go past simple "preference," to the point of defining ability. Researchers have found not only evidence to support the hypothesis that children seem to *prefer* preverbal agents, as noted above, but also data which indicates that children have *trouble* with inanimate subjects. In his study on the relative ease with which children learned verbs taking different argument structures, Marantz (1982) noted a "reluctance on the part of the 4-year-olds to put inanimates before the verb (as association of subject position with animacy)," and hypothesized

on extralinguistic cognitive semantics, would predict that children acquiring EA languages should show effects in their non-adultlike production and comprehension similar to those seen here, as evidenced in children acquiring NA languages. Examining data from the acquisition of EA languages, in which the input does *not* align with the defaults that I am proposing are an innate endowment of UG and nonlinguistic cognition, would therefore provide an excellent test of the core hypotheses of this dissertation.

[22]There is also evidence supporting the idea that salience plays a general role in which element is lexicalized as the subject of a sentence. Lempert (1984, cited in Gordon, 1996) found that children were more likely to produce passives to describe pictures if the patient—but not the agent—was colored in. To the extent that full-color pictures can be considered more "salient" than black and white ones (which seems reasonable, given the discussion of visual salience in the footnote above), this would indicate that salience overlaps strongly with subjecthood.

that this tendency "might explain these children's difficulty with the PA [patient-agent] and LA [location-agent] verbs" (p. 53). Similarly, LEMPERT (1989) found that children produced fewer passives overall when they had been trained on passives with Static-Inanimate patients than with Animate patients (which, in passives, surface as subjects). The semantic scaffolding hypothesis suggests that this dispreference for, or difficulty with, inanimate subjects is in fact correlated with an increase in processing load associated with them. It seems reasonable to speculate that children would have even more difficulty with expletive subjects, which are not simply inanimate, but completely semantically empty and nonreferential. Thus, we should not be surprised if children perform poorly on utterances which involve expletive subjects. This prediction is supported both in evidence that children acquire expletive *it* after referential *it* (KIRBY AND BECKER, 2007), as well as in the results here on children's grammaticality judgments on RO and OC utterances involving embedded expletive subjects, as we will see in Chapter 7.

In sum, I am suggesting that all of these issues, which result in the non-linguistic salience of agents for very young children, are what ultimately lay behind the existence of the CAH and some elements of semantic bootstrapping, as well as the rest of the effects of semantic scaffolding seen in the child data presented in this dissertation.

6.8 Grammar-Internal or Grammar-External?

GRIMSHAW (1981) formulates her semantic bootstrapping approach in terms of a dependency between syntax and cognitive/conceptual semantics (i.e., "a relation between linguistic and nonlinuistic constructs"), and suggests that the Canonical Structural Representation (CSR) principle itself is *external* to UG (since, she believes, "syntax should remain autonomous"; p. 175). Instead, the Language Acquisition Device (LAD) exploits this non-linguistic principle for its own use. I believe that we see a broader example of this interface between linguistic and non-linguistic cognition in the range of effects of semantic scaffolding, which gives us an excellent example of how two vertical faculties (namely, syntax and conceptual/extralinguistic semantics) may interact under the auspices of other horizontal faculties (attention, memory).

However, my suggestion here is that *both* domain-external (or cross-/inter-domain) and domain-internal processes are at play. UG does interact with non-linguistic modules in a way that reflects those modules—for instance, in the tendencies we see towards proto-agent subjects and proto-patient themes, as these are semantically defined. This phenomenon would constitute a cross-domain interaction between the language module and the conceptual semantics module. However, UG also maintains its own autonomy as a specialized module by directing children's linguistic behavior in a principled fashion when linguistic and non-linguistic defaults clash. One instance of this, which we have witnessed here, is that UG directs children's attention towards preferential/nonrandom parsing when thematic alignment does not hold, or—as we will see in Chapters 7 and 8—when utterance length exceeds current processing power.

6.9 Canonical Alignment in Adult Language

6.9.1 Language Typology

The effects of canonical alignment can be seen to work against "mismatches" not only in acquisition, but in adult grammar as well. I suggested earlier that the elements which are highly salient for young children may also be salient for the adult speakers these children become. As one piece of evidence bearing on this prediction, consider the fact that a factorial typology constructed from the distinct elements of S(ubject), O(bject), and V(erb) yields 6 theoretically possible basic word orders for adult languages. However, by far the most common word orders cross-linguistically are those in which the subject appears before the object (with SVO and SOV the most common, and VSO represented in a smaller but still significant minority of languages; Greenberg, 1963). Taken together with Keenan's (1985) observation that across languages, basic subjects normally express the agent of the action (if there is one), it seems that preverbal agent-subjects are fairly widespread in adult language, and Greenberg in fact notes that SV order is dominant over

VS order.[23] This jibes strongly with the predictions of semantic scaffolding. In short, agents seem to be salient, and this may be a direct result of basic attentional processes responding preferentially to the properties that agents entail: animacy, action, motion, causation.[24]

6.9.2 Creole Genesis

Documentation on contact languages suggests that canonical alignment may have a hand in language genesis, as well. The canonical word order in all of the Atlantic creoles (those found in the Caribbean and West Africa) is SVO; this phenomenon may simply reflect substrate and superstrate influences in the region (Holm, 1988), but Bickerton (1981, p. 18) claims (much too strongly) that SVO "characterizes almost all contact languages."

This formulation is too extreme, since "contact languages" subsumes many language types which do not evince SVO order. However, the phenomenon of SVO in pidgins and creoles *does* appear fairly robust. For instance, although basic word order in pidgins shows significantly more variation (Bakker, 1994), there is a widespread occurrence of SVO here, as well—a tendency that Mühlhäusler (1997, p. 145) notes "deserves closer investigation." Explanations vary as to what the mechanism behind this wide distribution might be; Bickerton (1981) implies that SVO may be "bioprogrammatic" (and thus domain-specific), but it is also possible that extralinguistic (specifically, semantic) processing factors converge on this order due to its inherent ease of interpreting grammatical and thematic relations. Without the benefit of morphological case marking (which

[23] We might ask if the crucial aspect is whether subjects are *preverbal* or simply *preobject*. Greenberg's (1963) observations suggest that both play a strong role. As noted, SV order is dominant over VS order, indicating that preverbality is important. But Greenberg also notes the rarity of VOS, OSV, and OVS languages, which share in common the fact that the object precedes the subject. He formulates a linguistic universal from this observation, namely that "In declarative sentences with nominal subject and object, the dominant order is almost always one in which the subject precedes the object" (p. 110).

[24] Those interested in the phylogenesis of language could argue that human attention to animacy, motion, and the like serves a protective purpose, and therefore must have been selected for over the course of human evolution. For instance, it is not too difficult to imagine that humans who *did* pay attention to that moving sabertooth over there lasted longer (and procreated more) than those who did *not*. This issue clearly goes beyond the scope of this dissertation, but is worth mentioning.

most contact languages lack; Winford, 2003), languages must resort to other strategies to distinguish verbal arguments, and allocating the subject and object to distinct sides of the verb is one of the best ways to accomplish this.[25]

To the extent that creole genesis gives us a window into the most basic structure of UG (and clearly, this is not an uncontroversial claim), this evidence suggests that languages which maintain a canonical word order other than SVO and/or allow for freer word orders may have moved further away from some cognitively basic language structure. On the other hand, though, such a hypothesis would not explain the crosslinguistic predominance of SOV.

6.9.3 Computer Simulations of Language Evolution

Some of the research which has modeled language evolution also supports the notion that there may be something special about SVO and SOV as basic word orders. For instance, Minett et al. (2006) developed a model of phylogenetic language emergence which combines multiple *local syntax rules* (i.e., those which order two lexical elements relative to one another: e.g., *cat* before *drink/eat*) to deduce a *global syntax* (i.e., the canonical ordering of S, V, and O) for the ambient language.

Importantly, the authors found that "bias in the word order of simple utterances is constrained primarily by the need to distinguish the agent and the patient" and that "competition between SO and OS drives the evolution of global syntax" (p. 212). When SO is dominant, SV also tends to emerge as a local rule, yielding SOV and SVO as global syntaxes. On the other hand, when OS is dominant, VOS and OVS tend to surface as coexisting global orders.[26]

[25]It should also be noted that while OVS similarly distinguishes the verbal arguments, this is *not* a highly attested canonical order for contact languages. Interestingly, the other word orders common in pidgins are SOV and OSV (Bakker, 1994). I take the preverbality of subjects in these orders as yet another indication that subjects are salient. Moreover, this fact may provide one piece of evidence indicating that preverbality plays a larger role in word order than does preobjecthood. See the earlier footnote on this matter.

[26]Interestingly, Minett et al. (2006) also found that combinations of local syntax rules that generate an *imprecise syntax*—that is, those which are congruent with more than one possible global syntax (e.g., the local rules SV and SO are consistent with both global SOV and SVO)—tend to persist, while those

Thus, the agent-patient distinction which seems to influence creole word orders may also play a significant role in non-contact language evolution. In short, the notion of actors in an event—what we lexicalize as verbal arguments—seems to be a major shaping force in the configuration of languages.

6.9.4 Agrammatic Aphasia

A number of studies with agrammatic aphasics suggest that the effects of semantic scaffolding and canonical alignment may also be seen under adult situations of brain trauma. Some case studies indicate that aphasics produce fewer tokens of the passive voice than do control subjects (e.g., Stark and Dressler, 1990) or have significant trouble producing passives correctly, even when it is modeled for them in a picture description task (Dickey and Thompson, 2007); likewise, some aphasics show considerably more difficulty with non-canonical Patient-Agent (PA) verbs than they do with canonical AP verbs (e.g., Salis and Edwards, 2007). Moreover, in at least some (but not all[27]) cases of agrammatic aphasia, comprehension of reversible full passives is significantly *below* chance (Berndt et al., 1996), indicating that these individuals systematically interpret the first NP as the agent and the second as the patient. Finally, Caplan and Hildebrandt (1988) found evidence indicating that processing

local syntax rules that generate a *precise syntax*—those combinations which are consistent with only one global syntax (e.g., local SV and VO are only allowable in a global SVO order)—tend not to persist. In short, it appears that because precise syntaxes only allow a single word order, any evidence for another word order within the speaker population will quickly spread, throwing the stability of the single global syntax out of alignment; thus, these grammars tend to be transient. Meanwhile, a global syntax which allows for two word orders will remain stable, since it can handle significantly more variation in speaker behavior to begin with.

[27] Caramazza et al. (2001) perform a careful analysis of data reported in other studies and ultimately reject the received wisdom that agrammatic aphasics perform at ceiling in their comprehension of active voice utterances but at chance on passive voice utterances. Instead, they stress that a number of distinct comprehension patterns exist in the population of aphasics, and claim that the method of analysis chosen to interpret the data is vital in coming to accurate conclusions about it. In short, it is possible to achieve a group mean of "chance performance on passives" if some individuals are performing significantly above chance and some significantly below it. While I am sympathetic to this complaint, it is important to realize that this is a possibility inherent in *any* study which pools data from a number of individuals, including the current one. Ideally, such studies will include a large enough group of participants to make the experimental results empirically valid; regardless, this may simply be a shortcoming about experimental research that we have to accept.

load increases with non-canonical θ-role ordering.

Both passives and unaccusatives involve movement of an NP from an internal to an external argument position for reasons of Case (see again Section 3.2.2 for syntactic details). THOMPSON (2003) conducted a study which examined spontaneous production by agrammatic aphasics, and found that these individuals had significantly more trouble producing unaccusative intransitive verbs than unergative intransitive verbs.[28] To explain this, she proposed the *argument structure complexity hypothesis*, which claims that verbs will be more difficult when (a) they are associated with a larger number of arguments (i.e., θ-roles), or (b) their underlying argument structure does not match the S-structure representation.[29] This second phenomenon meshes with the effects of semantic scaffolding we have seen here: specifically, the prediction that violations of canonical form may correlate with higher processing loads.

In short, many similarities exist between child language acquisition and aphasic speech; this one in particular may constitute a case of a kind of "syntactic emergence of the unmarked," in which a default preference—normally hidden by typical adult brain function and processing power—surfaces under circumstances of duress.

6.10 Alignment in Relative Clause Processing

The coordination of particular thematic roles with particular syntactic functions, as seen in semantic scaffolding, is not the only place where alignment seems to be at work in the grammar. Specifically, I will argue that another exemplar of the phenomenon of alignment is the mechanism behind what MACWHINNEY (1982) refers to as "perspective maintenance."

[28]In contrast with unaccusatives, whose subject begins as an internal argument (see Chapter 3 for more detail), the subject of an unergative begins as an external argument. Thus, the unergative is syntactically "simpler" than the unaccusative because it does not require a transformation between D-structure and S-structure.

[29]The results were slightly more complicated than this: both aphasics *and* normal age-matched controls produced fewer unaccusatives than other verb types in their narrative samples. This suggests an overall disadvantage for unaccusatives—and supports the universality of semantic scaffolding.

6.10.1 MacWhinney's (1982) Predispositions

MacWhinney discusses *perspective* as one of a number of "predispositions" in child language—that is, universal strategies which influence the processes of both lexicalization and syntactic acquisition (or what he alternately refers to as "the acquisition of word-order patterns"). He discusses seven predispositional principles[30] in total, including the following:

(74) *MacWhinney's Predispositional Principles*

informativeness: the most informative/newest piece of information appears first, or to the exclusion of older information

grammatical complexity (or size): shorter constituents appear before longer ones

agency: the first NP is interpreted as the agent

salience: the perceptually most vivid element appears first

perspective: the element with which the child most closely identifies (often the agent) appears first

order of occurrence: clausal order reflecting temporal order; causes are ordered before effects

relatedness: words related with respect to semantic constituency appear together

Several of these proposed predispositions resemble principles that have been proposed to hold in adult languages as well, most notably in the work of Otto Behaghel (1909, 1932), who formulated a number of laws describing cross-language principles. For instance, Behaghel's First Law[31] is quite reminiscent of MacWhinney's concept of

[30] While MacWhinney (1982) acknowledges some problems with this list (e.g., some of the proposed predispositions have not yet been tested in child language experimentally, some are confounded with frequency effects in the languages in which they have been tested, and some have been proven to not hold), many of the predispositions appear to be on track; indeed, while the precise formulation of the principles may not match, I would argue that we observe some of their effects (in particular, *perspective* and *relatedness*) here in the current research.

[31] Erstes Behaghelsches Gesetz: "Das oberste Gesetz ist dieses, dass das geistig eng Zusammengehörige auch eng zusammengestellt wird" (Behaghel, 1932, p. 4).

relatedness;[32] it states that elements (free morphemes or affixes) which belong together conceptually will also appear together linguistically, with distance thus inversely correlated with strength of relatedness.

This First Law, and MacWhinney's relatedness predisposition, will become especially important for us in Chapter 8 below.

6.10.2 Perspective Maintenance in Relative Clauses

Returning to how these predispositions relate to the current research, perspective maintenance is hypothesized to play a role in multiple clauses appearing in sequence (both in sequential monoclausal utterances and even more so in multiclausal utterances), in which a perspective established in the first clause is maintained into following ones. The phenomenon of perspective maintenance may aid in the interpretation of relatives, complements, and conjoined clauses, in which elements like pronominals play a role (e.g., *Louise told Suki that [her] coffee was decaf*; "her" = Louise/Suki). Furthermore, and more relevant to the experiments described here, perspective also appears to help children in the interpretation of passives, by establishing a semantic focus.[33] By hypothesis, once

[32] As a side note, BEHAGHEL's Law of Increasing Terms (1932) resembles MACWHINNEY's (1982) predisposition of *grammatical complexity*; the former suggests that whenever possible, a shorter term will precede a longer one. On other matters, though, MacWhinney and Behaghel disagree. For instance, Behaghel's Second Law claims that old information will be placed before new; this stands in direct opposition to MacWhinney's notion of *informativeness*. Behaghel's statement might instead correspond more closely with linguists' notions of the "theme-rheme" (i.e., topic-focus, or topic-comment) structure inherent in language (see LI AND THOMPSON, 1976, for extension discussion on this matter).

Indeed, MacWhinney himself notes that, although informativeness is the predisposition which has received the most attention in the child language literature, this predisposition runs completely counter to the adult tendency to order the old before the new. Both strategies are explainable, given the distinct (but related) cognitive effects of primacy and recency (DEESE AND KAUFMAN, 1957; MURDOCK, 1962; GLANZER AND CUNITZ, 1966; ATKINSON AND SHIFFRIN, 1968; see also the discussion of Experiment 7 in Chapter 7 below). In general, however, it is worth noting explicitly here that "unmarked" (default, or first acquired) in child language simply does not *always* equate to "unmarked" (most common) in adult language; the childhood phenomenon of informativeness and the patterns leading to the formulation of Behaghel's Second Law may be a perfect example supporting this notion.

[33] For instance, Dewart (1975; cited in MACWHINNEY, 1982) found that, given the sequence *bad duck # the cat was bitten by the duck*, children who "did not know the passive" correctly chose the duck as the actor in the event; in contrast, children who heard *poor cat # the cat was bitten by the duck* could correctly choose the duck as the actor, but could not correctly reenact the passive. MacWhinney does not spell the following out, but it seems that without the perspective cue, the second group perhaps parsed the sentence less fully (or even more "shallowly") than the first group did.

a perspective is established, it will be maintained until it is overtly canceled by the establishment of a new perspective.

MacWhinney (1982) notes that the first major area in which children's perspective maintenance has been explored is in the interpretation of relative clauses. He discusses data from a number of studies in which children have been asked to enact sentences which vary on both the placement of the relative clause with regard to the matrix clause (i.e., whether it modified the matrix subject or object), and the syntactic role of the relative pronoun within its clause (i.e., subject- or object-extracted). Given these two dichotomous possibilities, the range of possible sentence types includes the following:

(75) Relative clause types (S-/O-modifying, S-/O-extracted)

SS: *The dog [that$_i$ t$_i$ chased the cat] kicked the horse*

SO: *The dog [(that$_i$) the cat chased t$_i$] kicked the horse*

OO: *The dog chased the cat [(that$_i$) the horse kicked t$_i$]*

OS: *The dog chased the cat [that$_i$ t$_i$ kicked the horse]*

Given the perspective maintenance hypothesis, which claims that a perspective established in the matrix clause should be held through the relative, we can predict the relative levels of difficulty that children should have in the comprehension of each of these sentences.

(76) Predicted difficulty on comprehension (perspective maintenance assumed):

SS > OO/OS > SO

Namely, the easiest sentences to comprehend should be SS utterances, which can be interpreted with no perspective shift at all (since the perspective of the subject, "the dog," which is established in the matrix clause, can be maintained as the perspectival subject of the subject-modifying relative clause). Meanwhile, OO and OS sentences require one perspective shift; in the former case, this occurs when the NN sequence "cat–horse" is encountered, since the second N establishes a new perspective; in the latter case, the shift occurs when the object noun "the cat" is followed by a relative pronoun. Finally, SO sentences require a double shift of perspective: once when the NN sequence "dog–cat" is encountered, and again when "chased" requires a return to the perspective of the dog (which is the semantic object of that verb). In short, in contrast with semantic scaffolding, which predicts a uniform benefit for certain configurations of thematic roles and syntactic positions, the perspective maintenance theory predicts an alignment *interaction* between extraction type and modifier position (Gibson et al., 2005).

MacWhinney reports that data from a number of enactment studies with children supports the predictions of the perspective maintenance hypothesis quite strongly[34] (though many of them have only tested a subset of the predicted difficulty pairs; e.g., OO > SO, Sheldon, 1974—but see MacWhinney, 1982, for many, many more).

Returning to the issue of adult language, similar effects—and specifically the object/subject asymmetry—are evident in adults' processing of subject- and object-extracted relative clauses. In an eye-tracking study by Traxler et al. (2002), adult participants read sentences containing relative clauses which modified the matrix subject; the relatives differed in whether the relative pronoun was subject- or object-extracted. As predicted by the perspective maintenance account, subjects experienced considerably more difficulty on object-extracted relatives (i.e., SO, in MacWhinney's terminology; e.g., *The banker that the lawyer irritated played tennis every Sunday*) than subject-extracted relatives (SS; *The banker that irritated the lawyer played tennis every Sunday*), since the latter maintain the perspective established in the subject of the matrix clause.[35]

[34] MacWhinney (1982) notes that the only exception to the predictions of the prediction maintenance hypothesis has been failure to find significant differences—that is, there is no data supporting significant reversal (e.g., SS > OS/OO). He hypothesizes that this effect may be a result of a ceiling effect.

[35] Traxler et al. (2002) discuss a number of possible alternative mechanisms for why this pattern might obtain in adult language processing. Apart from MacWhinney's perspective-shifting account, the authors also mention a number of memory-based accounts (the *integration cost* account, the *similarity-based interference* account) and syntax-based accounts (the *parallel function* account, the *active filler* strategy). MacWhinney himself cites these accounts, as well as several others; for a list of these hypotheses with relevant citations, see MacWhinney (1982); for details, see Traxler et al. (2002).

On the other hand, in contrast to the predictions made by the perspective maintenance theory,[36] Gibson et al. (2005) conducted research with adults which systematically varied modifier position and extraction type and found that object-extracted RCs were more difficult (i.e., they were read more slowly) than subject-extracted RCs, but that object-modifying RCs were also more difficult than subject-modifying RCs. The authors concluded that there was no evidence in processing for the predicted interaction between extraction type and modifier position. They explained the observed effect with the *information flow hypothesis*, that is, that "[b]ackground information (like that in restrictive RCs) is processed more quickly earlier in a sentence rather than later in a sentence" (p. 337). Thus, subject-modifying RCs are read more quickly than object-modifying RCs because the former both include background information and tend to occur earlier in the sentence.[37] Furthermore, the authors hypothesize that there is a continuum relating "expectedness" of input words (or syntactic categories) to processing difficulty, such that less-expected input words (as determined by linguistic experience) will cause a higher processing load; object-modifying RCs are less usual and therefore less expected and harder to process than subject-modifying RCs. Gibson et al. suggest that this tendency to order old information (such as the background information in RCs) before new arises from the relative cognitive ease of starting with information that is already known; this resonates quite strongly with the hypothesis in Li and Thompson (1976) that the ordering of topic before comment relates to the serialization of the information to be communicated (see footnote above).

6.10.3 Canonical Alignment and Perspective Maintenance

Is there any overlap between the effects of perspective maintenance and those of semantic scaffolding, apart from a general notion of "alignment" in whatever form it might take? I would argue that there is.

[36] Gibson et al. (2005) refer to this as the *perspective shift* theory.

[37] Note that this analysis would predict the opposite effect for languages with OS ordering.

To the extent that the research from MacWhinney (1982) and Gibson et al. (2005) *do* find some common ground, it appears that there is evidence for an asymmetry in processing, such that object-extracted relatives prove more difficult than subject-extracted relatives. Note that this configuration of the relative clause results (at least in English) in a word order in which the object appears before the subject (77).

(77) The dog [(that$_i$) the cat chased t$_i$] kicked the horse
$\rightarrow$ (that$_i$) the cat chased t$_i$ = the cat chased [that (dog)]

The fact that this ordering causes processing difficulties for both adults and children is congruent with the semantic scaffolding hypothesis, which predicts that preverbal objects, which violate canonical alignment, should result in a higher processing load.

Moreover, in research on relative clause processing conducted with adult speakers of Hungarian (which, unlike English, has no word-order requirement that subject precede object), MacWhinney and Pleh (1988) found a preference (as determined by reaction time) for orders in which the subject precedes the object. Since the ambient language has no syntactic constraint requiring that subjects precede objects, speakers' preference for such may be yet another piece of evidence for the semantic scaffolding account.

6.11 Interim Conclusions and Further Directions

Thus, the semantic scaffolding approach (and, in particular, its formulation of the notion of "processing load") seems to find support in both child and adult processing of language. I would argue that the effects of semantic scaffolding provide support for the hypothesis that there is, in fact, a "default perspective" present in the earliest stages of language acquisition. This perspective is reflected in the canonical alignment of thematic roles as mapped to arguments, and can be seen in both child language and adult typology, in terms of the shape that subjects and objects take. That is, there is a spectrum of "goodness" for both subjects and themes: some are "better" than others.

However, up to now we have only probed children's knowledge of the semantic and syntactic distinctions between RO and OC verbs in a few ways. As detailed in Chapter 3 above, RO and OC verbs also differ in the semantic restrictions they place on their embedded clauses, and in whether they may grammatically embed an expletive subject. In the next chapter, I will present the results of two experiments designed to test whether children ages 4 and 5 have acquired these restrictions.

Chapter 7

Experiments 5–8: Semantic and Syntactic Restrictions

In Chapter 5, I explored children's syntactic representations of RO and OC utterances by testing their comprehension of basic (active) RO and OC utterances, matrix passives, and passives embedded under RO and OC verbs.

In the current chapter, I present evidence from several experimental tasks designed to further probe children's grammars by testing their knowledge of these verbs' semantic restrictions on the embedded clause and whether they allow the embedded clause to contain an expletive subject.

7.1 Participants

Two groups of participants took part in the following experiments. The child group comprised the same 32 4- and 5-year-old participants who took part in Experiments 2–4 (see Chapter 5 for a full description of the child participant group).

The adult group was included as a control group, and comprised 14 monolingual English-speaking undergraduate students (3 males, 11 females; mean age = 18.57 years).[1] These students were recruited from linguistics courses at the University of North Carolina at Chapel Hill. Criteria for inclusion were similar to those for children: adults had to be monolingual speakers of English with no speech or hearing impairment. Adult participants received course credit for taking part in the study.

[1] One other adult participated but was excluded from the analysis for being bilingual.

7.2 Materials and Experimental Design

Once again, see Chapter 5 for a full description of the overall experimental design.

The child group took part in two sentence judgment tasks designed to resemble the reward/punishment version of the truth-value judgment (TVJ) task (Crain and McKee, 1985; Gordon, 1996); specifically, the child's task was to reward the puppet for semantically felicitous and grammatical comments, and to punish him for semantically anomalous or ungrammatical comments.

The adult group took part in two pen-and-paper sentence judgment tasks (one assessing semantic anomaly and one assessing grammaticality). Adults were instructed to read the sentences, and after each sentence, to mark whether the sentence sounded "ok" or "weird" for English *as it is normally spoken.*

The test items in the adult tasks were identical to those that child participants received, with the one exception that proper NPs were changed for adults when they reflected characters common in children's media.

7.3 Experiment 5: Semantic Restrictions

In Experiment 5, children's competence on semantic anomaly restrictions of clauses embedded under RO and OC verbs was tested. Recall that so long as the internal semantic selectional restrictions of the embedded verb are met, any clause may grammatically be embedded under an RO verb. On the other hand, OC verbs have their own selectional restrictions, which the subject of the embedded clause must meet. Specifically, the OC verbs tested do not allow embedded inanimate subjects. Experiment 5 tested whether children have acquired the distinct selectional properties of RO and OC verbs.

7.3.1 Method

Children were first trained to provide judgments on semantic felicity with sentences like *The mice want to eat the cheese* (OK) and *The ball needs to take a nap* (#). They were then asked to provide such judgments on a number of test items. For each test item, children saw a picture and listened to a short vignette describing the picture; after each vignette, the experimenter asked the puppet to comment on the vignette/picture, and the puppet delivered the test item. The child's task was to reward the puppet for semantically felicitous comments, and punish him for semantically infelicitous comments.

To reduce processing load, test items in Experiment 5 were limited to two lexical NPs. If a test item had a third argument, it appeared as a pronoun.

(78) Example vignettes: Semantic anomaly

a. RO: The boy's mother was making a cake, but he didn't know what kind. He really wanted a chocolate cake, though.

   Experimenter: *What would you say about that picture?*

   Puppet: *The boy wanted the cake to be chocolate*

b. OC: Bert and Ernie were listening to music together, but Ernie didn't like the music. He said to Bert, "Can you turn that music off?"

   Experimenter: *What would you say about that picture?*

   Puppet: *#Ernie asked the music to stop playing*

Test items appear below. Note that all RO test items had target "okay" answers, while all OC items had target "silly" answers.

(79) Semantic anomaly judgment test items: "want/ask" group

a. The boy wanted the cake to be chocolate

b. The girl wanted the coat to fit her

c. She wanted the key to open the door

d. # Ernie asked the music to stop playing

e. # The girl asked the trees to be tall

f. # The boy asked the ball to fall back down

(80) Semantic anomaly judgment test items: "need/tell" group

a. The teacher needed the books to weigh less

b. The cat needed the bed to be shorter

c. Big Bird needed the pen to write

d. # Elmo told the toys to be smaller

e. # The girl told the soup to have carrots in it

f. # Bert told the car to drive faster

All test items and pre-stimulus vignettes appear in Appendix F.

Importantly, all full RO items were felicitous, but all OC items were infelicitous. However, the embedded clauses in both verb classes were infelicitous, when considered by themselves—that is, they were either false or not verifiably true.

7.3.2 Results

The outcome of Experiment 5 was that both 4- and 5-year-olds performed significantly above chance in their judgments on the semantic restrictions of OC verbs, but that neither group performed above chance on RO items. This means that both groups correctly rejected sentences like #*Elmo told the toys to be smaller*, but that both groups, to some extent, also incorrectly rejected sentences like *The boy wanted the cake to be chocolate*. Children's high level of performance on filler items indicated that there was no general "no" bias for any subject.

The results are given in Table 7.1.

Table 7.1: Child Performance on Anomaly Judgments

	Percent Correct	
Age	RO	OC
4	56.3	77.1*
5	58.3	79.2*

*$p < 0.01$

For ease of understanding, the results also presented in the following tables as a function of how often children accepted ("OK") or rejected ("silly") a given construction. In Table 7.2 these appear as percents, and in Table 7.3 they appear as proportions.

Table 7.2: Anomaly: Child Responses by Class (%)

Type	Item	adultlike		4-year-olds		5-year-olds	
		OK	silly	OK	silly	OK	silly
RO	... wanted [the cake to be chocolate]	100	0	56.3	43.7	58.3	41.7
OC	... asked [the music to stop playing]	0	100	22.9	77.1	20.8	79.2

Table 7.3: Anomaly: Child Responses by Class (Proportions)

Type	Item	adultlike		4-year-olds		5-year-olds	
		OK	silly	OK	silly	OK	silly
RO	... wanted [the cake to be chocolate]						
OC	... asked [the music to stop playing]				*		*

*$p < 0.01$

As in Experiments 2–4, the data was analyzed by age group and by verb type, and logistic regressions were performed to compare the number of correct responses per age group to a chance level of performance. A test of the hypothesis that children's performance was equal to chance levels on OC items was rejected; both 4- and 5-year-olds' judgments on OC utterances were significantly above chance (4: $z = 2.81$, $p = 0.0050$; 5: $z = 2.85$, $p = 0.0044$). However, neither group performed in an adultlike way in their judgments of RO verbs (4: $z = 0.71$, $p = 0.4771$; 5: $z = 0.90$, $p = 0.3678$).

When children's performance on each verb type is considered in this experiment, both age groups showed a trend towards performing better on OC than on RO verbs. However, this trend did not reach significance for either group (4: $\chi^2 = 2.20$, $df = 1$, $p = 0.0.1380$; 5: $\chi^2 = 2.00$, $df = 1$, $p = 0.1578$).

This performance can be explained if we assume that children are only assessing the felicity of the embedded clause in each test item. In the next section, I will discuss this possibility.

7.3.3 Discussion

In the semantic anomaly task, children were asked to provide judgments on the felicity of RO and OC constructions containing embedded clauses with inanimate subjects. Given the pre-stimuli vignettes, all of the test items for both RO and OC verbs contained embedded clauses that by themselves were either false, or not verifiably true. However, when considered as biclausal utterances as a whole, all RO items were semantically felicitous, while OC items were semantically infelicitous, due to the embedded inanimate subject. For instance, one story described a boy who didn't know what kind of cake his mother was baking, although he hoped it was chocolate. In this situation, the entire RO prompt *The boy wanted the cake to be chocolate* would be true, while the embedded clause *the cake [to] be chocolate* alone would not be verifiable. Similarly, another story told how Ernie and Bert were listening to music together, but Ernie didn't like the music, and asked Bert to turn it off. Given this vignette, the entire OC utterance *#Ernie asked the music to stop playing* in infelicitous, due to the matrix verb-embedded subject mismatch. However, the embedded clause *the music [to] stop playing* is also false, since the music did not stop.

Both 4-year-olds and 5-year-olds performed in an adultlike way by correctly rejecting OC utterances. However, both age groups also *incorrectly* rejected RO sentences, performing at chance levels on these items.

Thus, the response pattern evidenced by children in both age groups indicates that children may have been parsing only the embedded clause in each item, leading them to reject all items. Since all embedded clauses were infelicitous (either false or unverifiable), but only the full OC (and not the full RO) utterances were infelicitous, this strategy would lead to what looks like adultlike behavior on OC, but not RO, items.[2]

[2] As an alternative (or perhaps supplemental) explanation, consider the fact that it is possible to judge the felicity of the types of OC utterances tested here by simply assessing the semantic relationship between the matrix verb (*ask, tell*) and its object complement (*Neil, #the espresso machine*), without having to consider the utterance (or even the entirety of the embedded clause, as is required with the RO utterances in this task) as a whole. It may be precisely this issue—and namely, the judgment strategy that it entails—which enabled even the 4-year-olds to perform at such high levels in the semantic anomaly

To see if the veridicality of the embedded clause was influencing children's response patterns, I tabulated children's "weird" responses to the items whose embedded clauses were false (given the pre-item vignette) and those whose embedded clauses were simply unverifiable. If children are simply assessing the felicity of the embedded clause, we would predict a higher level of "weird" answers to clauses which are clearly false than to clauses which are simply unverifiable; for the latter, children would be likely to provide an answer by simply guessing at random.

The groupings of test items appears in in Table 7.4.

Table 7.4: Anomaly: Items by Veridicality

False	Unverifiable
wanted the coat to fit her	wanted the cake to be chocolate
needed the pen to write	wanted the key to open the door
needed the bed to be shorter	asked the music to stop playing
needed the books to weigh less	asked the ball to fall back down
asked the trees to be tall	told the soup to have carrots in it
told the toys to be smaller	told the car to drive faster

Unfortunately, the veridicality of the items is confounded to some extent with the matrix verb and matrix verb class, since (a) all the *need* items were false, and (b) more RO items were unverifiable, and more OC items were false.

Children's pooled responses by item type appear in Table 7.5.

The 5-year-olds *did* perform in the predicted direction: that is, they were more likely to say an item was "silly/weird" if the embedded clause itself was false (68.8%), than if the embedded clause was unverifiable (52.1%). On the other hand, however, 4-year-olds did not evidence this pattern; they were more or less equally likely to say an

task (77.1%, $p < 0.01$); recall that while both age groups performed significantly above chance on the SA-OC items, neither age group performed above chance on SA-RO items. Note, however, that this assessment strategy would still require some knowledge about how RO and OC verbs work: namely, that the matrix verb in an OC (but not in an RO) utterance stands in a semantic relationship to the matrix object, and must therefore the matrix verb's semantic subcategorization requirements must be met for the entire utterance to be felicitous. In contrast, the semantic requirements that must be satisfied in an RO utterance are simply those internal to the embedded clause.

Table 7.5: Anomaly: Child Responses by Veridicality

	Percent "Weird"	
Age	false	unverifiable
4	58.3	62.5
5	68.8	52.1
Total	63.6	57.2

item was "silly/weird," regardless of the veridicality of the embedded clause in the context of the pre-item vignette. Thus, 4-year-olds may be assessing the embedded clauses in some way that does not consider the pre-item context they were given.

Why might children preferentially assess the embedded clause instead of the entire biclausal utterance? Such an interpretation strategy might be caused by a bottleneck on utterance size with regard to parsing, as a result of limited processing resources. That is, biclausal utterances (with their concomitant high NP load) may simply overtax 4- and 5-year-olds' processing resources, such that children must "pick and choose" what makes it through to the interpretive function of the grammar. This processing overload may be further compounded by the abstract nature of the semantics of these verbs.

However, it should be noticed that—if the results of Experiment 5 are indicative—what *does* make it through is not a random or haphazard collection of morphemes. Instead, it is a semantically and syntactically independent proposition: the embedded clause. Thus, even the allotment of limited processing resources may be constrained and guided by UG. (I will discuss this issue in greater detail in Chapter 9 below.)

On the other hand, when we consider children's performance on this task in comparison with their adultlike performance on the basic RO/OC task, the question arises as to why such a bottleneck should exist in the former but not the latter. The test items in both tasks comprised active-voice utterances with a limit of 2 lexical NPs; why, then should one task prove to have a greater processing load than the other? I assume that the greater processing load inherent to the semantic anomaly task is related to the novelty of the judgment task itself. Researchers have long considered children to be cognitively unable to provide such metalinguistic judgments, and while some researchers (especially McDaniel and Cairns, 1996) have had success with training young participants to perform such judgments (usually by providing them with very large numbers of training items), it is likely that even with adequate training children still struggle to some extent with the cognitive demands of this particular metalinguistic task. The TVJ task used in the basic RO/OC task requires absolutely no metalinguistic awareness whatsoever, and so it should be utterly unsurprising for it to pose a much lower processing load for children.

The semantic anomaly judgment task also requires the child to use abilities at the interface of linguistic and non-linguistic cognitive abilities. Namely, to succeed at this task, the child must be able to assess a linguistic representation of a real-world state of affairs: knowing how the verbs *ask* and *tell* work requires knowing which things in the world can reasonably be *asked* and *told*. The ability to seamlessly integrate this linguistic and non-linguistic knowledge may take some time, and at younger ages, the process may require an amount of extra processing power which is not available. I will return to the issue of processing constraints in child language research in Section 8.2 below.

Not only is it possible that interface abilities might present a higher processing load, but this particular task also requires a specific level of semantic development on the part of child subjects. Since the experiments detailed here did not involve any tests of semantic development, it is impossible to know if the child participants had adultlike concepts about which of the characters and items appearing in the vignettes could reasonably be *asked* or *told*.

However, there are two reasons to believe that children's semantic development alone is not to blame for non-adultlike performance on this task. First, even the younger 3- and 4-year-old subjects in Becker's (2005) study seemed to show adultlike conceptions of the type necessary for such a task, and anecdotal evidence from the current study itself suggests that the relevant aspects of semantic development may be in place by the age under consideration.

For instance, children's justifications for their rejections were particularly enlightening. A number of children seemed to reject semantically anomalous statements for adultlike reasons,[3] as seen in (81).

(81) Children's adultlike justifications for judgments of semantic anomaly

a. *The girl told the soup to have carrots in it*

Because the soup... can't put carrots in it all by itself (JS, 5;0.27)

Not told the soup—told her daddy (AS, 5;6.17)

Cause it won't talk to me! (CO, 4;4.4)

The girl told the daddy to put carrots in it (SP, 5;7.20)

No, she told her *daddy* to do it! (AT, 4;11.12)

b. *Bert told the car to drive faster*

The car can't drive by itself; it needs to have a steering wheel (JS, 5;0.27)

You can't tell the car... You have to *drive* the car (AS, 5;6.17)

No, you have to *drive* faster! (GH, 4;7.4)

c. *Elmo told the toys to be smaller*

Because he *needed* the toys to be smaller (AS, 5;6.17)

You have to *buy* toys that are small (JG, 5;7.11)

Elmo can't talk to toys, and toys can't talk to Elmo (KC, 5;0.18)

d. *Ernie asked the music to stop playing*

You can't *ask* it to stop playing! You can ask *somebody else* if they can stop playing (RR, 5;9.18)

Because Ernie didn't like it, and said "Stop the music, Bert!" (AS, 4;3.13)

[3] Well, *essentially* adultlike—although some justifications are more transparently adultlike than others.

You can't *ask* the music—you can ask Bert (LW, 5;1.30)

No! You can't ask the music to turn off (DS, 4;10.29)

e. *The girl asked the trees to be tall*

You can't ask them. They have to be *grown* taller (RR, 5;9.18)

Trees can't hear (CS, 5;9.22)

No, they don't understand you (AS, 4;7.20)

f. *The boy asked the ball to fall back down*

You can't *ask* it! (RR, 5;9.18)

The trees can't make the ball fall down (JC, 5;3.7)

g. *She wanted the key to open the door*

The key can't open the door by itself (*Experimenter: But can you <u>want</u> the key to open the door?*) Yeah (RR, 5;9.18)

Some of these justifications even provided a correction for the anomaly by substituting a RO verb for the original OC verb (e.g., *Because he needed the toys to be smaller*).

However, other children seemed to be rejecting SA utterances for reasons different than those which would presumably cause adults to do so, and many of the stated justifications for rejection do, as hypothesized above, appear to focus on the embedded clause alone. This focus may be the mechanism behind children's rejection of semantically felicitous constructions with RO verbs, as seen in the list below (82).

(82) Children's non-adultlike justifications for judgments of semantic anomaly

a. *Elmo told the toys to be smaller*[4]

Because they can't turn into small (JS, 5;0.27)

Pretty silly... 'Cause they will not do it! (CO, 4;4.4)

Because the toys can't get smaller (SA, 4;4.1)

They can't just shrink—except for my Shrinky-Dinks (AT, 4;11.12)

b. *The girl told the soup to have carrots in it*

Carrots don't be in soup (GH, 4;7.4)

c. *Bert told the car to drive faster*

Because you can't crash into cars (DU, 4;1.19)

Because the car can't go faster (SA, 4;4.1)

It was silly because cars don't drive (KC, 5;0.18)

d. *The boy asked the ball to fall back down*

Cause it couldn't come back down, but if they got a ladder they could get it (KO, 5;11.15)

He can't reach up to the tree. But if he climbs the tree, he can (HI, 4;11.9)

If you ask the ball to fall back down, it won't (DS, 4;10.29)

[4]Several of the test items used in this task are ambiguous between a stative and an inchoative meaning of the embedded predicate. For instance, the embedded clause in *Elmo told the toys to be smaller* is congruent with an interpretation of this clause as describing a state of affairs—namely, one in which the toys simply *are* smaller. On the other hand, there is also an interpretation of this clause which corresponds to the *event* of the toys *becoming* smaller (cf. *Elmo told the toys to get small*). It is possible that for these utterances (which also include *The girl asked the trees to be tall* and *The cat needed the bed to be shorter*), this inchoative interpretation is the one that children are picking up on; this would explain justifications such as *Because [the toys] can't turn into small* (JS, 5;0.27) here.

However, the fact that the embedded clause alone does not *necessitate* an inchoative reading suggests that children are adding something, interpretively. I will assume here that the stative reading is the preferred reading for both adults and children, and will not explore this matter in any detail here. However, future research may wish to probe the possibility that children preferentially interpret *be* as *get* under certain circumstances. If so, the phenomenon seen here could be related to children's mastery of the *get*-passive before the corresponding *be*-passive; see also the discussion in Section 6.4 on this matter.

e. *Ernie asked the music to stop playing*

Because he asked Bert because he liked the music and if he said ‘no’ then the music would keep playing, but if he said ‘yes’ it would stop playing (KO, 5;11.15)

f. *The girl asked the trees to be tall*

If it rains, they can grow (HI, 4;11.9)

g. *The girl wanted the coat to fit her*

Because it was from last year and she knew it didn’t fit her (KO, 5;11.15)

That’s silly that it doesn’t fit her (AS 4;3.13)

h. *She wanted the key to open the door*

She had to bring the right key (HI, 4;11.9)

The key doesn’t work (MC, 4;2.16)

i. *The teacher needed the books to weigh less*

She *wanted* them to weigh less (AS, 5;6.17)

The books needed to weigh less (SP, 5;7.20)

Because—they’re so heavy (MB, 4;1.15)

Because they can’t! (SA, 4;4.1)

They can’t leigh wess! [*sic*] (AT, 4;11.12)

j. *The cat needed the bed to be shorter*

Because the bed can’t turn into small (JS, 5;0.27)

Beds can’t be short (EC, 5;1.2)

It can’t get smaller (SA, 4;4.1)

It’s silly ’cause beds can’t get shorter (KC, 5;0.18)

k. *Big Bird needed the pen to write*

The pen can't put ink in by itself (JS, 5;0.27)

Cause the pen couldn't write by itself (CO, 4;4.4)

Big Bird didn't know how to write it without the pen (GH, 4;7.4)

No, because! It needs ink (MB, 4;1.15)

Because it couldn't write (SA, 4;4.1)

It can't write by itself! (AT, 4;11.12)

It was silly because pens don't write, people write. Because pens help people draw (KC, 5;0.18)

Finally, some of children's justifications seemed to be on the right track, but still slightly skewed—or at least, presented in response to the wrong prompt. (The first two in fact make it sound like children were "hearing" the wrong matrix verb, and responding as though the prompt sentence had contained an OC rather than a RO verb.)

(83) (*The girl wanted the coat to fit her*) That's not right! You can't ask coats! (DS, 4;10.29)

(*The teacher needed the books to weigh less*) It's silly because books can't talk (KC, 5;0.18)

(*The girl asked the trees to be tall*) She can't *ask* the trees! She could ask the seeds (LW, 5;1.30)

(*Bert told the car to drive faster*) The car can't drive by itself, only a ghost can drive it—'cause you can't see it (AT, 4;11.12)

The results of the semantic anomaly task conducted here are noteworthy in light of Becker's (2006) work on raising-to-subject (RS) and subject control (SC) verbs. In her experiment on semantic anomaly judgments, 3- and 4-year-olds performed significantly above chance on RS utterances, but had much poorer performance with SC utterances.

That is, they correctly rejected RS sentences with a lower predicate that was semantically incompatible with the subject (e.g., *The hay seems to be excited*) and correctly accepted those with a compatible lower predicate (e.g., *The hay seems to be on the ground*). On the other hand, while they correctly rejected SC sentences with an incompatible lower predicate (e.g., *The flower wants to fly away*), they failed to correctly reject those control sentences with a compatible lower predicate (e.g., *The flower wants to be pink*). Thus, it appeared as though 3- and 4-year-old subjects were only parsing the matrix subject and the embedded predicate, rather than the entire utterance as a whole (though Becker ultimately rejects this analysis of children's performance).

In light of the current experimental results, it might at first seem as though Becker's participants used a distinct parsing strategy from that found above. However, when we consider that RS and SC sentences contain only one overt subject—namely, that found in the matrix clause—the two patterns become essentially identical: namely, the embedded VP is parsed with the next (overt) c-commanding NP as a subject. In RO and OC utterances, this NP is in fact the object of the matrix clause, but in RS and SC utterances, the only c-commanding NP is the matrix subject.

In fact, this performance pattern of parsing a matrix subject with its embedded VP predicate becomes even more interesting in light of results from 5-year-olds' performance in the grammaticality judgment task described in Experiment 7 below. See Section 7.5 for details.

However, the final word on how "adultlike" children's productions are cannot be pronounced until we know what the adult input on such constructions truly looks like. In Experiment 6, I probed how strict adult semantic restrictions on these verb types truly are, by asking adult subjects to assess the semantic felicity of the same stimuli that children themselves had received.

7.4 Experiment 6: Adult Semantic Restrictions

Davies and Dubinsky (2004) claim that semantic restrictions are much stricter on clauses embedded under OC verbs than on those embedded under RO verbs. However, anecdotal evidence suggests that colloquial adult usage might not support this claim. More specifically, adults—when speaking metaphorically or playfully—often allow an OC verb like "ask" or "tell" to embed an inanimate subject in the lower clause. If adults allow (and produce) such utterances with a regular enough frequency, this "anomalous" speech will comprise a piece of children's input. More importantly for the current experiments, however, it is unfair to hold children accountable for a semantic restriction that does not necessarily hold for adult speakers.

Thus, in Experiment 6, adult semantic restrictions on clauses embedded under RO and OC verbs were tested.

7.4.1 Method

Adults were presented with a pen-and-paper questionnaire including semantic anomaly judgments. They were instructed that after each sentence, they should indicate whether that sentence was "okay" or "weird" for English as it is normally spoken.

Test items for the adult task were nearly identical to those appearing in Experiment 5, with the following exceptions:

- proper NPs were changed when they reflected characters common in children's media,
- adults did not receive a pre-stimulus vignette, so some extra context was provided when the lack of context which children received might have made the test item unclear, and
- adults received all test items from both the "want/ask" and the "need/tell" conditions.

Test items that were changed for reasons of characters or context are marked with Δ in (84) below.

Test items alternated with filler items which included *want, ask, need*, and *tell* in single-clause frames. Both test and filler items appear in Appendix F.

(84) Adult semantical anomaly judgment test items

a. The boy wanted the cake to be chocolate

b. The girl wanted the coat to fit well Δ

c. She wanted the key to open the door (but didn't know if it was the right key) Δ

d. # Ernie asked the music to stop playing

e. # The girl asked the trees to be tall

f. # The boy asked the ball to fall back down

g. The teacher needed the books to weigh less

h. The cat needed the bed to be shorter

i. The author needed the pen to write (but there was no ink in it) Δ

j. # Ella told the toys to be smaller Δ

k. # The girl told the soup to have carrots in it

l. # Bert told the car to drive faster

7.4.2 Results

The results from the adult semantic anomaly questionnaire are given in Table 7.6.

Table 7.6: Adult Anomaly Judgments

Class	Verb	Predicate	% “Weird”
RO	want	. . . the cake to be chocolate	7.1
		. . . the coat to fit well	0.0
		. . . the key to open the door	7.1
	need	. . . the books to weigh less	28.6
		. . . the bed to be shorter	50.0
		. . . the pen to write	7.1
OC	#ask	. . . the music to stop playing	78.6
		. . . the trees to be tall	85.7
		. . . the ball to fall back down	92.9
	#tell	. . . told the toys to be smaller	78.6
		. . . told the soup to have carrots in it	92.9
		. . . told the car to drive faster	57.1

Although it results in a loss of information to do so, we can collapse these results and present the data in terms of adults’ predicted and actual responses. These appear in Table 7.7 as percentages of “OK” and “weird” responses, and in Table 7.8 as proportions. For ease of comparison, Table 7.9 presents the adult and child responses by verb class as proportions.

Table 7.7: Anomaly: Predicted and Observed Adult Responses (%)

Type	Item	predicted		observed	
		OK	weird	OK	weird
RO	. . . wanted [the cake to be chocolate]	100	0	83.35	16.65
OC	. . . asked [the music to stop playing]	0	100	19.03	80.97

Table 7.8: Anomaly: Adult Responses (Proportions)

Type	Item	predicted		observed	
		OK	weird	OK	weird
RO	. . . wanted [the cake to be chocolate]				
OC	. . . asked [the music to stop playing]				

Table 7.9: Anomaly: Observed Adult and Child Responses (Proportions)

Type	Item	adults		4-year-olds		5-year-olds	
		OK	silly	OK	silly	OK	silly
RO	...wanted [the cake to be chocolate]						
OC	...asked [the music to stop playing]						

As expected, adults were more likely to judge the OC utterances as anomalous than they were the RO utterances, indicating that OC verbs are stricter in their semantic restrictions on embedded clauses than are RO verbs.

However, it should be explicitly noted that neither were RO utterances accepted, nor were OC utterances rejected, across the board by participants. In fact, one RO utterance (*The cat needed the bed to be shorter*) was judged as anomalous by fully 50% of adult participants, and one OC utterances (*Bert told the car to drive faster*) was judged as acceptable by roughly 43% of adult participants. Only one RO utterance (*The girl wanted the coat to fit well*) was judged as acceptable by 100% of participants, and no single OC utterance was rejected by all participants.

Moreover, anomaly judgments seem to be linked with particular verbs, rather than simply with a class as a whole: the *want* utterances were, overall, judged as more acceptable than the *need* utterances.

This data indicates that the utterances comprising children's input—that is, the set of utterances from which children must extract the syntactic rules relevant to RO and OC verbs—is not nearly as neat as previous literature may have indicated. More precisely, semantic anomaly seems to exist on a spectrum, rather than as a dichotomy, and the phenomenon of this messy input must certainly contribute to the challenge of learning these verbs.

As a comparison, Table 7.10 presents both adults' and children's responses to the semantic anomaly items as percentages. The child data is presented by age group, as well as pooled.

Table 7.10: Adult and Child Anomaly Judgments by Item

Class	Verb	Predicate	Adult	% "Weird" 4	5	Child
RO	want	...the cake to be chocolate	7.1	12.5	0.0	6.25
		...the coat to fit well	0.0	50.0	25.0	37.5
		...the key to open the door	7.1	50.0	12.5	31.3
	need	...the books to weigh less	28.6	50.0	62.5	56.3
		...the bed to be shorter	50.0	37.5	75.0	56.3
		...the pen to write	7.1	62.5	75.0	68.8
OC	#ask	...the music to stop playing	78.6	87.5	50.0	67.9
		...the trees to be tall	85.7	87.5	87.5	87.5
		...the ball to fall back down	92.9	75.0	75.0	75.0
	#tell	...told the toys to be smaller	78.6	62.5	87.5	75.0
		...told the soup to have carrots in it	92.9	62.5	87.5	75.0
		...told the car to drive faster	57.1	87.5	87.5	87.5

It is difficult to know exactly what to make of the comparative data. On the one hand, since the adult system comprises children's input, it is important to compare the judgments of adult and child speakers. On the other hand, however, because the adult system is *not* all-or-nothing (as the literature has essentially assumed), no neat predictions or hypotheses can be made or tested—at least, not with any sort of statistical precision.

At the very least, I would argue that what we see in the table above is the beginnings of adultlike appreciation of the semantic restrictions inherent to these verbs. As with adults, there is no perfect agreement among children as to which utterances were acceptable and which not; also like adults, however, children show a stronger tendency to reject inanimate subjects embedded under OC verbs than under RO verbs.

Moreover, between the ages of 4 and 5, there appears to be some development in the direction of the adult system: for instance, 4-year-olds perform at chance on both *want the coat to fit well* and *want the key to open the door*, but most 5-year-olds correctly accept these as felicitous. Likewise, almost half the 4-year-olds incorrectly accepted *tell the soup to have carrots in it* as felicitious, but far fewer 5-year-olds did.

On the other hand, the 5-year-olds did not perform in a more "adultlike" way across the board; for instance, they tended to incorrectly reject the *need* items as a group more often than 4-year-olds did. Moreover, while 4-year-olds correctly rejected *ask the music to stop playing*, 5-year-olds were at chance on this item.

Since children (like adults) do not perform in a categorical way on one utterance type versus another, and since development on adultlike semantic knowledge about these verbs is non-monotonic, there must be factors influencing children's performance beyond the verb classes. In the style of Becker (2006), future research should attempt to tease apart what lexical and syntactic cues sway adults in their judgments on semantic anomaly with RO and OC utterances.

7.5 Experiment 7: Grammaticality of Embedded Expletives

In Experiment 7, children's competence on the grammaticality of expletive constructions embedded under RO and OC verbs was tested. Recall that grammatically, RO (but not OC) verbs allow embedded expletive subjects. This task will test whether children respect this grammatical restriction.

7.5.1 Method

As in the semantic anomaly task in Experiment 5, children were trained to provide judgments on the grammaticality of sentences like *The sheep is standing under the tree* (OK) and *The stick is be near the tree* (*). They were then asked to provide such judgments on a number of test items. For each test item, they saw a picture and listened to a short vignette describing the picture; after each vignette, the experimenter asked the puppet to comment on the vignette/picture, and the puppet delivered the test item. The child's task was to reward the puppet for grammatical comments, and punish him for semantically ungrammatical comments.

To facilitate the felicity of existential *there*-constructions in Experiment 7, the limit on number of lexical NPs appearing in test items was waived. However, to reduce processing load, there were not more than 2 animate NPs in any test item (Goodluck and Tavakolian, 1982).

(85) Example vignettes: Grammaticality judgment

a. RO: The woman bought some ice cream at the grocery store. When she got in the car, she realized she needed to turn on the air conditioning so the ice cream wouldn't melt.

   Experimenter: *What would you say about that picture?*

   Puppet: *The woman needed it to be cooler in the car*

b. OC: The girl was walking around outside and got really cold. She said, "I sure wish it was warm outside today!"

   Experimenter: *What would you say about that picture?*

   Puppet: **The girl told it to be warm*

Test items appear below. As in Experiment 5, all RO test items had target "okay" answers, while all OC items had target "silly" answers.

(86) Grammaticality judgment test items: "want/ask" group

a. The girl wanted there to be cookies in the bag

b. Big Bird wanted there to be crayons in the box

c. Dora wanted it to be her friend Boots on the phone

d. * The girl asked it to snow

e. * The boy asked it to be time for bed

f. * The policeman asked there to be people on the sidewalk

(87) Grammaticality judgment test items: "need/tell" group

a. The woman needed it to be cooler in the car

b. The chef needed there to be more sandwiches

c. The farmer needed it to rain

d. * The girl told it to be warm

e. * Sponge Bob told there to be a party at his house

f. * The woman told there to be flowers on the table

All test items and pre-stimulus vignettes appear in Appendix G.

Once again, all full RO items were felicitous and grammatical, but all OC items were felicitous but ungrammatical. As in Experiment 5, however, the embedded clauses in both verb classes were infelicitous, when considered by themselves—that is, they were either false or not verifiably true.

7.5.2 Results

The outcome of Experiment 7 was that development of the restrictions on embedded expletives appears to be non-monotonic. That is, while 4-year-olds judged expletives embedded under OC verbs in an adultlike way (that is, by correctly rejecting sentences like **The girl asked it to snow*), they did not perform above chance on expletives embedded under RO verbs (that is, they did not correctly accept sentences like *The farmer needed it to rain*). In contrast, however, 5-year-olds performed above chance on expletives embedded under RO sentences, but were at chance for judging expletives embedded under OC sentences. Thus, performance by 4- and 5-year-olds was diametrically opposed.

The results are given in Table 7.11.

Table 7.11: Child Performance on Grammaticality Judgments

	Percent Correct	
Age	RO	OC
4	62.5	72.9*
5	77.1*	50

$*p < 0.01$

For ease of understanding, the results are also presented in the following tables as a function of how often children accepted ("OK") or rejected ("silly") a given construction. In Table 7.12 these appear as percents, and in Table 7.13 they appear as proportions.

Table 7.12: Grammaticality: Child Responses by Class (%)

Type	Item	adultlike		4-year-olds		5-year-olds	
		OK	silly	OK	silly	OK	silly
RO	. . . needed [it to be cooler in the car]	100	0	62.5	37.5	77.1	22.9
OC	. . . told [it to be warm]	0	100	27.1	72.9	50	50

Table 7.13: Grammaticality: Child Responses by Class (Proportions)

Type	Item	adultlike		4-year-olds		5-year-olds	
		OK	silly	OK	silly	OK	silly
RO	. . . needed [it to be cooler in the car]						*
OC	. . . told [it to be warm]				*		

*$p < 0.01$

The data was analyzed by age group and by verb type, and logistic regressions were performed to compare the number of correct responses to a chance level of performance. This test indicated that only 4-year-olds performed significantly above chance on judgments for the OC items ($z = 2.91$, $p = 0.0037$), but not the RO items ($z = 1.23$, $p = 0.2197$), while 5-year-olds showed the opposite pattern: they performed above chance on RO items ($z = 2.62$, $p = 0.0089$) but not OC items ($z = 0.00$, $p = 1.0000$).

Furthermore, this was the only experiment in which performance by 4-year-olds was significantly different (and, in fact, better) than performance by 5-year-olds: 4-year-olds outperformed 5-year-olds on OC items ($z = 1.96$, $p = 0.0499$).

When children's performance on each verb type is considered in this experiment, 5-year-olds showed a trend towards performing better on RO than on OC verbs. However, this trend did not reach significance ($\chi^2 = 2.94$, $df = 1$, $p = 0.0866$). On the other hand, 4-year-olds performed slightly (not significantly) better on OC than on RO verbs ($\chi^2 = 0.88$, $df = 1$, $p = 0.3490$).

7.5.3 Discussion

As with the semantic anomaly task, children's justifications for their rejections provided a valuable window into their thought processes. Many children apparently rejected ungrammatical statements for adultlike reasons, as seen in (88).

(88) Children's adultlike justifications for judgments of ungrammaticality

a. *The boy asked it to be time for bed*

He asked him mother if he could go to bed (KO, 5;11.15)

b. *The girl asked it to snow*

No! She *wanted* it to snow, but it was a hot day (KO, 5;11.15)

Because you can't ask the sun to go away! (DS, 4;10.29)

No, you have to *wait* until it snows! (AS, 4;7.20)

c. *The girl told it to be warm*

No, if there is a air conditioning you can *make* it warm (AS, 5;6.17)

"Be warm"... Ha! (LJ, 4;6.25)

It's silly 'cause girls can't talk to nothing, and nothing can't talk to girls (KC, 5;0.18)

d. *The policeman asked there to be people on the sidewalk*

The police asked the people to stay on the sidewalk (RR, 5;9.18)

e. *The woman told there to be flowers on the table*

She wanted there to be flowers on the table (CO, 4;4.4)

However, as with the semantic anomaly task, some of children's justifications were quite different than those adults might have given, as seen in (89).

(89) Children's non-adultlike justifications for judgments of ungrammaticality

a. *The woman needed it to be cooler in the car*

Cause if she wanted it to be hotter in the car, then her ice cream would melt (JS, 5;0.27)

It can't blow dry itself, only ghosts can do that. And ghosts aren't real! (AT, 4;11.12)

b. *The boy asked it to be time for bed*

Asked it to be *time* for bed? I can't understand this word, too! (DS, 4;10.29)

c. *The girl told it to be warm*

'Cause the girl can't change to be warmer. If she went inside, then she would be warmer (JS, 5;0.27)

It's supposed to be warm (CO, 4;4.4)

d. *The girl asked it to snow*[5]

It only snows in winter (CS, 5;9.22)

e. *The farmer needed it to rain*

The farmer *wanted* it to rain (CO, 4;4.4)

f. *Dora wanted it to be Boots on the phone*

She didn't know if it was Boots on the phone (HI, 4;11.9)

g. *Big Bird wanted there to be crayons in the box*

He would buy more crayons (HI, 4;11.9)

It's silly because there's no crayons (MC, 4;2.16)

[5]As a humorous aside, one child (AS, 4;3.13)—when asked by the experimenter, "Can you ask it to snow? Is that something you can do?"—began waving his hands at the picture frantically, saying, "TURN TO SNOW TURN TO SNOW!" quite loudly. It is unclear whether he simply misunderstood the illocutionary force of the "can" in the question (that is, whether he took the question to mean "will you do it right now?" rather than "is it generally possible?") or whether he also interpreted the expletive "it" in the experimenter's question as a referential pronoun.

h. *The girl wanted there to be cookies in the bag*

Because she thought it could be cookies (MC, 4;2.16)

As in the semantic anomaly task, all expletive-subject clauses embedded under both RO and OC verbs were grammatical (if untensed), when considered independently of their matrix frame, insofar as the expletive appearing as a subject of the embedded predicate. However, only the full RO utterances, and not the full OC utterances, were grammatical with regards to the appearance of the embedded expletive. For instance, one vignette described a woman who got into a hot car with an ice cream cone. The full RO utterance which followed this vignette, *The woman needed [it to be cooler in the car]*, is felicitous and grammatical, while the embedded clause alone, *it [to] be cooler in the car*, is infelicitous (it was not yet cool in the car) but "grammatical" to the extent that an expletive subject is cooccurring with a weather predicate. Likewise, after a vignette about a girl who got cold being outside and wished it were warm, the full OC utterance **The girl told [it to be warm]*) was both infelicitous and ungrammatical, while its embedded clause—though infelicitous, since it was a cold day—likewise includes a grammatical configuration of weather predicate with expletive subject. On the other hand, to the extent that all embedded clauses were untensed, they were ungrammatical in isolation.

As a result, children's responses suggest they are not interpreting these sentences in an adultlike way.

However, when we consider the possibility that children may actually be performing a semantic, rather than a grammatical, assessment of the test items, we get a different picture. Specifically, given the pre-stimulus vignettes, none of the embedded clauses were semantically felicitous, while all of the full utterances—both RO and OC—were felicitous.

For instance, consider the following vignettes and test items:

(90) *RO vignette:*

The girl's mother gave her a bag with something tasty inside. The girl said, "I hope it's cookies!"

RO test item:

The girl wanted [there to be cookies in the bag]

(91) *OC vignette:*

The girl wanted to play it the snow, but it was a bright, sunny day. The girl said, "I wish it would snow! Why can't it snow?"

OC test item:

*The girl asked [it to snow]

Syntactically, the entire RO utterances, but not the entire OC utterances, are grammatical. However, the bracketed embedded clauses in both RO and OC utterances are grammatical (if untensed) with respect to the cooccurrence of expletive subjects and predicates. Semantically, however, the bracketed embedded clauses are infelicitous, given the pre-stimulus vignettes: each embedded clause corresponds to a state of affairs that was *not* described in the vignette.

Given the response pattern we see here (namely, that 4-year-olds correctly reject OC utterances, but also incorrectly reject RO utterances), then, it appears that just as in Experiment 5 with semantic anomaly judgments, 4-year-olds again are assessing the embedded clauses (rather than the full biclausal utterances) in isolation, and are doing so for semantics, rather than syntactic grammaticality. This strategy of using local semantics in their judgments, and not global syntax, led to what appeared to be adultlike rejection of OC items, paired with non-adultlike rejection of RO items.

However, notice that the 5-year-olds' data *cannot* be explained with this analysis, as 5-year-olds responded in the opposite fashion: they correctly accepted RO items, but also incorrectly accepted OC items.[6]

Instead, it may be the case that 5-year-olds, who must certainly have greater processing resources than 4-year-olds, have greater flexibility in what linguistic information they allow through the processing bottleneck to reach the parser. While it is clear that they are still not parsing the full utterances in an adultlike way, we might explain their response pattern by supposing that 5-year-olds prefer to parse the embedded verb with the next c-commanding *lexical* (not expletive) NP, which in the test items can only be found in the matrix clause. By disregarding the embedded expletive, 5-year-olds are able to construct "grammatical" semantically-driven parses for both RO and OC utterances. Thus, test items like those in (92) may be interpreted by 5-year-olds as in (93), allowing these children to accept both RO and OC utterances.

(92) a. The girl wanted there to be cookies in the bag

b. * The boy asked it to be time for bed

(93) a. The girl wanted... cookies in the bag

b. The boy asked... for bed

As in Experiment 5, I again tabulated children's "weird" responses to the items whose embedded clauses were false (given the pre-item vignette) and those whose em-

[6] An alternative explanation is that 5-year-olds are able to incorrectly accept the OC utterances by assuming a null complementizer such as "for": e.g., *The boy asked [for] it to be time for bed.* On this analysis, children could be incorrectly hypothesizing an overt/null complementizer pattern for all the verbs in question, on the analogy of the alternation seen with *that* (e.g. *The man [that] Louise kissed was Neil*). However, two pieces of evidence suggest that this analysis is unlikely. First, while complementizer *for* can indeed grammatically appear with 3 of the verbs tested here (*Neil wanted/needed/asked for Louise to drink espresso*), it cannot grammatically appear with the verb *tell* (cf. **He told for me to drink espresso*). This fact is not damning, however, when we consider that children creatively hypothesize novel (non-adultlike) instances of attested (adultlike) patterns in acquisition all the time—for instance, novel causatives (e.g. *She giggled me*, 'she made me giggle'; formed on analogy to *She melted the butter*, 'she made the butter melt').

However, there is a second piece of evidence which is more convincing. Recall from Chapter 4 that utterances including overt complementizer *for* are vanishingly rare in the input: in all the corpora examined, there were only 2 instances of spontaneous productions containing this morpheme under *want, need, ask* or *tell* (see Section 4.5.2 for details). While novel causatives might arise on the basis of a common alternation seen in adult speech, it seems unlikely that multiple 4-year-olds would have posited a pattern for complementizer *for*, on analogy from an alternation with complementizer *that*, when the overt *for* construction is so rare in adult speech.

bedded clauses were simply unverifiable. Recall that if children are simply assessing the felicity of the embedded clause, we would predict a higher level of "weird" answers to clauses which are clearly false than to clauses which are simply unverifiable; for the latter, children would be likely to provide an answer by simply guessing at random.

The groupings of test items appears in in Table 7.14, and children's pooled responses by item type appear in Table 7.15. Note that this task has a more even breakdown of verb class by veridicality type (3 RO utterances and 3 OC utterances per condition).

Table 7.14: Grammaticality: Items by Veridicality

False	Unverifiable
wanted there to be crayons in the box	wanted it to be Boots on the phone
needed there to be more sandwiches	wanted there to be cookies in the bag
needed it to rain	needed it to be cooler in the car
asked it to snow	asked there to be people on the sidewalk
told it to be warm	asked it to be time for bed
told there to be flowers on the table	told there to be a party at his house

Table 7.15: Grammaticality: Child Responses by Veridicality

	Percent "Weird"	
Age	false	unverifiable
4	58.8	52.1
5	33.3	39.6
Total	46.9	45.9

The numbers are less pronounced here than in the data for the semantic anomaly task. That is, in the grammaticality task, 4-year-olds were slightly more likely to reject false items (58.8%) than unverifiable items (52.1%). The 5-year-olds, however, flipped this performance: they were marginally more likely to reject unverifiable items (39.6%) than false ones (33.3%). It is perhaps worthy of note, however, that 5-year-olds in general tended to accept most items overall. Thus, it appears that as in the semantic anomaly task, something is influencing children's response patterns apart from the simple veridicality of the test item in the context of the pre-item vignette.

The phenomena involved in 5-year-olds' performance on the GJ task—that is, that 5-year-olds seemed to parse the matrix subject with the embedded predicate—are certainly not without precedent, and as such should perhaps not come as a surprise. First, data that indicate that children disregard the "middle" of a utterance dovetail with BECKER's (2006) findings indicating that when confronted with subject-raising and subject control sentences like those in (94), children ages 3–4 *appeared* at times to parse the matrix subject with the embedded predicate, ignoring the matrix verb (although Becker herself ultimately concluded that children are in fact parsing the matrix verb).

(94) a. The hay [seems] to be on the ground (subject-raising)

b. The flower [wants] to be pink (subject control)

The current data also meshes with previous findings about how—given a known verb in a frame that violates its own argument structure—children may be willing to alter their normal linguistic interpretation strategies to accomodate new data. LIDZ ET AL. (2004) found that when presented with a novel (ungrammatical) utterance like *The zebra goes the lion to the ark*, children are willing to override their previous knowledge of verb meanings in order to remain "frame compliant" (that is, to respect the constructional meaning of the syntactic frame in which that verb appears).

Clearly, the issue of frame compliance does not apply in the same way to the work presented here, since none of the stimuli used violated the verbs' subcategorization frames in such a blatant way (although OC verbs *did* appear with embedded subjects which violated their syntactic and semantic restrictions). What is more notable for the current research, however, is the basic fact that children may be willing to alter their normal interpretations to accomodate a novel utterance type. In the case of 5-year-olds performing the GJ task here, parsing only the matrix subject and the embedded predicate of a biclausal utterance may not be children's normal interpretation strategy. However, in the face of a structure whose syntax they may not have mastered and whose sheer length may otherwise overtax their processors, it does not seem unreasonable (given the Lidz et al. evidence referenced above) that children might "pick and choose"—in an otherwise unorthodox way—to decide what makes it through to the parser.

Finally, children's choice of matrix subject and lower predicate also makes sense in the context of studies on serial position effects on memory, specifically the effects of primacy and recency (Deese and Kaufman, 1957; Murdock, 1962; Glanzer and Cunitz, 1966; Atkinson and Shiffrin, 1968). Studies indicate that when a number of items (say, words) are presented in succession, the elements at the beginning (i.e., "primacy") and at the end (i.e., "recency") of the list will be disproportionately salient, and thus better recalled. In contrast, items in the middle of the list will be less easily recalled.

There is some debate on the extent to which domain-specific language processing is influenced by domain-general effects of memory. Gordon et al. (2000) note that the general tendency in the literature has been to take as a given the *sentence memory assumption*, which claims that the reaction time to a given word in a probe-word recognition task (PWRT; e.g., "Did you see the word *gorp* in the preceding sentence?") should correlate with the accessibility of that word in the memory representation of the sentence for a speaker-listener. This assumption crucially predicts that performance in a given experimental task should be influenced *only* by grammar-internal processes involved in speech comprehension. As an alternative to the sentence memory assumption, Gordon et al. propose (and ultimately accept) the *probe-list hypothesis*, which states that subjects taking part in a PWRT may resort to a different strategy as an adaptation to the task itself: namely, they may create a special memory representation for use in responding in the PWRT. The prediction here is that memory demands imposed by the task itself also play a role in subjects' patterns of performance, and as a result, performance in such tasks may not exactly mirror the kind of language processing that takes place under normal circumstances.

In a similar vein, Neath and Knoedler (1994) argue strongly for a processing model that links participants' performance in the PWRT to completely nonlinguistic factors. Instead, they propose a *dimensional distinctiveness model* which includes aspects of both the "verbally stated" and "umbrella" models of performance in such tasks. This model makes use of the notion of "distinctiveness," which is defined as "the extent to which a stimulus stands out from other stimuli"[7] (p. 777); distinctiveness may be calculated for temporal, physical, or other dimensions, including serial position, but crucially can only be defined among members of a group, rather than for any element in isolation.

Neath and Knoedler suggest that verbal/linguistic factors play absolutely no role in the memory and processing taking place in a PWRT, and suggest that effects of primacy and recency will play the same role here as in a traditional recognition memory experiment. However, they suggest that the distinctiveness model may not apply in cases where the task requires processing the *meaning* of a sentence, and recommend further research into which aspects of language processing are explainable with domain-general effects of memory, and which must be related to higher-level linguistic parsing.

Taking the proposals of both Gordon et al. and Neath and Knoedler under consideration, it seems reasonable to suggest that there is an interaction between normal quotidian sentence processing, which is primarily a language-internal phenomenon, and other effects of domain-general memory—for instance, primacy and recency. When the experimental task in question is less "language-y" in its approximation of normal (i.e., non-experimental) language comprehension, we could predict that children will make heavier use of domain-general memory processes. In short, asking children to perform a task which removes them from the usual language processing situation—as in the metalinguistic judgment tasks in Experiments 5 and 7—might in fact encourage them

[7] This formulation is strongly reminiscent of traditional notions of "salience"—that is to say, it is not well operationalized. While distinctiveness might be easy to measure concretely in some situations (e.g., serial position), it will prove more elusive in others (e.g., size or color). Thus, predictions based on this notion of distinctiveness may or may not be easily testable.

to depend on domain-general memory and attention strategies, à la those proposed by Gordon et al.

If we then allow for the idea that domain-general serial position effects in memory may have an influence on language processing, this phenomenon makes exactly the prediction we see borne out in 5-year-olds' interpretations of items in the GJ task: namely, that they would parse the matrix subject and the embedded predicate together, but would appear to disregard the "middle" of the utterance (i.e., the semantic subject of the embedded clause, and perhaps the matrix verb as well).

Several studies on children's language have suggested that utterance-position of a given morpheme or lexeme has a relation to children's later acquisition. First, Newport et al. (1977) provide data indicating that children's acquisition of auxiliaries is positively correlated with parental use of yes-no questions, in which the auxiliary appears in sentence-initial position. They suggest that this effect is due to children's attention biases (or perhaps processing constraints)—specifically, a bias towards selectively or primarily attending to the beginning of utterances. Likewise, Tardif et al. (1997)[8] note Slobin's (1985) "principles of paying attention to the beginnings and end [*sic*] of linguistic units" and propose that this effect extends to full utterances, in which the items at the beginning (utterance-initial position) and the end (utterance-final position) will be more salient than those items appearing in medial utterance position. They find evidence for the noun-bias in children's early vocabularies in both English and Italian, but not Mandarin, and hypothesize that among other factors, the utterance-position of nouns in the first two languages make them more accessible for children.

Once again, however, we cannot hold children accountable for acquiring a restriction on embedded expletives if adults themselves do not respect that restriction. In the next experiment, I tested whether adult subjects indeed allow embedded expletive sub-

[8] On the other hand, Tardif et al. (1997) also mention that Richards and Robinson (1993; cited therein) found no correlation between adult sentence-final copula use and children's copula use. Tardif et al. maintain that one example to the contrary is not enough to exclude utterance-final position as a possible position of salience.

ject with RO but not with OC verbs, by asking them to assess the grammaticality of the same stimuli that children themselves had received.

7.6 Experiment 8: Adult Grammaticality of Embedded Expletives

As with semantic restrictions, anecdotal evidence suggests that adult grammaticality restrictions on clauses embedded under RO and OC verbs might not be as strict as previously believed. More specifically, adults—when speaking metaphorically or playfully—often allow an OC verb like "ask" or "tell" to embed an expletive subject in the lower clause (*I'm so sick of this heat, I'm gonna ask it to snow*). If adults allow (and produce) such utterances with a regular enough frequency, we cannot necessarily expect children to acquire a "restriction" against them at an early age.

Thus, in Experiment 8, adult grammaticality restrictions on expletive subjects embedded under RO and OC verbs were tested.

7.6.1 Method

As in Experiment 6, the same group of adults were presented with a pen-and-paper questionnaire including grammaticality judgments. They were instructed that after each sentence, they should indicate whether that sentence was "okay" or "weird" for English *as it is normally spoken.*

Test items for the adult task were identical to those appearing in Experiment 7, with the following exceptions:

- proper NPs were changed when they reflected characters common in children's media (marked with Δ in (95) below),
- adults received all test items from both the "want/ask" and the "need/tell" conditions.

Furthermore, as in Experiment 6, adults did not receive a pre-stimulus vignette.

Test items alternated with filler items which included *want, ask, need*, and *tell* in single-clause frames. Test and filler items appear in Appendix G.

(95) Adult grammaticality judgment test items

a. The girl wanted there to be cookies in the bag

b. Barry wanted there to be crayons in the box Δ

c. Dora wanted it to be Ben on the phone Δ

d. * The girl asked it to snow

e. * The boy asked it to be time for bed

f. * The policeman asked there to be people on the sidewalk

g. The woman needed it to be cooler in the car

h. The chef needed there to be more sandwiches

i. The farmer needed it to rain

j. * The girl told it to be warm outside

k. * Bob told there to be a party at his house Δ

l. * The woman told there to be flowers on the table

7.6.2 Results

The results of the adult grammaticality judgment task are given in Table 7.16.

Table 7.16: Adult Grammaticality Judgments

Class	Verb	Item	% "Weird"
RO	want	...there to be cookies in the bag	21.4
		...there to be crayons in the box	14.3
		...it to be Ben on the phone	0.0
	need	...it to be cooler in the car	14.3
		...there to be more sandwiches	21.4
		...it to rain	0.0
OC	*ask	...it to snow	64.3
		...it to be time for bed	100.0
		...there to be people on the sidewalk	92.3
	*tell	...it to be warm outside	64.3
		...there to be a party at his house	92.3
		...there to be flowers on the table	78.6

We can again collapse these results and present the data in terms of adults' predicted and actual responses. The percentages appear in Table 7.17, and the proportions in Table 7.18. For ease of comparison, Table 7.19 presents the adult and child responses by verb class as proportions.

Table 7.17: Grammaticality: Predicted and Observed Adult Responses (%)

Type	Item	predicted		observed	
		OK	weird	OK	weird
RO	...needed [there to be more sandwiches]	100	0	88.1	11.9
OC	...told [it to be warm outside]	0	100	28.75	71.25

Table 7.18: Grammaticality: Adult Responses (Proportions)

Type	Item	predicted		observed	
		OK	weird	OK	weird
RO	...needed [there to be more sandwiches]				
OC	...told [it to be warm outside]				

Table 7.19: Grammaticality: Adult and Child Responses (Proportions)

Type	Item	adults		4-year-olds		5-year-olds	
		OK	silly	OK	silly	OK	silly
RO	...needed [it to be cooler in the car]						
OC	...told [it to be warm]						

As in Experiment 6, adults were more likely to judge the OC utterances as ungrammatical than they were the RO utterances, indicating that embedded expletive subjects are less grammatical under RO than OC verbs.

However, as with semantic restrictions, the restriction on embedded subjects did not hold across speakers. In fact, speakers showed even less agreement on the acceptability of the phenomenon as a function of verb class than they did for the semantic restrictions on animacy tested in Experiment 6.

Two RO utterances (*Dora wanted it to be Ben on the phone*, *The farmer needed it to rain*) were judged as grammatical by 100% of participants, and one OC utterance (*The boy asked it to be time for bed*) was rejected by 100% participants. However, participants were much more divided in their judgments of the remainder of both RO and OC test items.

Unlike the anomaly judgments presented above, grammaticality judgments do not seem to be linked with particular verbs: when "weird" judgments are pooled for the test sentences within a verb class, the *want* and *need* utterances were judged as equally acceptable overall, and the *ask* and *tell* utterances were judged as more or less equally unacceptable.

As with the adult semantic anomaly data, Table 7.20 gives both adults' and children's responses to the grammaticality judgment test items as percentages. The child data is presented by age group, as well as pooled.

Table 7.20: Adult and Child Grammaticality Judgments by Item

			% "Weird"			
Class	Verb	Item	Adult	4	5	Child
RO	want	...there to be cookies in the bag	21.4	25.0	25.0	25.0
		...there to be crayons in the box	14.3	25.0	25.0	25.0
		...it to be Ben/Boots on the phone	0.0	37.5	25.0	31.3
	need	...it to be cooler in the car	14.3	50.0	37.5	43.8
		...there to be more sandwiches	21.4	50.0	12.5	31.3
		...it to rain	0.0	37.5	12.5	25.0
OC	*ask	...it to snow	64.3	82.5	50.0	68.8
		...it to be time for bed	100.0	100.0	75.0	87.5
		...there to be people on the sidewalk	92.3	37.5	25.0	31.3
	*tell	...it to be warm outside	64.3	82.5	75.0	81.3
		...there to be a party at his house	92.3	62.5	50.0	56.3
		...there to be flowers on the table	78.6	75.0	25.0	50.0

The caveat made in Section 7.4.2 above, about the comparative semantic anomaly judgment data, holds here as well. In short, there are no hard and fast statistical comparisons to be made on systems which appear to have no hard and fast rules.

But here, just as with the semantic anomaly data, I believe that we see stirrings of the adult system in children's grammars. Again, neither children nor adults show the dichotomy in judgments which Davies and Dubinsky (2004) suggest should hold. However, both groups do show at least a *tendency* (at least on *some* utterances) towards rejecting expletive subjects embedded under OC verbs more often than they reject those expletive subjects embedded under RO verbs.

Moreover, there are some trends in the data here that are worthy of note. Across the board on RO items, 5-year-olds are equally (or more) likely to correctly accept utterances containing embedded expletive subjects than are 4-year-olds; thus, it appears that children are moving towards the adult system. However, the picture of the development of this grammatical restriction on OC verbs is less neat: 5-year-olds are more likely to incorrectly accept these utterances than are 4-year-olds. Here, then, the 4-year-olds actually look more "adultlike" than the 5-year-olds, and in some cases the difference is striking. For instance, although 75% of 4-year-olds rejected *tell there to be flowers on the table*, only 25% of 5-year-olds did!

Perhaps the most baffling bit of data, though, is the fact that the grammatical restriction on embedded expletives does *not* appear to hold for adults—at least, not across the board. This leaves us with the difficult task of deciding how to interpret the child data in comparison. Naturally, the question we are left with is, *How do we define the "adult" system, and which age group is actually closer to it?*

Overall, in contrast with the semantic anomaly data, though, children as a group seem much more willing to accept *all* utterances than are adults: consider that neither *The policeman told there to be people on the sidewalk* nor *The woman told there to be flowers on the table* received a particularly high "weird" score from children. On the other hand, children gave some of the most consistent "weird" responses to the weather and time predicates involving expletive *it*, including the OC utterances *ask it to snow/be time for bed* and *tell it to be warm outside*. Note, too, that some of the RO utterances (assumed to be "grammatical" for adults) that received the highest "weird" scores from children were those involving *it* (*want it to be Boots on the phone, need it to be cooler in the car*). This was *not* the pattern in adult responses; both OC-*it* utterances like *ask it to snow* and *tell it to be warm outside* and RO-*it* utterances like *want it to be Ben on the phone* and *need it to rain* were among those which received the lowest number of "weird" responses from adults (in fact, these latter were—as noted—the only utterances that were judged grammatical by 100% of the respondents).

It is possible, given this data, that children's assessments of these utterances break down along expletive lines, and that they incorporate the restriction against expletives embedded under OC verbs for expletive *it* before they do for expletive *there*. The surprising thing about this is that *there* is usually considered to be a much more canonical expletive than *it*. That is, *there* is considered to be entirely nonreferential, in contrast with *it*—which, it has been suggested, is a quasi-argument which carries a "#" θ-role (Chomsky, 1981). There is evidence that expletive *there* and expletive *it* arise separately in spontaneous production (Kirby and Becker, 2007), so the notion that children assimilate the expletives separately to the grammaticality restrictions of OC verbs is not entirely unthinkable.

In light of the current data, it seems possible that children's relationship to expletive *it* may undergo a shift over the course of linguistic development. Since this expletive is acquired relatively early, at least in its quasi-argument/weather predicate form (from 1;11–2;6 in the 4 children examined in Kirby and Becker, 2007), children may initially place very stringent restrictions on its appearance under OC verbs as result of its dominance in the nascent grammatical category of expletive. Meanwhile, over time, such restrictions may relax, as children acquire the less referential uses of "true" expletive *it*, as it appears in clefting (*it wasn't Louise who drank coffee*) and "unraised" raising constructions (*it seems Louise is drinking coffee*). Having productive use of true expletive *it* could conceivably result in quasi-argument *it* it not seeming so "bad" in such OC constructions. That is to say, OC utterances with an embedded weather *it* may simply be "grammatical" for adults by comparison to the other expletives.

This hypothesis is also consistent with the child data we see: namely, that across the board 4-year-olds are less willing to accept weather-*it* embedded under RO/OC verbs than are 5-year-olds. This would be explainable if we assume that the 5-year-olds have had more exposure to constructions involving true expletive *it*, and have thus been able to recategorize weather *it* as a pseudo-argument.

Meanwhile, the adult data is equivocal as regards this hypothesis; adults were relatively lenient with weather *it* embedded under OC verbs in 2 out of 3 cases (*ask it to snow, tell it to be warm outside*) but were unanimous in rejecting the 3^{rd} case (*ask it to be time for bed*). It is unclear why this distinction should exist.

As with the results of the adult semantic anomaly experiment, grammaticality of embedded expletives seems to exist along a continuum, contributing to the difficulty of acquiring what we consider to be adultlike knowledge of these verbs. Here, as above, future research should test whether the hints of a distinction between the expletives found in these experiments is, in fact, a robust phenomenon, or instead simply a result of a small sample size. If it does prove to be robust as a finding, we should also probe what lexical and syntactic cues cause adults to judge expletives embedded under RO and OC verbs as grammatical or ungrammatical.

7.7 Comparative Results Across Tasks

7.7.1 Semantic Anomaly vs. Grammaticality Judgment

7.7.1.1 RO Verbs

When we consider the children as a group, performance on RO verbs is slightly better in the grammaticality judgment task than in the semantic anomaly task, although this trend does not reach significance ($\chi^2 = 2.32$, $df = 1$, $p = 0.1281$). That is, children are slightly better at correctly accepting sentences like *The farmer needed it to rain* than they are at correctly accepting sentences like *The girl wanted the coat to fit her*. One possible explanation is that with RO verbs—which liberally allow the embedding of any clause that is itself semantically felicitous—children may be focusing only on the semantics of the lower clause and its relation to the pre-stimulus vignette. For instance, for the item *The girl wanted the coat to fit her*, the coat was described as not fitting the little girl; as such, children may be in essence judging only [*the coat to fit her*], rather than assessing the entire sentence, with regard to this context. Thus, there may be something about the liberal nature of RO verbs' semantic restrictions that falsely encourages children to ignore the matrix predicate in favor of only assessing the lower predicate's relation to reality. Note, however, that this strategy still requires children to know something about the way RO verbs function and their semantic restrictions (or lack thereof) on embedded clauses.

7.7.1.2 OC Verbs

Meanwhile, children's performance on OC verbs is significantly better in the semantic anomaly task than in the grammaticality judgment tasks ($\chi^2 = 6.94$, $df = 1$, $p = 0.0085$). That is, children are much better at correctly rejecting sentences like *Ernie asked the music to stop playing* than they are at rejecting sentences like *The policeman asked there to be people on the sidewalk*. This indicates that children may internalize semantic restrictions regarding the animacy/sentience requirements of OC verbs before they acquire grammatical issues relating to the θ-role assignment of such verbs. This is perhaps unsurprising, considering that even the youngest children in Becker's (2006) study correctly rejected SC sentences with incompatible embedded predicates like *The flower wants to fly away*.

However, the strange performance by 5-year-olds—namely, that they perform at chance on OC verbs in the grammaticality judgment task, although 4-year-olds perform above chance in this task—suggests that other issues are to blame. See Chapter 8 for more details.

7.7.2 Semantic Anomaly vs. OC-EPs

Recall that both 4- and 5-year-olds succeed at the SA task with OC verbs (e.g., *The boy asked the ball to fall back down*), but that 4-year-olds fail at comprehending passives embedded under OC verbs (*She asked the cat to be licked by the dog*).

Children's relatively poor performance on the OC-EP task could appear somewhat bizarre when we consider that part of mastering passives embedded under an OC verb is understanding the θ-role assignment inherent between the matrix OC verb and the matrix object (which is co-indexed with the embedded PRO). This ability to monitor the s-selection/θ-assignment of the matrix verb was also required in the SA task, but here, children succeeded at high levels. It appears that something apart from simple θ-assignment is at play in children's trouble with OC-EPs. As I suggested in Section 5.6.3 above, it is likely that the noncanonical nature of a PRO generated in object position and then raised to the subject of the embedded OC passive is what causes this trouble.

In the next chapter, I will present an analysis of children's performance on the semantic anomaly and grammaticality judgment tasks presented here. In this analysis, I describe another component of the semantic scaffolding hypothesis, which—like the idea of canonical alignment—also utilizes the notion of children's default hypotheses about the shapes that utterances will take.

Chapter 8

More Pieces in the Semantic Scaffolding Puzzle

While there is no succinct description of one single mechanism guiding children's responses in every experimental task described above, it does seem that children make use of a range of strategies which can be grouped together in terms of their basic approach. It is precisely this cluster of strategies which I have referred to above as semantic scaffolding (SS).

8.1 SS and the Interpretation of Biclausal Utterances

The experiments detailed in Chapter 7 above probed children's assessments of the semantic and grammatical restrictions on the subject of the embedded clause in RO and OC utterances. The adult restrictions on these are repeated here.

(96) Semantic anomaly restrictions

RO: Suki wanted/needed [the coffee to be ready]

OC: Suki asked/told [#the coffee to be ready]

(97) Grammaticality restrictions

RO: Suki wanted/needed [there to be more coffee]

OC: Suki asked/told [*there to be more coffee]

In children's performance on the semantic anomaly and grammaticality judgment tasks, we can see how semantic scaffolding constrains and directs interpretation in the absence of adultlike syntactic knowledge or processing power. Faced with a syntactically complex biclausal utterance (and possibly also the extra demands made by the metalinguistic judgment task itself), along with whatever other cognitive load may arise from having to integrate linguistic and non-linguistic (real-world) knowledge, children may face a processing bottleneck in terms of the linguistic components that make it through to the interpretive function. Here we see semantic scaffolding, as an innate predisposition, guiding precisely *what* makes it through: not a haphazard collection of morphemes, but rather *a clausal proposition as an independently functioning semantic "whole."* The upshot of this phenomenon is that children appear to be parsing almost exactly what Chomsky has described as the basic unit driving all considerations of locality: namely, the phase. Chomsky (2001) defines phases as propositions—as verbal phrases together with their full argument structure—and this single proposition appears to be what children of this age parse, when they must strip down a larger utterance.

It should be noted that the particular shape of the proposition that makes it through the bottleneck seems to change over time (for 4-year-olds, it is the embedded clause; for 5-year-olds, it is the embedded verb plus the next c-commanding lexical—not expletive—NP, whether that be the embedded or the matrix subject), but the thrust of the process of semantic scaffolding is the same in either case.

Thus, although children do distinguish the verb classes syntactically under other circumstances (as seen in the results on EPs, for instance) and to parse the entire biclausal structure in some situation (such as the truth-value judgment tasks, which required no metalinguistic facility), in both the SA and GJ tasks, children did not *appear* to do so. Rather, they "scaffolded" their judgments of biclausal RO/OC utterances by parsing the smallest *acceptable* semantically independent proposition in each utterance: either the embedded clause alone (4-year-olds), or the embedded predicate plus the first c-commanding lexical NP (5-year-olds). Indeed, it should be noted that what may appear to be a conflation of the two verb types (by parsing them both in the *same* preferential way) may instead simply be a result of the matrix verb not making it through the entirety of the interpretive process (that is, a reflection of the fact that the parsing is, in fact, constrained by a bottleneck).

It seems, then, as though young children who do not have the adequate resources to parse the entire utterance pay preferential attention to the embedded clause in multi-clausal constructions.

This should perhaps not be too surprising, as it appears to be a natural and expected result of tendencies observed in MacWhinney's (1982) relatedness or Behaghel's (1932) First Law, discussed in Chapter 6 above. That is to say, this strategy of parsing of the embedded clause as a unit, to the exclusion of lexical elements in the matrix clause, appears to arise from the desire to keep units together syntactically which function together semantically. For children, as well as for adults, the clausal proposition is the basic semantically coherent unit which should also (ideally) be processed together syntactically.

Semantic scaffolding, then, biases the child not only to expect particular configurations of arguments in a clause, but furthermore to expect and prefer a particular clausal shape: specifically, a well-formed clause is syntactically contiguous, and contains a subject and a predicate.

Moreover, given 5-year-olds' performance in contrast with that of 4-year-olds', over time, it appears that the grammar prefers that the subject appearing in the contiguous clause be referential, rather than expletive.[1] This makes sense, considering what we have

[1]Why, then, do 4-year-olds not show this same preference? I would suggest that the preference for a referential subject is trumped by the lack of adequate parsing resources in the younger group. This leaves open the question as to whether they ignore the expletives completely, or perhaps do not distinguish them from referential NPs. Since 4-year-olds have long since mastered the productive use of expletives (Shafer and Roeper, 2000; Kirby and Becker, 2007), it seems unlikely that they ignore them entirely. However, it is quite possible that they have not yet established the full scale of referentiality (Kirby and Becker, 2007) with true expletives (*It was Neil who made the coffee*) at one end, weather predicates (*It isn't raining*) somewhere in the middle, and actual referential pronouns (*It looks tasty*) at the other end. However, the data here—in which processing load appears to trump the preference for referential subjects in 4-year-old speakers—will not allow us to test this hypothesis; future research should probe what young children's representations of expletive subjects actually are.

As a side note, this example of two preferences which may pull the grammar in opposite directions (i.e., contiguity of subject and predicate vs. nonexpletive subject) might be one area in which those researchers interested in the possibility of optimality theoretic syntax (e.g., Pesetsky, 1997; Boersma seen about the "goodness" of subjects and themes, in Chapter 6 above.

Moreover, it seems possible to link this selective attention to the contiguous clause with the notion of canonical alignment as presented in the preceding chapters. Specifically, the default hypothesized shape of an utterance may be a 2-place predicate with an agent-subject and a theme-object. Findings such as those by Naigles (1996), which indicate a preference for attending to caused action over contact action or intransitive action, provide some support for this notion. Ideally, future research would probe children's biases more deeply to test whether this prediction is correct.

8.2 Some Observations on Methodology

At this point I would like to pause and consider a possible objection that could be raised against this piece of the semantic scaffolding analysis of children's performance on the semantic anomaly and grammaticality judgment tasks.

It could be argued that the judgment tasks presented here are not actually testing children's knowledge of the semantic and syntactic restrictions on RO and OC verbs, and thus, that the analysis provided to explain this performance gives us no actual window into the part of children's grammar which relates to the semantic and syntactic restrictions on these verb classes. Indeed, this complaint is reasonable: if we assume that this description of children's performance is on track, it is true that the research presented here does *not* tell us much about these issues. Instead, this research seems to shed more light on the question of what children do when the input is "too much"; that is, what they do when the processing load becomes too great.

As has been noted in the literature (Gordon, 1996), a major benefit of the truth-value judgment task is that it requires no metalinguistic awareness on the part of the child, and thus can be used with extremely young children. But for all its benefits, the TVJ still has its limits, in terms of what can be tested. Unfortunately for the current research, if we wish to probe whether children allow inanimate or expletive subjects to be

et al., 2000) might explore in first language acquisition. However, the issue clearly extends beyond the scope of the current dissertation.

embedded under RO and OC verbs, there is no real alternative to the sentence judgment tasks used here.

Although McDaniel and Cairns (1996) have had success with teaching very young children to perform such sentence judgments (usually via long pre-task discussions about language and/or a very large number of training items), the task still carries with it a significant cognitive load. There is also clearly a spectrum of capability, as far as judgment tasks are concerned; even language researchers who work with adults know that some individuals are simply better informants than others, where sentence judgments are concerned. In a similarly way, it was clear during my own experimental sessions that some children immediately "got it" during the training period, while others were slower to understand what they were meant to do in these tasks. It might appear that an ideal participant pool would include only those children who grokked the task, but there is a good chance that those children's grammars are not going to be indicative of *all* children's grammars.

The issue of adult performance on such tasks is illuminating here. As noted, some adults are poor informants, when it comes to a sentence judgment task; however, this does not mean that they have less sophisticated grammars or are not "adultlike" speakers of their native language. Instead, their response pattern is linked to their ability to perform the task itself. I would argue that just as we do not exclude experimental data from adults who may or may not be skilled at performing sentence judgment tasks, we similarly should not discard children's data by virtue of their difficulties with the task demands.

The argumentation here is slightly circular, but in order to claim that a particular cognitive or linguistic phenomenon occurs in the presence of a processing load, you must in fact present the experimental subject with such a processing load. Just because there is a decline in children's performance as a function of the demands of a particular task does not necessarily mean we should throw out that task, or those results. The data here still tell us *something* about the state of children's minds, and still give us a picture of what's going on in their grammars—just not necessarily the picture we originally set out to paint.

It is obviously a good thing, in experimental research, to have a task that tests what you want it to test; unidentified effects resulting from the form of the experimental task itself are clearly undesirable confounds. However, the sheer existence of task-related effects is not in and of itself a negative thing: much of the experimental paradigm of adult cognitive psychology is based on precisely such effects. In many research situations, adults are asked to perform memory tasks (often simultaneously with another task) that are designed specifically to present them with a processing load, and in fact *meant* to tax them to failure, in order to see what then happens. This paradigm is founded on the notion that failure tells us just as much about cognition as success—if not more.

The fact that children performed in the way they did on the judgment tasks raises several questions about their performance in the TVJ tasks presented earlier.

First, we might ask whether the parsing strategy proposed for the SA and GJ tasks here presents us with an alternative hypothesis for how children evaluated the test items in the TVJ tasks which probed basic (active) RO/OC utterances, as well as passives embedded RO/OC verbs. This does not appear to be the case. If children were parsing only the embedded clause in Experiment 2, they would have performed very poorly on the task, since just as in the judgment tasks, the embedded clause alone would've been false/unverifiable. Thus, in a situation where parsing the entire utterance would lead a child to accept a statement, given the pre-stimulus vignette (e.g., *She wanted the policeman to stop the dog*), parsing only the embedded clause (*the policeman [to] stop the dog*) should have led the child to reject that utterance, and vice versa. However, as we have seen, 4- and 5-year-old children performed essentially at ceiling on their comprehension of both active RO and active OC utterances. Similarly, the proposal that children parsed only the embedded clause in the embedded passives task leaves us with no way to explain the distinction in performance between RO-EPs and OC-EPs. Thus, it appears as though the semantic scaffolding strategy of parsing the smallest acceptable proposition is a last resort taken in the face of demands posed by the judgment task itself.

Second, as we have seen, children's performance on the judgment tasks indicates that at least in this situation, they are not distinguishing the two verb classes syntactically, but rather conflating them with a single parsing process. Here again, we must also ask whether we have any data indicating that children similarly conflated RO and OC verbs in the TVJ tasks, or whether they instead treated them as distinct verb types. There are several sources of evidence suggesting that even the youngest children maintain a distinction between the two classes.

First, there was a slight difference in performance on the two verb classes by 4-year-olds in basic RO/OC task (RO: 81.25% correct, $p = 0.0007$; OC: 87.50% correct, $p < 0.0001$); however, this distinction is so small as to be suggestive, at best. A much stronger argument for the notion that children distinguish between RO and OC verbs comes from the EP task, where 4-year-olds performed significantly above chance for RO-EPs but not for OC-EPs.

In both of these situations, however, children performed "better" on RO items than they do on OC items. To some extent, then, children's performance RO utterances patterned with their performance on the biclausal experimental fillers, which was at ceiling. The fillers included biclausal utterances like the following.

(98) *Example biclausal filler items*

a. She knew it was the dog who ate the sandwich

b. He said that the horse won the race

c. He saw the tiger eat the banana

The notable thing about such fillers containing matrix verbs like *know* or *say* is that they *can* successfully be parsed in a clause-by-clause fashion; that is, a listener can parse the matrix frame (e.g., *She knew...*) alone, and then move on to parsing its embedded clause (*it was the dog who ate the sandwich*). Similarly, RO verbs, by nature of their syntax, can be parsed as two separate clauses: the matrix frame, and the embedded clause (e.g., (a) *Suki wanted/needed...*; (b) *Neil to drink coffee*). On the other hand, in order to comprehend the meaning (or assess the truth value) of an OC statement, a listener must parse both clauses together. Returning to the notion of phases once again (Chomsky, 2001), we could say that both RO verbs and the mental state/perception verbs appearing in filler items allow for crisp phasal processing, while OC verbs do not.

The fact that children's performance on biclausal factive and perception verbs like those in the fillers above patterns with their performance on RO (but not OC) items thus constitutes further evidence that the notion of semantic scaffolding is on track.

8.3 Tying it Together: CFCs and the MDP

The "contiguity" effect in semantic scaffolding may also be seen in the multiclausal control structures examined by C. Chomsky (1969), which are highly relevant to the current experiments. Specifically, C. Chomsky found that children were slower to acquire the syntax necessary for the multiclausal subject control (SC) verb *promise* (*Neil promised Louise to cook steak*) than for object control (OC) *tell* (*Neil told Louise to cook steak*); children who have not acquired the relevant syntax interpret both sentences under the OC pattern, assuming that *Louise* is the chef in both utterances. C. Chomsky notes that the *promise* SC pattern is the exception, rather than the rule, in English, and hypothesizes that children's delay in acquisition of the *promise* is a matter of learning where the "Minimal Distance Principle" (as formulated by Rosenbaum, 1967) does *not* apply.

However, C. Chomsky does not explicitly hypothesize *why* this general rule (and late acquisition of the exception to it) might exist. I would suggest that the staggered acquisition of the *tell* and *promise* patterns is in fact related to the alignment of thematic roles within the embedded clause and whether they allow for the contiguous appearance (and thus processing) of an embedded clausal proposition. In the *tell* utterances, the subject of the the embedded predicate is a PRO which is co-indexed with the first overt c-commanding NP above it: the matrix object. Using the previous example, this allows the predicate *cook steak* to form a contiguous unit with its semantic subject, *Louise*. In contrast, with the *promise* utterance, the semantic subject of the cooking event, *Neil*, does not appear contiguously with its embedded predicate; instead, the child must look past one c-commanding NP to reach the semantic subject of the event. As predicted by the semantic scaffolding approach, which assumes that children will parse a contiguous clause as a semantic unit, the children in C. Chomsky's Stage 1 CHOMSKY, 1969 incorrectly interpret *promise* sentences as having object control, as do *tell* sentences.

As with the component of canonical alignment, the desire to match semantic and syntactic contiguity may also have left a mark in adult language. Children's reduced and preferential interpretations of the contiguous embedded clause in such multiclausal utterances may be related to effects seen in adult language which have historically been ascribed to the Specified Subject Condition (SSC; e.g., in GB theory; CHOMSKY, 1973). The SSC both limited NP movements (i.e., an NP may not raise over another NP that could have moved) and defined domains for anaphor binding, or more specifically "complete functional complexes." These CFCs are of interest here as they are essentially clausal propositions of the type in which we are interested: "all grammatical functions compatible with its head are realized in it—the complements necessarily, by the projection principle, and the subject, which is optional unless required to license a predicate, by its definition" (CHOMSKY, 1986, p. 169). Thus, it seems that there is a preference, even in adult language, for producing and interpreting clausal propositions (that is, subject plus predicate) together, as independently functioning semantic units—yet another effect of semantic scaffolding.

8.4 Syntactic Contiguity and Conceptual Contiguity in RCs

Though he does not explicitly recognize it as such, MacWhinney (1982) introduces data from relative clause *production* in early language which supports the semantic scaffolding proposal that children also prefer to produce (and not just parse) entire semantic (clausal) units as contiguous units. Specifically, he cites data from Limber (1976) and Menyuk (1969; both cited MacWhinney, 1982) indicating that OO and OS relatives emerge in spontaneous production before SO and SS types. I would argue that this acquisition pattern arises specifically from the desire to present clausal units as an uninterrupted whole: where subject-modifying relative clauses would disturb the contiguity of the matrix subject and its verb, object-modifying relative clauses do not.

RC processing by adults seems to show similar effects, as well. Beyond the experiments discussed in Section 6.10.2 above, researchers working in adult language processing have further hypothesized that sentences containing subject-modifying relative clauses should be more difficult to parse than those containing object-modifying relatives. Gibson et al. (2005) note that the subject-modifying relative separates the matrix subject and its verb, and thus requires more storage during the processing of the matrix subject-verb dependency. On the other hand, an object-modifying relative requires no such "extra" storage during processing. However, contrary to the expectations of this *syntactic storage* hypothesis, some other experiments comparing the relative difficulty of subject- and object-modifying relatives in processing have in fact found no significant difference in difficulty between the two modification sites (e.g., Baird and Koslick, 1974; Hakes et al., 1976; Gibson and Thomas, 1996; all cited in Gibson et al., 2005).[2] This finding should perhaps not be entirely surprising, in light of the fact that MacWhinney's data on children's performance on relative clause comprehension did not indicate an un-

[2]Due to methodological problems in some studies claiming to find a object-modifying relative advantage, as well as the presence of other studies which have found an unexpected advantage with subject-modifying relatives (e.g., Holmes, 1973; cited in Gibson et al., 2005), Gibson et al. (2005) conclude that the evidence on this issue is actually equivocal.

mitigated advantage for subject-modifying clauses (since both SS and OO sentences are easier for children than SO sentences). Instead, the patterns in children's performance seem to arise as a result of an interaction between modification site and extraction site, such that children perform best of all with SS sentences, but OO sentences are *not* the absolute hardest for children.

This finding raises a number of issues. As just noted, it is hard to tease apart the individual influences of modification site and extraction site, although experiments which hold one constant while varying the other might aid in this process. (Traxler et al., 2002, discussed in Section 6.10.2 above, might constitute a good starting point in this.) If the match between the modification and extraction types were shown to be the major contributing factor, we could deduce that perspective maintenance is more strongly at play. In contrast, if we *were* to ultimately find a basic advantage of object-modifying relatives in terms of ease of processing, it would appear to be a matter of semantic units appearing contiguously, and would point us in the direction of relatedness—and the semantic scaffolding hypothesis, which predicts that semantically contiguous units should be produced and/or parsed in a manner which is syntactically contiguous, if at all possible.[3] (However, recall from the 5-year-olds' data that a demand for a semantically full/non-expletive NP subject may sometimes trump the preference for sheer syntactic contiguity.)

As a final note on RCs here, it should be mentioned that an initial advantage on the side of object-modifying relatives, as seen in the production data mentioned above, and which is predicted by relatedness as well as by semantic scaffolding, could reasonably be overcome in the course of acquisition, as processing power and storage increase. This might ultimately result in no difference between the difficulty of subject- and object-

[3]A related effect might be seen in the results from Hakes et. al (1976, cited in Gibson et al., 2005) that object-extracted RCs were more complex than subject-extracted RCs. (They found no significant effect of modification site.) Notice that subject-extracted RCs allow for a clausal unit comprised of *relative pronoun + verb + object* (*the man that cooked steak*), rather than *relative pronoun + subject + verb* (*the man that the steak sickened*); the former corresponds more closely to the canonical shape of a clause.

modifying relatives, as a result of subject-modifying relatives simply being "chunked" with their head nouns in comprehension and processing. At this point, however, such a hypothesis is highly speculative and would require much deeper exploration before strong predictions could be made.

See more discussion about the role that chunking may play in acquisition in Section 10.3 below.

8.5 Interim Conclusions, Part Two

We have now seen a broad range of strategies which cluster under the umbrella term "semantic scaffolding." These are strategies which children turn to in the absence of adultlike syntactic knowledge and/or processing power, and which dictate what the canonical and expected overall shape of clauses and relationships among elements in clauses should be. These strategies can be seen not only in child language, but also in adult language as well: in both normal speech (basic word order typology, syntactic restrictions on movement, relative clause processing) and abnormal speech (processing load in aphasia). Given the literature on child cognition in both linguistic and extralinguistic realms, it appears that the strategies of semantic scaffolding have a basis in domain-external structure. However, as we have seen, UG takes these extralinguistic notions and puts them through its own domain-specific filter, giving rise to the particular *linguistic* patterns we see here (rule-driven/orderly semantic bootstrapping, canonical alignment, preferential parsing of multiclausal utterances, etc.).

In the next chapter, I will consider a few more results from the experimental tasks discussed in the previous chapters, and then I will consider in greater clarity what the learning trajectory for RO and OC verbs looks like, including proposing how children might move from the strategies of semantic scaffolding to the adultlike state of the grammar. Then I will consider how the evidence presented here bears on several debates in the child and adult syntactic literature. Finally, I will consider a few issues relevant to the intersection of psychology and linguistics in child language acquisition.

Chapter 9

General Discussion

In this chapter, I will consider in greater detail the experimental findings on children's performance on RO and OC verbs presented in Chapters 5 and 7. I will also present some final comparisons between experimental tasks, and consider other ramifications of the data. Finally, I will comment on the process of acquisition of adultlike knowledge of these verbs.

9.1 Results: A Recap

In Chapters 5 and 7, I presented the data from a number of experiments probing 4- and 5-year-olds' knowledge of two RO (*want, need*) and two OC (*ask, tell*) verbs. These experiments indicated that by the age of 4, children have mastered the basic active syntax of these verbs, in both comprehension and (for many) in production. Likewise, although only 5-year-olds performed at above-chance levels on comprehension of basic matrix passives and passives embedded under OC verbs, even 4-year-olds were able to comprehend passives embedded under RO verbs.

When the same children's knowledge of grammatical and semantic restrictions on these verbs was tested, other interesting patterns emerged. With regard to the restrictions on the semantics of embedded clauses, I found that both 4- and 5-year-olds performed at above-chance levels on OC verbs, but not RO verbs. However, when judging both the acceptability of embedded expletive subjects and the semantic felicity of embedded clauses, both age groups appeared to parse the embedded clause rather than the entire biclausal utterance.

This cluster of performances on the different tasks, which were meant to test children's grammatical knowledge about the meanings and range of permitted behaviors of these verbs, gives us both a static snapshot of each of several stages in the process of acquisition, as well as some idea about how the syntax and range of behaviors of RO and OC verbs are acquired by the learner (i.e., the extended trajectory of acquisition).

In Chapters 6 and 8, I outlined an analysis of children's performance which states that children crucially depend on canonical semantics to support their syntactic interpretations of utterances for which they do not yet have adultlike syntactic parsing access. I previously commented on a number of the results from the experimental tasks, including comparative results across tasks. I will now make a few last comments about this data.

9.2 Other Comparisons and Results

Some of the most interesting and informative results of the previously detailed experiments appear when patterns of performance are considered as a function of the individual verbs, independent of the separate experimental tasks. A number of these phenomena are discussed below.

9.2.1 Performance and Verb Frequency in the Input

In order to gain some perspective on how frequency in the input affects the speed of children's acquisition of RO and OC verbs, children's performance on all tasks was pooled, and the percent of correct (adultlike) responses for each verb was considered. This process yielded the hierarchy in (99), where verbs are listed in hierarchical order, according to how successfully children performed on a given verb.

(99) Children's performances (i.e., correct responses) by age and verb

4: want/tell > ask/need

5: want > tell > ask > need

Recall that the verbs tested here are not equally frequent in the spontaneous speech of the adults who comprise children's input. Perhaps unsurprisingly, children's overall performance on each of the 4 verbs mirrored those verbs' frequencies in spontaneous production, as reported in Table 4.1 above (reproduced here as Table 9.1).

Table 9.1: Token Frequencies of Use by Verb (Corpus Search)

Speaker	*want*	*tell*	*ask*	*need*
Adult	2987	304	128	60
Child	689	70	9	19

That is, the verb that was the most common in the adult input (*want*) was also the most correctly handled verb, while the verb that was the least common in the adult input (*need*) was the verb that children had the most trouble with. In the middle, children did somewhat better with *tell* than with *ask*.

Furthermore, this pattern becomes clearer as children get older. That is, 4-year-olds performed equally well on *want* and *tell*, and equally well on *ask* and *need*, performing better on the first pair than the second. Performance by 5-year-olds on each of the verbs was slightly (but not significantly) better differentiated.

Table 9.2: Child Performance (% Correct) by Verb

		Age Group	
Verb	Type	4	5
want	RO	75	84
tell	OC	75	72
ask	OC	66	71
need	RO	66	69

This pattern of performance is at least suggestive of the notion that both frequency in the input (an external factor) and length of experience with these verbs (an internal factor) may play a role in children's acquisition of RO and OC verbs: children show a tendency towards more correct use with the more frequent verbs, and the older children also show a tendency towards using all verbs correctly more often.

It should also be noted that performance on *need*, an RO verb, is not identical with performance on *want*, another RO verb. That is, children do not initially give strong evidence of having an *"RO"* verb class that functions as a unit, but instead show at least slightly differing performance on individual verbs. This will play a role in answering the question I raised at the beginning of this dissertation concerning top-down and bottom-up learning. Specifically, the results here are suggestive of a bottom-up stage in the learning curve, in which these verbs may not be fully relegated to a verb class with all its associated syntactic and semantic behaviors; instead, children may take time to build up an adultlike lexicosyntactic entry for these verbs. I will return to this issue of top-down and bottom-up learning again below.

9.2.2 Overall Performance on Verb Classes

Similar to the previous analysis by verb, children's responses on all tasks were once again pooled, and their performances on the two verb classes was compared.

When children's performance on RO and OC verbs is considered in the context of all the tasks, 4-year-olds perform equally well on RO and OC verbs. 5-year-olds perform only slightly (but not significantly) better on RO than on OC verbs. These results are summarized in Table 9.3.

Table 9.3: Child Performance (% Correct) by Verb Class

	Age Group	
Verb Type	4	5
RO	70	77
OC	70	71

A series of logistic regressions (with adjustments made for multiple observations within subjects) were performed on the number of correct responses, using a model that included both effects for verb type and age group. No main effect was found for age ($\chi^2 = 0.71$, $df = 1$, $p = 0.3986$). Similarly, no main effect was found for verb type ($\chi^2 = 0.33$, $df = 1$, $p = 0.5635$).

The fact that children's performance is roughly equal on the two verb classes may be related to the fact that the RO verbs comprise one extremely common (*want*) and one fairly rare (*need*) verb, in terms of their appearance in the input, whereas both OC verbs (*tell, ask*) appear with middling frequency. Thus, the average appearance of each verb *class* (though not of each individual verb, either within *or* across classes) may be roughly equivalent.

However, what we can actually take away from this comparison is very little; these results pools children's responses on 4 separate verbs on a number of distinct tasks, and therefore it is perhaps not surprising that no striking trends emerge. Given the breadth of knowledge on which children were tested, it is essentially predictable that a number of differences seen within individual experiments would essentially balance out over the entire research agenda. Thus, these numbers should be taken with a large grain of salt.

9.3 The Trajectory (and Problems) of Acquisition

RO and OC verbs have complex multiclausal syntax involving the silent elements t and PRO, respectively; this structure results in a breadth of behaviors that children must learn, ranging from the basics of subcategorization in active clauses, to θ-assignment and interpretation of embedded passives, to what types of embedded subjects and clause-internal semantic configurations may appear in embedded clauses.

With such a wide range of behaviors, there are two possibilities for the trajectory of learning; namely, the learner may acquire the syntax of these verbs with the full range of its associated behaviors (that is, top-down learning), or instead the child may acquire each grammatical phenomenon one by one, perhaps slowly (via a bottom-up approach—which should not necessarily be conflated with the concept of "lexically-based learning," e.g., Tomasello, 1992; Pine and Lieven, 1997).

Top-down learning might be correlated with (and, in fact, be the result of) the process of acquiring each verb as an exemplar of a particular verb class. Let us assume the existence of a class, raising-to-object (RO) verb—namely, a verb that (a) subcategorizes for a clause whose subject raises to become the object of the matrix clause, leaving behind a t in the subject of the embedded clause, and (b) assigns no θ-role to the matrix object position. Given the pre-existing grammatical conception of this class, knowing that *gorp* is a RO verb would allow the child to construe all associated behaviors immediately, as a result of the presence of raising/t and the absence of θ-marking on the raised object. That is, if the learner can access these two pieces of knowledge as a result of a verb's inclusion in the RO class, then the full range of observed behaviors of RO verbs will fall out naturally. The same would be true of a verb assigned to the OC class: the class OBJECT CONTROL VERB would simply contain the specifications that the verb (a) subcategorizes for a (semantically felicitous) object, which is itself coindexed with an embedded clause headed by a PRO subject, and (b) assigns a θ-role to the subcategorized matrix object (as per the θ-Criterion).

On the other hand, rather than assimilating all the related phenomena into the lexicosyntactic entry for a given verb simultaneously, a learner might instead learn, one by one, the range of frames that a given verb may or may not appear in, and the syntactic and semantic behaviors that are inherent to each of these frames. In this bottom-up scenario, a child might—for instance—know the basic surface shape of the subcategorization frame in which *ask* may appear, but not yet know that the embedded subject must be "askable" (i.e., sentient, and perhaps human) in order for the entire utterance to be semantically felicitous.

However, the dichotomy just posed may actually be a false one. In order for children to assign a given verb to the class of RO or OC predicates, they must amass enough data—via positive input only!—about the behavior of that verb to assign it to the correct verb class. This process may not be so easy, for as noted in Chapter 4, even RO and OC constructions containing the verbs *want, ask, need* and *tell* (which were specifically chosen in this project for their relative accessibility in parental speech to young children) are still fairly uncommon in spontaneous speech, with some members of the group (e.g., *ask, need*) appearing vanishingly rarely (see again Chapter 4 for details). Even worse for learnability considerations, the input may contain significantly less (and significantly more rare) evidence about other RO (*acknowledge, certify, stipulate...*) and OC (*coax, persuade, urge...*) verbs.[1] In fact, these verbs' pronounced *infrequency* would suggest that, ultimately, the top-down "verb class" approach to learning would be helpful, if not absolutely necessary, in their acquisition.

Regardless of the frequency of the verbs in the input, however, there are several major stumbling blocks in the acquisition of RO and OC verbs. First, there is the fact that a single string may correspond to two distinct underlying structures differing in their silent syntax. And silent syntax is just that! The distinct patterns of *t* and PRO are not something for which children will receive overt, observable data in the input.

Moreover, it should be noted that the verbs considered here (both the specific verbs tested, as well as the classes they represent) also appear in multiple distinct multiclausal frames. For instance, the verbs *want* and *expect* can appear as both raising-to-object verbs, when they cooccur with an overt object in embedded clause, *or* as subject control verbs, when they appear with a complement clause containing a PRO subject.

(100) Subject Control/Raising-to-Object Alternation: *want/expect*

SC: Suki$_i$ wanted/expected [PRO$_i$ to drink espresso]

RO: Suki wanted/expected Neil$_k$ [t$_k$ to drink espresso]

Meanwhile, verbs like *ask* and *beg* instead pattern as both subject control *and* object control.

(101) Subject Control/Object Control Alternation: *ask/beg*

SC: Suki$_i$ asked/begged [PRO$_i$ to drink espresso]

OC: Suki asked/begged Neil$_k$ [PRO$_k$ to drink espresso]

[1]For an inexhaustive but extensive list, see DAVIES AND DUBINSKY (2004).

While I do not know of any detailed semantic analysis as to why these patterns might obtain, it is possible that the range of semantics for each of the verbs in question is what allows one of these alternations or the other, in the following way.

For instance, consider the verb *ask*. This verb semantically entails both an "asker" and an "askee," although the latter need not necessarily be overt. While the "askee" is overt in the OC version (*Suki asked [Neil] to drink espresso*), it is not in the SC version (*Suki asked [X] to drink espresso*). However, the askee in the SC version is still "there" in abstract semantico-conceptual form, as the complement to the matrix verb. If we assume that something like the Minimal Distance Principle holds here, the PRO in the embedded clause will simply be controlled by the next highest *overt* c-commanding NP:[2] *Neil*, if he is present, and *Suki* otherwise. The important take-home point, here, is that the *semantic* structure of the event entailed is the same, regardless of the particular syntactic alternation in which the verb *ask* appears.

In contrast to *ask*, a verb like *want* (or, for that matter, *expect*) functions very differently, semantically. The verb *want* does entail a "wanter," but—unlike *ask*—there is no required "wantee." Instead, *want* necessitates an embedded proposition;[3] this proposition can take any (internally grammatical and felicitous) shape, as there are no semantic restrictions on what can be *wanted*. Importantly, though, the verb *want* (at least in its multiclausal frame) does *not* s-select for a complement, in the way *ask* does.

Once that propositional complement is present, it is simply a matter of whether the clause contains an overt subject (which will result in an RO utterance: *Suki wanted Neil*$_i$ *[t*$_i$ *to drink espresso]*) or not (in which case the EPP will require the presence of

[2]With the obvious exceptions, mentioned in Chapter 3, of the verb *promise* as well as the indirect questions and complement clauses of prepositions and nouns, mentioned by Cairns et al. (1994).

[3]This obviously glosses over uses of *want/expect* in their transitive form, e.g. *Suki wanted/expected espresso*. However, on the level of abstraction at which we are currently discussing these verbs, I would suggest that this syntactic frame, too, falls out naturally as a result of the verbs' semantics: you can want an item (*espresso*), or you can want a state of affairs (*[Neil] to drink espresso*); both equate to roughly the same thing, semantically. Note that wanting an item is, in some way, also wanting a state of affairs: you are desiring the existence of a possible world in which you have that item. I will leave this issue aside, so as not to get too deep into possible-world semantics.

PRO, which will—again, by the MDP—be govered by the matrix subject, resulting in a SC utterance: *Suki$_i$ wanted [PRO$_i$ to drink espresso]*).

This semantic decomposition of a syntactic alternation may or may not be on target. At the very least, it is fair to say that these distinct syntactic alternations for the different verbs are likely to prove yet another impediment to learning. Children will require adequate time, exposure, and input data to arrive at the correct conclusions about how each of these verbs and their corresponding membership classes function—and "adequate" may equate to "quite a lot." Indeed, children's performance on these verbs does seem to improve, given more information from which to extract data; as noted in Section 9.2.1 above, children's performance on a given verb appears to be at least moderately correlated with that verb's frequency of appearance in the input.

Furthermore, the learner may have to "know" a few verbs in each class (specifically, the range of syntactic behaviors associated with the verbs) before the class itself can be generalized from the individual lexical entries. This process might reasonably result in a timeline in which verbs are learned in a more bottom-up fashion by younger children, but via quite speedy top-down assignment to a verb class by older children, who have already formed a solid conceptualization of the underlying syntax (and thus the behaviors) of each verb class. Thus, it is possible that any delay seen in children's (especially younger children's) knowledge of the full range of a verb's behavior is not a problem in assigning a single verb to a pre-existing verb class, but rather a step in the process of constructing a full representation of what the verb class itself looks like, via the tools of comparison, deduction, and generalization from instances of individual predicates.

In light of the evidence from the experiments presented here, and especially the fact that children of both ages performed significantly above chance on some tasks within a verb class (e.g., comprehension of active RO and OC utterances; passives embedded under RO verbs, semantic anomaly judgments for OC verbs) while still performing at chance on other tasks with the same verbs (e.g., semantic anomaly judgments for OC verbs, 4-year-olds' restrictions on expletives embedded under RO verbs and 5-year-olds' restrictions on expletives embedded under OC verbs), we can make some claims about the trajectory that the acquisition of these verbs appears to take. Namely, while we cannot say anything about how children *older* than those tested (say, 7- or 8-year-olds) might learn a new RO or OC verb, at least it appears clear that 4- and 5-year-olds do *not* exhibit top-down learning as defined above, since a child who succeeded at the basic active RO/OC task might still fail at the semantic anomaly or grammaticality judgment task. That is, children did not indicate an "all or nothing" pattern of knowledge on a given verb.

Given the previous discussion, though, this still leaves options open as to how these verbs are learned. That is, children at this age might either be learning the behavior of each verb separately (à la lexical learning), or they may simply be in the process of building up grammatical representations of the verb classes which will later allow a more or less immediate trickle-down of lexicosyntactic knowledge, once a given verb has been assigned to a verb class.

However, since the both of these courses of acquisition would initially involve learning at least a few, if not all, verbs and their behavior one by one, then both strategies will look essentially identical during the earlier stages of acquisition. It may be difficult or impossible, given only data from children of this age (i.e., those children who we hypothesize have not yet had time to establish the verb classes under consideration here), to tease apart the distinct phenomena; however, data from older children, who *have* had the requisite time to conceptualize these classes, could prove quite useful in this matter. Further research could be conducted which first established with participants a baseline facility with more common RO and OC verbs, and then taught children novel (nonsense) RO and OC verbs via input which showcased a subset of the verbs' possible behaviors (for instance, basic active utterances and utterances including embedded passives). Testing the children on structures which had *not* appeared in the experimental input could allow us to determine whether and at what age children ultimately do form classes of verbs into which new verbs can be instantly slotted, thus allowing children to deduce more information about the verbs than that present in the input, as a result of their class membership.

To my knowledge, such an experiment has so far *not* been conducted with children. However, there is some adult data which bears on this issue. In one experiment reported in Becker (2005), adults completed a fill-in-the-blank task in which test items differed on particular cues to syntactic structure and cues to the verbs themselves. Frames differed on subject animacy (animate: *The salesman* ______ *to advertise...* vs. inanimate: *The banner* ______ *to advertise...*), predicate eventivity (eventive: *The boulder* ______ *to hit...* vs. stative: *These shapes* ______ *to belong...*), and the presence of expletive subjects (*It* ______ *to be too foggy...* or *There* ______ *to be no end...*).

The results indicated that adults as a group patterned towards responding with raising verbs when subjects were inanimate or expletive and when predicates were stative. However, when the subject was animate or the predicate was eventive, participants were more likely to respond with a control verb. While this experiment tested raising-to-subject and subject control verbs (rather than RO and OC verbs), it seems fair to conclude that adult speakers of English have built up stable grammatical representations of raising and control verbs, and that they can quickly access the class to which a novel verb (or a missing one, in the case of the fill-in-the-blank task) should belong, given particular cues in the verb's syntactic frame. Such evidence leads me to conclude that while they may initially exploit the behaviors of individual verbs on their way to accumulating enough evidence to represent a verbal class, children do not ultimately depend on "lexical learning" *per se*, as their major verb acquisition strategy.

It is actually wrongheaded to ask "whether" children can ultimately form verb classes which pattern together, since we know that adults themselves are able to do it. Not only do we have Becker's data, described above, but every adult is famously able to take a novel verb, say, *greem*, meaning something like "talk loudly and hoarsely," and

> know that... it will be possible to greem (i.e., speak loudly and hoarsely), to greem for someone to get you a glass of water, to greem to your sister about the price of doughnut, to greem "Ecch" at your enemies, to have their greem frighten the baby, to greem to me that my examples are absurd, and to give a greem when you see the explanation. (Zwicky, 1971, p. 232)

Thus, instead of "whether," we should simply be asking "when."

The current research unfortunately does *not* provide an answer to this question. When tested on their comprehension of basic active RO and OC utterances, even the youngest group performed at levels which were significantly above chance; likewise, both groups were able to make adultlike judgments of semantic anomaly on OC utterances. In contrast, neither group performed at above-chance levels on judgments of anomaly for RO utterances. As a result, we do not yet have a complete picture of the developmental trajectory from absolutely no knowledge about RO and OC verbs (that is, failing on all 5 tasks) to full, adultlike knowledge of these predicates (succeeding on all tasks)—although we know that these ends of the spectrum must include an age younger than 4 and one older than 5. Even in the absence of this complete timeline, though, the information gleaned on 4- and 5-year-olds' knowledge here provides us with some snapshots of points along the developmental path.

9.4 From Semantic Scaffolding to Syntactic Knowledge

As just noted, this research does not provide a full picture of the path that children take on the way from no knowledge of RO and OC verbs, to the full adultlike knowledge of these predicates. Even if it did, however, we would likely still be stuck with the challenge of hypothesizing how children are able to find their way out of the "hole" posed by the strategy of semantic scaffolding. That is, if children initially depend on semantic scaffolding to support their syntactic interpretations of complex utterances, how do they ever progress from this stage to the adultlike process of parsing multiclausal utterances syntactically?

My conjectures about how this transition may proceed draw strongly on notions which are familiar in the traditions of semantic and syntactic bootstrapping. Namely, my sense is that children begin with the canonical and make a base of it; that is, they form a scaffold of the dependable, and use the support provided by this scaffold to branch out from there.

Both semantic and syntactic bootstrapping make similar assumptions, in terms of the abstract sense of how far the strategy will get children. The semantic bootstrapping hypothesis hypothesizes that children will make basic assumptions about the way that syntactic labels align with objects or actions in the world (i.e., objects are labeled with nouns and actions with verbs), and then about the particular syntactic positions with which thematic roles will align (subjects tend to be agents; objects tend to be patients/themes). Syntactic bootstrapping claims that children should be able to deduce (at least some of) the semantics of a novel verb, given its syntactic frame(s). But as noted in Chapter 2, semantic bootstrapping will not help the child to correctly assign *every* lexical item to a syntactic class, or to correctly parse *every* sentence with one preverbal and one postverbal NP. Likewise, syntactic bootstrapping may fail to provide a child with a precise definition of a given novel verb which will differentiate that verb from others in the same semantic space, even given comparisons over a number of distinct syntactic frames.

Neither of these strategies (nor, in fact, the two in concert) has been heralded as the be-all and end-all of learning. Instead, they are simply assumed to be a way for the child to break into the learning process. Once the child has gained any sort of access, things likely become easier: learning is, in many ways, a process which accelerates over time.

The onus on all researchers then clearly becomes explaining how children in fact *do* move past these defaults and strategies—that is, how they are able to take the foundation they have built (be that via semantic and syntactic bootstrapping, semantic scaffolding, or even some other domain-general learning process or tool) and proceed towards achieving the adult state of the grammar, one in which all novel grammatical sentences can be interpreted and understood in an adultlike way, grammatical but semantically anomalous sentences can be identified (and perhaps recognized as playful, metaphorical, or "poetic" language), and ungrammatical sentences can be pinpointed as such (and either labeled as such, in the context of a sentence judgment task, or—given a real-world situation—parsed as well as is possible).

Though I do not have all the answers as to how children move past a state in which they depend on bootstrapping and scaffolding towards a fully adultlike grammar, I will note a few of the possible issues at play here. Hyams et al. (2006) suggest that it is only with an increase in pragmatic and processing resources that children become able to deal with utterances whose transformations do distort fundamental syntactic shape in the ways we have seen. But how might pragmatic and processing resources in fact increase?

First, notice that neither the semantic nor syntactic bootstrapping hypotheses have anything to say about *what* to parse, given an overload of input. The semantic scaffolding hypothesis, on the other hand, suggests that children are in fact guided by UG to preferentially attend to semantically complete propositions—that is, contiguous clausal units—as parsing units. As noted above, this may be an innate reflex, seen in children, arising from the same source of the adult effects described by MacWhinney (1982) as "relatedness," by Behaghel (1932) in his First Law, and defined as "complete functional complexes" by Chomsky (1986) in his observations on Specified Subject Condition effects, or as "phases" in his later work (2001).

I would like to suggest here that it is by practice that children are able to use these clausal processing units—even when they do not comprise the whole of an utterance—as the raw data from which they are able to deduce a number of pieces of information about their language: the canonical word order, the meanings of novel verbs, the inclusion and workings of a given silent element like NP-trace or PRO. Indeed, a number of researchers (e.g., Gleitman, 1990; Haryu et al., 2005, among many, many others) have found evidence that *clauses* are highly informative about things like verb meaning—even more informative than single verbs. Children may exploit these contiguous clausal units as "language training wheels," and use them until they have extracted enough data to move up to the next level: for instance, multiclausal structures which must be interpreted as functioning units.[4]

What allows children to proceed to the next rung on the language ladder? I am not entirely sure, but I do not think it is out of the question to assume that strategies seen in adult cognition and memory, such as chunking, may be at play. That is, enough practice with enough similar exposures to single clauses (whether those clauses appear in isolation in the input, or are stripped down to such, from a multiclausal utterance) may ultimately allow children access to a sort of top-down linguistic processing in which clauses (rather than individual lexical items) ultimately come to comprise the elements occupying a limited working memory store.

I should not be mistaken for suggesting a sheerly frequency-driven or connectionist account of language acquisition here. On the other hand, though, it should not be controversial to suggest that frequencies are a vital source of information in this process. Very few linguistic phenomena are all-or-nothing; for instance, even in English, a non-pro-drop language, there are some examples of utterances in which it is (more or less) "grammatical" to exclude an overt subject—for instance, in imperatives (*Eat your steak!*) and in so-called "diary speech" (*Went to the store today, bought some steak*). An account of language acquisition such as Hyams (1986), which assumes that a single piece of "triggering data" will reset a given parameter in the grammar, makes the wrong predictions about how language and language acquisition work. Instead, children must

[4] As opposed to, say, multiclausal utterances which might reasonably be parsed clause by clause: for instance, reported speech (*Louise said [Neil was drinking coffee]*) or some mental state verbs (*Louise knew [Neil was drinking coffee]*).

(and do seem to) attend to relative frequencies in the input to ultimately achieve the adult state of the grammar.

What I am suggesting is that both external frequency (i.e., in the input) and internal frequency (i.e., in the input structures parsed by the interpretive function) play a role in acquisition in the same (moderated) way: not as a *replacement* for UG, but as a piece of evidence that UG may exploit. Specifically, the "increase in pragmatic and processing resources" to which Hyams et al. (2006) refer may simply equate to enough "practice" with canonical clauses to be able to chunk them together in working memory. Once this chunking occurs, children will be better able to handle less canonical structures in the input, as well as in their own production.

This hypothesis is supported by the data reported here. As an example, consider basic active RO utterances like the following.

(102) Suki wanted [Neil/him to drink espresso]

Syntactically, there is obviously a connection between the matrix verb and the embedded subject—this is undeniable, given the morphological marking on the embedded subject *him*. However, the interplay between language and real-world semantics that are ultimately entailed in this utterance are slightly more complicated, as described above: that is, what the matrix subject *Suki* actually wanted was *a state of affair*s in which *Neil was drinking espresso*. That is to say, the matrix subject *Suki* wanted the embedded proposition to come to pass.

Meanwhile, in the OC version of the sentence, this is not the case.

(103) Suki asked Neil/him [to drink espresso]

That is, in the OC version of the sentence, there is an *asking* event taking place in the matrix clause, and that asking event crucially requires an *askee*—a significant factor differentiating *ask* from *want*. The asking event presented in the main clause includes a request presented in the embedded clause.

A hypothesis which suggests that children initially prefer to parse contiguous single clauses would predict that the RO utterance—which includes a semantically contiguous embedded proposition available for parsing—would be slightly easier to process than the OC utterance, in which the embedded clause does not contain an overt subject. The results of Experiment 2 suggest that this hypothesis may be correct; recall that while 5-year-olds were at ceiling in their interpretation of both RO anc OC utterances (both 91.7% correct, $p < 0.0001$), 4-year-olds performed slightly better on RO than on OC utterances (RO: 87.5% correct, $p < 0.0001$; OC: 81.3% correct, $p = 0.0007$). Ideally, data from younger participants would be brought to bear on this question, to see if—at a younger, less experienced age—such RO structures really are measurably easier for children than OC structures.

My sense is that it is the syntactic and semantic shape of RO utterances—which allows for processing of the embedded clause alone, before interpretation of its matrix clause frame—result in RO utterances being more in line with what the semantic scaffolding strategy predisposes very young children to do. Thus, children may in fact use RO utterances as a stepping stone on the pathway to full adultlike competence on related multiclausal utterances, including the surface-same, syntax-different OC utterances.

Likewise, in the discussion on A-chains in Section 6.4.1 above, I suggested that due to the usual patterns of appearance for t and PRO, RO-EPs are in a sense more "canonical" (more frequent, less unusual) than OC-EPs. I also noted that it should perhaps therefore come as no surprise that children have comparatively more trouble with the latter. I would again suggest here that children may use RO-EPs as templates which are closer to the defaults provided by semantic scaffolding; after enough practice with these, they may then be able to bootstrap into the less canonical OC-EP constructions.

9.5 Data Bearing on the Debates

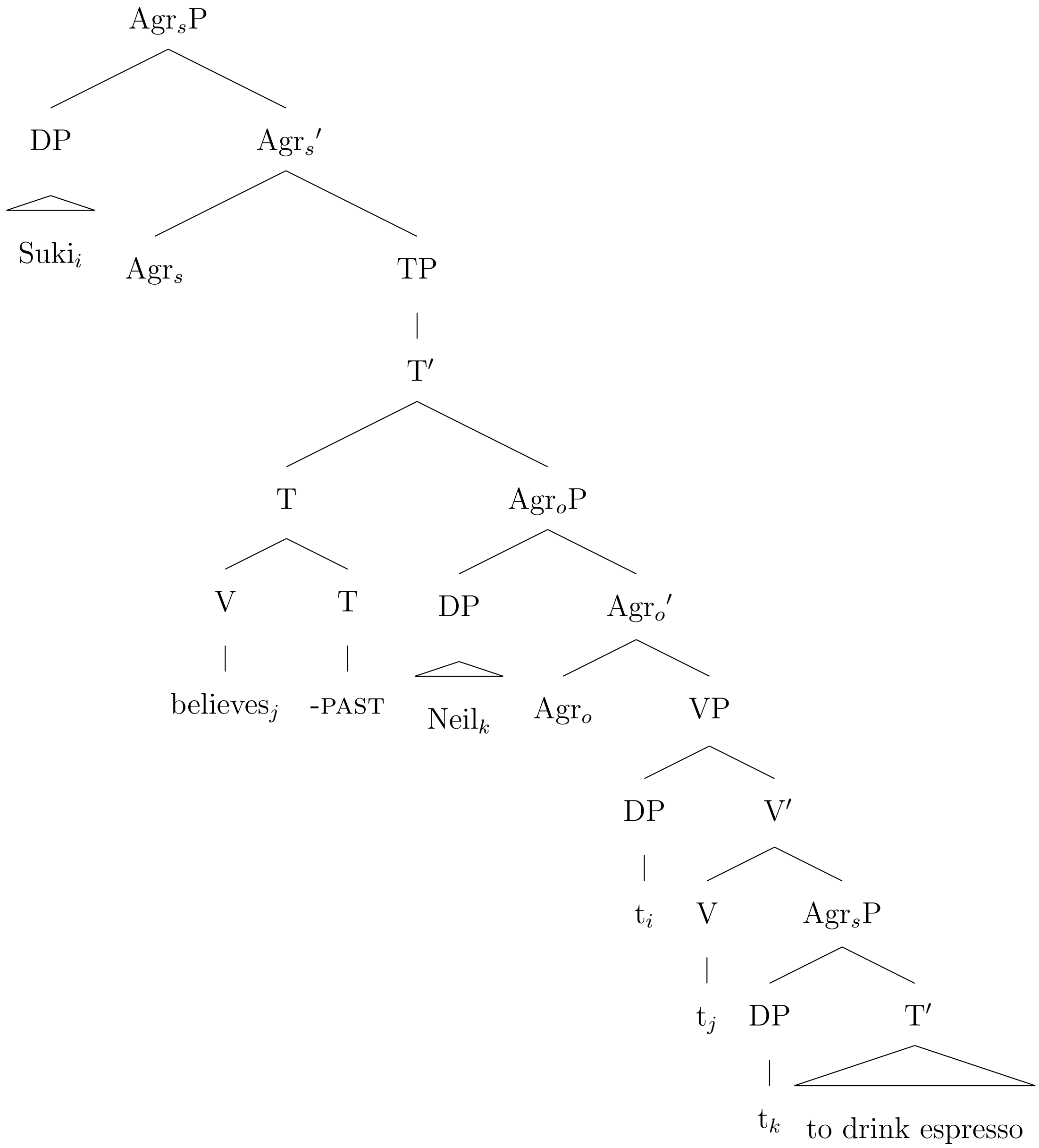
9.5.1 RO or ECM? Child Evidence on an Adult Issue

As noted in Chapter 3 above, a considerable amount of ink has been spilled over the issue of whether such constructions as *Suki believes/expects Neil to drink espresso* should be analyzed as raising-to-object or exceptional case marking structures. Recall that the major issue at hand is what happens, syntactically, to the embedded subject *Neil*.

Proponents of the RO analysis (e.g., Postal, 1974; Lasnik and Saito, 1991) believe that the subject raises out of the embedded clause and into the matrix object position, [Spec, Agr_oP], where it receives its Case (or has its Case feature checked) (104)–(105). Linear order is achieved by the matrix verb raising to a functional head above this projection—possibly TP or vP—and the matrix subject raising out of its base-generated verb-internal position up to [Spec, Agr_sP], for Case reasons.

(104) *RO analysis*: Suki believes Neil$_i$ [t_i to drink espresso]

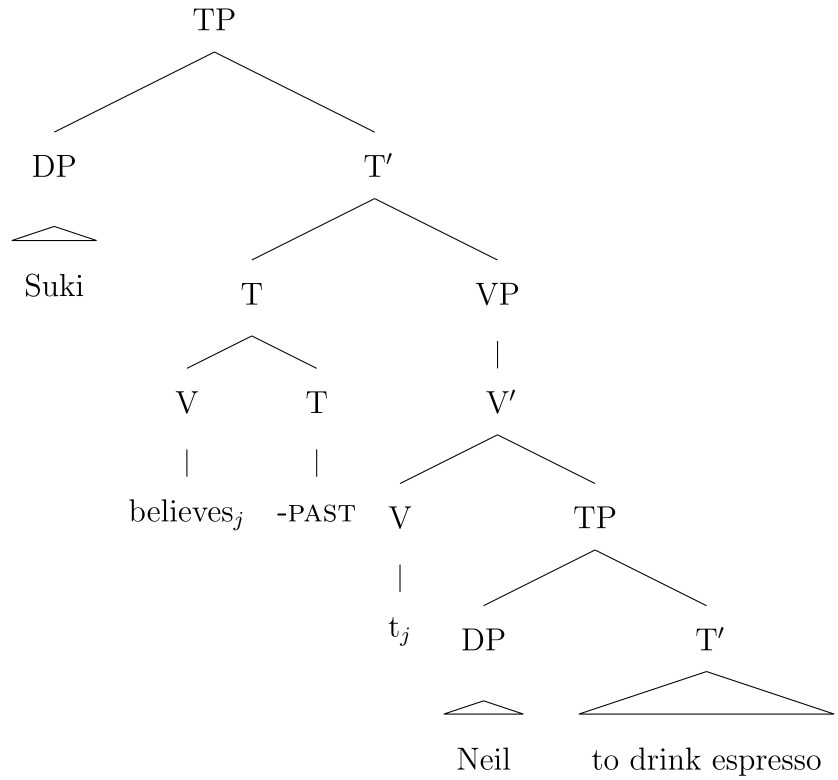
(105)



In contrast, the ECM camp (e.g., Chomsky, 1981, 1986; Chomsky and Lasnik, 1993) believes that the embedded subject remains *in situ* and is morphologically Case-marked as an object (i.e., has its Case feature checked) by the matrix verb (106)–(107). This situation constitutes an exception to the general rule against Case-marking across clausal boundaries.

(106) *ECM analysis*: Suki believes [Neil to drink espresso]

(107)



Data presented here provide some evidence in this debate. Recall that children perform quite well on active RO utterances: their comprehension of these is both significantly above chance, as well as significantly better than comprehension of RO-EPs. Under an RO analysis of these constructions, however, the embedded (semantic) subject is thought to raise to matrix (syntactic) object position, which would constitute precisely the type of subject-object mismatch in alignment that we have seen cause young children trouble in both matrix and OC-EP passives.

The fact that children do indeed perform so well on such active (so-called) RO utterances may instead constitute evidence supporting an ECM analysis. That is to say, the embedded subject may only be a Case-marked object, rather than a true object as defined by syntactic position. This would entail a structure in which the embedded subject (base-generated as such in an active RO, or raised from semantic object position in an RO-EP) receives its Case from the matrix verb, as seen in (108).

(108) RO: Suki wanted/needed$_{[Case]}$ [Neil$_{[Case]}$ to kiss Louise]

RO-EP: Suki wanted/needed$_{[Case]}$ [Neil$_{i,[Case]}$ to be kissed t_i by Louise]

Such a proposal would give us the "best of both worlds"; we explain children's ability to comprehend both active RO/ECM utterances (which contain no A-chain, and thus cannot violate canonical mapping) and RO/ECM-EPs (which contain an object-subject A-chain in the embedded clause that is "saved" from an alignment violation by virtue of having its head Case-marked as an object by the matrix verb).

Now compare the structures in (108)—in particular, the embedded passive—with the matrix passive.

(109) Neil$_{i,[Case]}$ was$_{[Case]}$ kissed t_i by Louise

Here the syntactic subject *Neil* is generated as the syntactic and semantic patient of the verb *kiss*. However, following an analysis of the passives like Jaeggli's (1986), the passive morphology "absorbs" the verb's Case, such that the semantic patient must raise to syntactic subject position for Case reasons. This results in a subject-object A-chain and thus a CAH violation, causing young children trouble.

There is one final issue to be considered here: compare passives (110a) with unaccusatives (110b). As noted in Chapter 3, unnaccusatives have exactly the same syntax as matrix passives, but in contrast to passives, seem to cause children no trouble (e.g., Snyder et al., 1993; Snyder and Stromswold, 1997; Guasti, 2002).

(110) a. Neil$_{i,[Case]}$ was$_{[Case]}$ kissed t_i (passive)

b. Karl$_{i,[Case]}$ has$_{[Case]}$ arrived t_i (unaccusative)

Children's early comprehension and production of unaccusative verbs appears to contradict the assumptions and analysis laid out here which predict that subject-object A-chains will cause trouble for them. Why might we see this apparent contradiction?

Once again, I propose that a possible explanation lies in semantics: namely, in the distinct semantics of unaccusative verbs and passivized (transitive) verbs. Specifically, unaccusative subjects have an initial "object-ness" which is only structural, not semantic. In stark contrast with a passivized verb, whose Case has been absorbed via passivization, an unaccusative verb *never had any object Case to assign.* This characteristic of unaccusatives appears to serve a protective function for children's comprehension, and is in line with the predictions of semantic scaffolding: unaccusatives do not violate canonical arrangements of thematic roles.[5]

9.5.2 RO "and/or" OC in L1A? A Response to Hornstein (1999)

Although it has not been my primary goal to focus on minute details of RO and OC syntax in this work, the syntactic assumptions laid out in Chapter 3 are essentially compatible with current GB or (mainstream) Minimalist claims about the syntax of RO and OC verbs. That is, I have proceeded on the assumption of a structural difference between the two predicate classes which ultimately originates in the distinction between the two silent elements NP-trace and PRO.

In contrast with this premise, though, many syntactic theories in fact do *not* take this structural difference between raising and control as a given (Davies and Dubinsky, 2004). The experimental evidence presented here bears most directly on Hornstein's (1999) Minimalist attempt to unify raising and control constructions, under the claim that both (controlled) PRO and trace involve instances of movement. Recall that for Hornstein, the transformations (though importantly *not* the number of θ-roles) involved in (111) and (112) are essentially the same.

(111) RO: Suki wanted/needed $\text{Neil}_{i(theta)}$ [Neil_i to be kissed Neil_i by Louise]

(112) OC: Suki asked/told $\text{Neil}_{j(theta,theta)}$ [Neil_j to be kissed Neil_j by Louise]

In this way, both control and raising structures are actually types of "raising" movement. To recap, Hornstein claims that in (112), just as in (111), the NP *Neil* is generated as the semantic object of *kiss*, but promotes for Case reasons to the subject of

[5]Another possibility is that children do not have as much trouble with theme subjects as they do with agent non-subjects. In either case, though, the semantic scaffolding shows through.

the embedded passive infinitive, and then moves once again to become the overt object complement of *wanted/needed/asked/told* in the matrix clause. Everything in the double-chain except the overt NP itself is marked for deletion in PF.

It should be explicitly noted that an account which essentially conflates RO and OC constructions seems to force the prediction that children will perform equally well (or perhaps equally poorly) on both verb classes, given any experimental task. However, this prediction is not borne out in the data, as we see a clear difference in 4- and 5-year-olds' comprehension of these two constructions: for instance, 4-year-olds who performed at chance in their interpretations of OC-EP utterances still performed significantly above chance in their interpretations of RO-EPs, and both 4- and 5-year-olds performed at above-chance levels on semantic anomaly judgments of OC, but not of RO, verbs. Likewise, we see a difference in performance levels on grammaticality judgments of RO and OC verbs at each age (although the direction of performance "flips" in development, as described in Chapter 7).

Data such as this, which indicate that children differentiate between the two constructions, suggest that Hornstein's approach is *not* correct; instead, it appears that the syntactic distinction between the two utterance types should be maintained.

There is one possible argument that might be raised against this line of reasoning. Namely, Hornstein continues to distinguish between the two constructions on the basis of θ-role assignment. Specifically, he claims that the distinction between an RO utterance and an OC utterance is the number of θ-roles assigned to the head of the raised chain (i.e., *Neil* in the examples above): in the RO utterance, the head bears only one θ-role, while in the OC utterance it bears two distinct roles. Thus, there are two θ-related differences between the constructions. First, there are simply more θ-roles assigned in an OC utterance than in an analogous RO utterance; second, the OC utterance contains a deviation from what might be considered the less marked/more canonical one-to-one correspondence between NPs and semantic roles.

Each of these distinctions might lie at the root of children's trouble. First, it is possible that the greater number of θ-roles inherent in an OC utterance results in a greater processing load, which ultimately overtaxes children. However, this explanation seems unlikely, since the filler items used in Experiments 2 and 4 also contained biclausal utterances with 3 NPs, and children performed at ceiling on these items.[6] (See Appendices for test and filler items.) Thus, the sheer number of θ-roles assigned in a given utterance is unlikely to be what caused children trouble in the OC-EP items.

Alternatively, it is possible that it is not the *number* of θ-roles, but rather their *configuration*, which results in the distinct patterns seen in children's comprehension. That is to say, the phenomenon of a single NP bearing multiple distinct θ-roles is less canonical than a situation in which there is a one-to-one correspondence between NPs and semantic roles; the former may therefore require greater processing resources than the latter.

I do not believe the current data can either support or refute this hypothesis. Ideally, future research would probe this possibility by testing children's comprehension and processing in a task which carefully controls for all variables except the two θ-role configurations detailed here.

9.5.3 Maturation of RO/OC: A Response to Wexler (1992)

The experiments presented here also constitute an initial response to the challenges set out by Wexler (1992). In this paper, he considers "some issues in the growth of control" and suggests a UG-Constrained Maturation account, according to which PRO (just like nontrivial A-chains) must mature. Prior to this maturation, Wexler suggests that children assign a nominalization representation to embedded clauses containing PRO, such that a sentence like *The children enjoyed [PRO singing the songs]* is represented as *The children enjoyed [the singing of the songs].*

[6]Recall that children who answered more than 2 filler items incorrectly would have been excluded from the analysis. However, all participants but one performed perfectly on filler items, and that last child only responded incorrectly to one filler.

As a test of this hypothesis, Wexler suggests that it would be useful to examine what children do on RO, OC, and passive utterances, as a constellation of behaviors within the same speaker's grammar. In this paper, he suggests a number of experiments which would prove informative. First, he notes that it is an open question what children do with RO/ECM constructions. This research constitutes a first exploration of that question: even at 4 years old, when children have not yet mastered matrix passives, they are still performing at ceiling in the interpretation of active RO/ECM utterances.

Wexler also proposes that children might have trouble with both A-movement and adultlike PRO as a result of a "Proto Case Filter" which rules out NPs without Case, and suggests that experiments testing control and verbal passive on the same subjects would be useful in testing this hypothesis. The data here indicates that, just as with RO/ECM constructions, children who have not yet mastered matrix passives also perform at ceiling in their interpretation of active OC utterances.

I would suggest that we can draw two conclusions in light of the current experiments. Firstly, the data presented in this dissertation suggests that if there *does* prove to be an age at which children do not have "control" of PRO, children have outgrown this stage by age 4. And secondly, given the pattern of performance by children in the matrix passive and active RO/OC tasks, it does not appear that children's performance on passives and their performance on OC utterances is correlated in any way.

9.6 Linguistic and Nonlinguistic Cognitive Development

Many researchers working in language acquisition (myself included) presuppose a domain-specific module that is at least partially innately specified. However, I think it is fair to assume that no one would argue that some aspects of what may leniently be described as the "grammar" (for instance, lexemes for the natural numbers, subcategorization requirements which make reference to animacy, and so on) cannot in a strict sense correctly be identified as grammar-internal phenomena. These are instead epiphenomena of the grammar's interaction with other nonlinguistic cognitive modules, if not sheerly extralinguistic phenomena as reflected in language.

RO and OC verbs engage in behaviors that can be pinpointed as originating in purely linguistic bases. One obvious area of grammar-internal knowledge necessary for the use of these predicates is the group of silent elements t and PRO, and the aspects of behavior which arise from inclusion of one versus the other in a given utterance. However, there are a number of issues surrounding RO/OC verbs and their allowable behavior which relate very strongly to nonlinguistic conceptual development and real-world knowledge. Any work dealing with the acquisition of these verb classes must distinguish which aspects of this multipartite acquisition are dependent on forces internal to the grammar, and which external.

Other researchers have also considered the interface between grammatical and extragrammatical knowledge. As I noted in the discussion on semantic bootstrapping in Section 2.3, GRIMSHAW (1981) makes use of the concept of the *Canonical Structural Representation* (CSR; e.g., CSR(*object*) = N, CSR(*action*) = V), assuming that children initially assign words to syntactic categories based on this CSR principle, until (or unless) there is evidence to the contrary. In this way, the language acquisition device (LAD) makes use of a principle that expresses a dependency between syntax and cognitive semantics. However, Grimshaw believes the CSR principle to be external to UG, since—as she claims—syntax should remain autonomous, and since the notions comprised in the CSR are general cognitive notions and not domain-specific to language. As she puts it, "CSR itself thus expresses a relation between linguistic and nonlinguistic constructs" (p. 175). I agree with the sentiment that there is no reason to burden UG with work that other areas of the mind are already doing, and this view resonates with a desire on the part of many researchers (in language acquisition, cognitive development, and other areas of psychology) for parsimony in theories of cognition.[7]

[7]A different approach can be found in LAKOFF (1971), who argues that well-formedness judgments about sentences—specifically, the principles of pairing of a sentence with the extralinguistic presuppositions required to make it well-formed—are a piece of a speaker's *linguistic* knowledge. Only through consideration of the speaker's knowledge about the nature of the world can a sentence be judged at all.

Semantic development is just as vital for the adultlike use of RO and OC predicates as it is for Grimshaw's CSR principle—if not more so. In order to use OC verbs like *ask* and *tell* correctly (be that in production or in comprehension, in real-world uses or in the lab), children must correctly identify which objects in the world are conceivably "askable" or "tellable." To a large extent, this is an issue of mastering the concept of animacy. Many researchers working in developmental psychology (among others, Piaget, 1929; Laurendeau and Pinard, 1962; Carey, 1985; Keil, 1989) have studied children's conceptual development in this realm; the general consensus is that children do initially engage in (non-adultlike) *animistic thinking* involving animistic causal reasoning, overattribution of consciousness, and overattribution of life (Carey, 1985).[8]

Although these researchers have claimed that children of this age do think animistically, I did not witness any flagrant or conspicuous instances of this in the research conducted with 4- and 5-year-olds here. Becker (2006) similarly found that even younger children (ages 3–4) were able to verbalize non-animistic ideas such as "flowers aren't alive" or "doors can't try to do anything" (p. 56).[9]

And in fact, speakers' judgments of semantic deviance do seem to vary with their beliefs and factual knowledge. For instance, speakers' judgments of the sentence *My cat believes I'm a fool* will depend on whether or not the speaker believes cats to have minds (which Lakoff, by the way, does). I may be "arguing semantics" here by taking issue with the fact that he refers to this as "linguistic" knowledge, but it seems to me at the very least to arise from the grammar's *interaction* with non-linguistic knowledge, if not primarily from the non-linguistic knowledge alone.

[8] Reaching the adultlike state of knowledge about animacy may also be strongly tied to distinct cultural ideas. For instance, Lakoff (1971) notes that the Papagos believe *events* to have minds of their own—a notion for which we would be hard-pressed to find any supporters in this country.

[9] Child participants in the current research responded well to shifting demands in the laboratory tasks. Experiments 2–4 utilized a standard TVJ task, and introduced animal characters who had the same abilities and took part in the same activities as humans. While both humans and non-human animals are animate, non-human animals do not typically engage in activities like doing homework, playing games, or going to the store, and a few of the children in the experiment even made comments to this effect (e.g., "Goats don't do homework!" MS, 5;1.15). However, even the children who explicitly note the unlikeliness of these scenarios (and these children were, it should be noted, in the slim minority) were still able to suspend their disbelief in the name of completing the demands of the task. In contrast with the TVJ tasks, the sentence judgments required a much stricter and more realistic view of the world; in order to succeed on these tasks, children had to switch from the circumstances of a possible world (specifically, one in which animals act much more like humans) to those of the real world. Notably, most children were able to do this; even many of the youngest 4-year-olds who failed on the sentence judgment tasks were still correctly able to answer questions like, "Can you ask trees anything?"

On the one hand, I may not have found evidence of animistic thinking simply because I did not explicitly probe for it; had my tasks included such a probe, I *might* have found evidence for childhood animism in the participants. On the other hand, however, Carey (1985) argues that the period from 4–10 years old involves a significant restructuring of knowledge in children, and specifically knowledge about animals and living things. It is possible that the children taking part in the current research were simply past the age at which their conceptualization of the world is strongly animistic. I lean towards this latter explanation: in the current study, there were strong indications that the semantic-conceptual prerequisites for use of RO and OC predicates are firmly in place for most children at the ages under consideration.

Exploring the realm of nonlinguistic conceptual development more fully is outside the scope of this dissertation, but it is worth noting explicitly that some of the tasks in the current research *did* make demands on child participants that were not entirely internal to the grammar. I will not belabor the point that a "grammar" which looks and acts in a fully adultlike manner includes not only linguistic knowledge, but also access to (or interaction with) non- or extralinguistic knowledge about how the real world works.

In general, though, it should not be controversial to claim that language bears the mark of other cognitive systems, and particularly of the semantic-conceptual system. For instance, returning to the issue of subjects, a number of Dowty's (1991) Subject Properties relate closely to the animate-inanimate distinction, especially as it is formulated by Gelman and Spelke (1981). They note that although both animates and inanimates are physical objects with delineated areas, the two differ in the following ways:

> (a) animates are agents—they initiate action in a causal event—but inanimates can only be acted on; (b) animate objects grow and reproduce; (c) animates can have mental states such as knowing, perceiving, and emotion; (d) animates possess parts that are directly related to biological function (e.g., limbs permit movement); and (e) only animates are capable of communication and reciprocity. (Gelman and Spelke, 1981, cited in Rakison and Poulin-Dubois, 2001, p. 210)

The notions implicated in the Subject Properties List are thus semantic-conceptual, rather than sheerly linguistic. And indeed, although the linguistic system is encapsulated in the grammar, it clearly still has ties to and reflects non-linguistic cognition. While language is itself a vertical domain, we have seen here how it interfaces very crucially with other vertical domains (such as conceptual semantics), and how it bears the imprint of other horizontal domains (such as attention and memory). In other words: the structure of speech is cognitively sound.

Chapter 10

Conclusions and Directions

10.1 Language-Specific Machinery: Innateness and Modularity

I opened this dissertation with a discussion of the theoretical debate over whether language was "special": that is, firstly, whether the language ability comprised a domain-specific module to itself, rather than comprising an epiphenomenal use to which we put a highly able but domain-general brain (the *modularity* question); and secondly, whether this module—if such should exist—was innately endowed, or instead arose upon interaction with the environment (the *nativism/empiricism* debate).

I then suggested that one way to test the contrasting predictions of the camps was (1) to look for evidence of language-specific mechanisms that would have no use outside the grammar, and thus would be highly unlikely to have arisen as a by-product of an intelligent "generalist" brain; and (2) to look for evidence of the existence of linguistic knowledge which would not be open to observation in the input, and thus would be a good candidate for innate knowledge.

As an example of language-specific mechanisms which are not subject to observation in the input, I introduced the elements *t* and PRO, two silent morphemes which appear in complementary distribution. These elements have no use outside of language, and comprise part of the underlying syntax which distinguishes raising-to-object from object control structures. On the other hand, RO and OC structures like those in (113) do share a surface string; without the knowledge of their underlying syntax and distinct silent elements, they are therefore otherwise ambiguous.

(113) RO: Suki believed/expected Neil$_i$ [t_i to make coffee]

OC: Suki allowed/persuaded Neil$_k$ [PRO$_k$ to make coffee]

Thus, I suggested, if very young children are able to distinguish RO from OC constructions, we would have excellent evidence supporting both the modularity and nativist positions on this debate.

Moreover, evidence from the acquisition of RO and OC would expand our knowledge of the phenomenon of verb learning, about which we still know regrettably little. Semantic and syntactic bootstrapping, described in Chapter 2, both appear to play a role in this process, but they certainly cannot explain the whole story.

In Chapters 5 and 7, I presented the data from a series of experiments with 4- and 5-year-olds which probed these children's understanding of the RO verbs *want* and *need* and the OC verbs *ask* and *tell*. These experimental tasks tested comprehension of active RO/OC utterances, comprehension of passives embedded under these verbs, and comprehension of matrix passives, as well as probing children's semantic and syntactic restrictions on these verbs. Although both 4- and 5-year-olds appear to comprehend basic active RO and OC utterances with little difficulty, and perform at levels above chance in their comprehension of RO-EPs, 4-year-olds do *not* comprehend OC-EPs at above-chance levels. This pattern of performance is exactly what we would expect, on the hypothesis that young children's mental representations of these two types of embedded passives are adultlike: that is, that their underlying structures differ in terms of the silent element which appears in each one.

Moreover, children in both age groups performed at above-chance levels on their interpretations of RO-EPs, although—as noted in Chapter 4—these are quite rare in the input. The ability to deduce an unobserved verbal behavior from the verb's other previously observed behaviors points towards the role of language-specific innate knowledge (and specifically towards top-down learning in the presence of nascent verb classes).

Thus, the evidence presented here weighs strongly in favor of both the modularity and innateness positions: children show evidence of using language-specific machinery for which there is no overtly discernable evidence in the input.

10.2 Semantic Scaffolding: Acquiring Verbs in Multiclausal Frames

In Chapter 1, I noted that the verb learning (and especially the syntactic bootstrapping) literature has primarily focused on monoclausal structures, and has essentially ignored verbs like RO and OC, which take multiclausal frames. This attention to monoclausal frames is reasonable and understandable as an initial step towards understanding an area we know so little about.

This dissertation is meant to augment the verb learning literature as an initial attempt to understand how children who have already laid significant foundations for a verbal lexicon then expand it to include structures which are far more complex, and which exhibit a variety of syntactic and semantic behaviors as a result of this syntactic complexity.

Because the range of behaviors in which RO and OC verbs participate *is* indeed so broad and varied, it is impossible—and perhaps even undesirable—to characterize all of them under one rubric. Instead, I proposed that children who have not yet reached the adult state of the grammar and who do not have adultlike levels of processing power at their disposal instead make use of a *cluster* of semantically-related strategies in the service of achieving a syntactic parse. These strategies include (but are likely not limited to) the canonical alignment of thematic roles (in both active and passive utterances), as well as default hypotheses (or preferences) about the shape that a complete semantic proposition, the clause, should take. I suggested that these strategies, which I grouped under the umbrella term "semantic scaffolding," could also be seen in a number of other areas, both in child research *and* adult language, in the areas of normal syntax, aphasic language processing, and typology. I then suggested that semantic scaffolding, which is obviously a language-specific process, still bears strongly the marks of other cognitive modules: primarily the semantic-conceptual system. Given this interaction of encapsulated domains in cognition, it seems clear that a point somewhere along the middle of the spectrum, rather than at either pole, will ultimately emerge as the *correct* answer to the modularity question.

While the research presented here presents a clear picture of several points along the trajectory of acquisition of complex verbal syntax, it is less clear how children are able to emerge from the strategies of semantic scaffolding into adultlike knowledge. However, I proposed a mechanism by which children might be able to climb the scaffold into a higher level of syntactic knowledge. Specifically, I surmised that those structures which most closely conformed to children's default hypotheses about the shape language should take—that is, those structures in which canonical alignment holds, and the shape of the CFC/phasal proposition is both complete and undeformed—may allow children a stepping stone in the "practice" they need to ultimately come to form chunked "templates" about the structures in their ambient language. After the more canonical constructions have begun to serve as templates, children may be in a better to position to more fully incorporate the less canonical utterances into their grammar, perhaps as a function of generalizing and abstracting away from those templates.

Note that this hypothesis of "chunking" in language comprehension and production would suggest that the final adult system is one in which both the whole (that is, the chunked unit) and its subparts (the individual morphemes) are accessible for manipulations (processing, syntactic transformations, etc.), but this is clearly a system in which top-down processes play a strong role (for more about this, see the next section). This phenomenon might explain some adult speech errors in which more common, highly practiced phrases supercede other utterance choices—for instance, in a conversational interaction such as the following.

(114) Waitstaff: Enjoy your meal.

Customer: You too.[1]

Such a mechanism in language acquisition and adult language use could certainly be analyzed as a result of highly connectionist pathways (see, for instance, the "spreading-activation theory" of lexical access, e.g., Dell, 1986, 1995).

However, as conceptualized here, it is crucially still a system driven by a language-specific grammar. As in Becker (2006), an approach such as the one presented here still assumes that the child must meet the learning task with a significant amount of internal equipment: the child must bring the assumptions of silent elements like *t* and PRO, as well as the ability to make use of semantic and syntactic bootstrapping and the strategies inherent in semantic scaffolding. Finally, and almost counterintuitively, the child must be able to cut loose from these strategies when they no longer serve.[2]

10.3 Q: Top-down or Bottom-up? A: Yes.

In Chapter 1, I asked whether there was evidence for top-down or bottom-up learning in children's acquisition of RO and OC verbs. I suggested that if children learned in a top-down fashion, we should see an all-or-nothing performance on these verbs. However, since 4-year-olds perform at ceiling on comprehension of basic active RO and OC utterances, but still fail to perform in an adultlike way on other frames involving these verbs, it would appear that top-down learning of this type is not at play—at least not at this age. It is possible that older children, who have built up stable and adultlike representations of these verbs, *do* in fact evince such top-down learning; indeed, adult studies involving fill-in-the-blank tasks, such as those conducted by Becker (2005), indicate that the adult state of the grammar is one in which top-down learning takes

[1] The idea here is not that the second speaker is *barred* from access into the syntactic (compositional) structure of the phrase, but rather that the "chunked" unit of the entire phrase may be available without clunky and resource-demanding active construction on the level of the individual morpheme.

[2] For instance, as Becker (2006) notes, "learners must assume that a verb may *but need not* stand in a selectional relation with an adjacent NP," even though such an assumption runs counter to the syntactic bootstrapping approach.

precedent. This will perhaps come as no great surprise; it is reasonable that a stable adult grammar would attempt to fit new data into pre-existing categories which have been constructed much earlier in the development of a native language.

As an alternative to the top-down style, I sketched in very broad terms a type of bottom-up learning. This strategy would require extended exposure to a particular verb in a number of its possible syntactic contexts, before the child is able to construct an adultlike lexicosyntactic representation of the item. Furthermore, it may take this kind of broad experience with a number of verbs before the child is able to abstract away to the point of constructing verb classes in which multiple exemplar lexemes can have membership.

However, I also noted that this bottom-up strategy did not preclude an acquisitional trajectory which was constrained and guided by UG. And indeed, this state of affairs is what we saw in 4- and 5-year-old children's performance on the experimental tasks described here. While they did not always perform in an adultlike manner on these tasks, their patterns of performance were principled rather than random, and describable in terms that make reference to linguistic features (e.g., the presence and alignment of particular thematic roles with particular syntactic functions in an utterance; the minimal acceptable shape of a clausal proposition), indicating that UG is there every step of the way.

Indeed, my sense is that both types of learning are at play in the lifespan of the language module, albeit at different points in the arc. In order to achieve the grammar of the ambient language community, the LAD (or whatever you wish to call the component of UG that monitors the input and controls the actual acquisition process) must pay attention to multiple cues at multiple frequencies: it must note which verbs appear in which frames (and how often), how many and what types of complements a verb appears with, what the semantic configurations in the matrix and/or embedded clause are, and so on.

In contrast, top-down learning (or top-down classification) at too early a point—that is, before the learner had a chance to observe a given verb in enough of its relevant frame alternations—would be likely to lead to the same types of errors caused by a parameter's being set by a single piece of triggering data. Recall that appearance in a single verb frame, without corroborating evidence, could lead a learner to categorize a verb very wrongly, since some verb frames are highly uninformative, if not downright misleading (recall our good friend, the utterance *Suki gorped Neil to make espresso*).

Clearly, the child does not have to see a verb in *every single one of its possible alternations* before the child can draw appropriate conclusions about the class membership and behaviors of that verb; indeed, the evidence from spontaneous productions presented in Chapter 4 indicates that children (and even adults) may not *ever* do so. However, we are only now beginning to have any sort of idea about what the *minimal* and *specific* (or, in other words, *necessary* and *sufficient*) sources of information are which children might exploit in their ultimate determinations of verb class membership and silent syntax (Becker, 2005, 2006); we have far to go before we can pronounce on the precise role that "frequency" plays in verb acquisition. While children seem to be able to "fast-map" a novel noun or a novel adjective after only one exposure (Carey, 1978; Carey and Bartlett, 1978; Heibeck and Markman, 1987, among many, many others), much research (Gentner, 1982; Haryu et al., 2005; Imai et al., 2005; Gentner, 2006) suggests that verbs are much harder to learn, and that even multiple exposures to a novel verb across contexts may not suffice in early verb acquisition.

Thus, the question for verb learning remains: *How much is "enough"?*

10.4 Still Unanswered: New Directions

As a final thought, I would like to pull the curtain back on the fact that I have left numerous questions unanswered here which touch on both the child and the adult data. Some of these relate to future directions the current research agenda could take, while others bear on issues that I did not cover here.

10.4.1 Adult Research

In order to arrive at mechanistic and decriptive analyses of a particular construction, linguists tend to abstract away from ideolectal differences among speakers of a language community, and to make categorical claims about what is or is not grammatical in a dialect; just one example of this is the notion that embedded inanimate or expletive subjects are grammatical under RO verbs but ungrammatical under OC verbs.

However, recent directions in the field (e.g., Becker, 2005; Kothari, 2008, as well as the adult data presented in Chapter 7 above) indicate that this tendency may be slowly decreasing; researchers are now attempting analyses of data indicating gradient acceptability of particular structures, and/or optionality of particular restrictions. The adult data here on judgments of the acceptability of inanimate and expetive subjects embedded under RO and OC verbs provides yet another avenue for what will likely prove productive and edifying research. Future work should probe what exactly makes a speaker more or less likely to accept such "unacceptable" constructions; such influences may include the particular expletive (*it* vs. *there*), the type of animate NP (description vs. name), and perhaps—as Becker's work indicates—the eventivity of the lower predicate.

10.4.2 Child Research

Because RO and OC verbs have not previously been examined in this way in child language, this dissertation was meant to serve as an initial exploration into the acquisition of these verbs. As a result, the current study has naturally left a number of stones unturned. There are several extensions of this research agenda which could prove quite fruitful to explore.

10.4.2.1 Once More: With Feeling

As noted in Chapter 5 above (as well as by Wexler, 1992), no previous research had tested the same child subjects on passive, raising, and control structures. One of the goals of this research agenda was therefore to provide within-subjects data on these three constructions as a way to determine the possible grammatical interrelations among them.

As an unfortunate result of this agenda, however, the number of test items which each child received within each task were quite small (3 for any given verb or construction, to be precise). A simple truth about research with child subjects is that we are limited by the attention span and goodwill of these young participants, both of which may be quite short.

Due to the small number of stimuli per verb for each task, there are a number of elements which it was impossible to systematically vary and/or control for, yet which may well have influenced children's response patterns. These phenomena include the length of the pre-stimulus vignette, inclusion of descriptions versus names in the lexical NPs, the topicality of the characters appearing in the vignettes/test items, and more. The research design likewise made it impossible to see how the 4 verbs pattern within a single child's grammar, and we have no idea how children might deal with *other* exemplars of RO and OC verbs that were not tested.

Ideally, future work would explore a subset of the current contrasts, but do so in much more depth. Fewer tasks would allow for significantly more items per task, which would in turn allow for systematic manipulation of the stimuli in such as way as to control for each of the aforementioned phenomena, and thereby observe the relative contributions which each makes in children's responses.

Before crafting new stimuli, there are several sources of information which could be examined, to better inform the direction in which test items should be emended. First, videos of the experimental sessions could be rewatched with an eye to child reaction times, under the assumption that longer reaction time correlates with higher cognitive load. Second, the child stimuli in its current form might be presented to adult subjects, who could respond explicitly to whether each test item seemed felicitous or not. As a final measure, data from adult reaction time might be used to assess which items presented a higher cognitive load to participants.

A different area in which the current experimental tasks should be expanded regards the age groups under consideration. Since the youngest 4-year-olds comprehended basic/active RO and OC items at above-chance levels, this task should be explored with 3-year-olds; similarly, the sentence judgment tasks should be re-run with subjects aged 6 (or perhaps older). In an ideal world, we would have a picture of the trajectory of acquisition of these verbs in its entirety.

10.4.2.2 Linguistic and Conceptual Development

As noted above, a number of the "linguistic" phenomena tested in the current research could more correctly be characterized as linguistic reflections of conceptual development; for instance, knowing how to correctly use verbs which subcategorize for animate complements requires understanding the concept of animacy.

Ideally, future work would probe the extent to which the state of the grammar and current linguistic ability reflects and/or correlates with non-linguistic cognitive development; this could involve a set of experiments which comprise linguistic and non-linguistic tests of concepts like animacy, agency, and sentience. At least one such experiment has already been conducted. Following Lakoff (1971), Schwartz (1980) noted that metalinguistic judgments on sentences (in particular, semantic felicity judgments) are inextricably linked with speakers' presuppositions about the world. He reasoned that judgments on violations of animacy restrictions (and the ability to revise anomalous sentences) should therefore be closely tied to children's concepts of life: those children with an adultlike concept of life/animacy should have adultlike sentence judgments, and vice versa. Forty children, ages 4;2–8:10, were categorized into groups based on questionnaires which assessed their attained concept of life; the groups varied in how "animistic" they were.[3] After assignment to a group, children were given a sentence-judgment task in which half of the anomalous sentences exhibited an anomaly across the *subject* + *verb* sequence (e.g., *the lamp sleeps*), while the other half exhibited an anomaly across the *adjective* + *subject* sequence (e.g., *the sad chalk*). Children were only given credit for having an adultlike response to a stimulus sentence if they were able to correct the sentence in an adultlike fashion (that is, if they were able to provide a correction which was still relevant to the original stimulus, but no longer anomalous). Schwartz's results indicated that all children, regardless of group, were able to provide similarly accurate judgments on well-formed sentences, but that there was a statistically significant difference between groups for performance on the anomalous sentences: the hypothesized relationship held, such that concepts of life (rather than chronological age) significantly determined behavior on sentence judgments.

Experiments like Schwartz's have clear implications for any study of the development of metalinguistic judgments, including those presented here. However, this research can also inform other areas of inquiry into acquisition, including those which probe areas of the grammar's interface with other modules (e.g., "overextension" of nouns, mathematical language, and more).

The major take-home point for the current research is this: when children's beliefs *about the world* differ from those of adults, it is unfair to hold them *linguistically* accountable.

10.4.2.3 Lexical Semantics

Perhaps the most glaring omission is the following: although I have proposed a number of ideas about how children might acquire the *syntax* of RO and OC (and, indeed, of other multiclausal structures, including sentences relative clauses), I have offered very

[3] These groupings were adapted from Laurendeau and Pinard (1962). Group 0 children attribute life to a variety of (perhaps all) inanimate objects; Group 1 children attribute life to moving, but not static, objects; Group 2 children attribute life only to objects with autonomous motion; and Group 3 children correctly attribute life only to animals and plants.

little in the way of a hypothesis about how children learn the *semantics* of these verbs, or of any other verbs whose meanings are largely closed to observation.

Future work should not only continue to probe the soundness of the semantic scaffolding hypothesis, but should also delve into the way children crack open the lexical semantics (the denotation and connotation) of these verbs. The theory of syntactic bootstrapping suggests that the meanings of verbs whose semantics are to a large extent unobservable may have to be learned via examination of those verbs' syntactic privileges of occurrence, and via comparison with other verbs which appear in similar frames; verbs with similar syntax tend also to share similar semantics. What this hypothesis does *not* explain, however, is how the child learns the meaning of the first verb in that cluster, so as to be able to introduce other verbs into its semantic neighborhood. The question is, how do children bootstrap into bootstrapping?

There is still so much more to know.

Appendix A

Adult Matrix Passives

The following were collected from a search of the entire American English CHILDES corpus. The collection process is described in Section 4.4.3 above.

The age of the speaker is included after the file name for matrix passives produced by older child speakers.

- *the alligator was kissed by the camel* (abe001)
- *the car was pushed by the boat* (abe001)
- *dinner was eaten by the boy* (abe009)
- *it was even made by Indians* (adam30)
- *these are are feelings expressed by the child of his parents* (adult)
- *have any structural damage been done to the house by the things* (aprmt52)
- *what people think of you is determined by very many factors* (bom)
- *so that child is being raised by the grandparents* (bom)
- *the age has been confirmed by geologists* (bom)
- *the little boy is going to get hurt by the lawnmower?* (boys26)
- *video games are played by computers* (boys63)
- *Luke was pulled under by a worm!* (boys 73b, 6;3.10)
- *you have to say the cat was chased by the dog* (boys77)

- *the pancake was eaten by mom* (boys 77, 6;7.01)
- *the ball was thrown by the boy* (boys 77, 6;7.01)
- *if I say Mark chased Ross does that mean the same as Ross was chased by Mark?* (boys77)
- *the fruit has been kissed by the # sun* (boys84)
- *and the other one was kissed by the kitty* (boys84, 7;8.18)
- *the yummiest one was kissed by the kitty* (boys84, 7;8.18)
- *one was kissed by Mark # the other was kissed by Ross* (boys84)
- *thunder is caused by energy in the clouds* (bramt1)
- *we have a white one here that's been dragged down by that stupid vine* (c1-1504)
- *are you bored by us?* (chatp2)
- *Fraser's paper is going to be written on by Fraser* (eve07)
- *neutrons since they're neutral um will not be repelled our um attracted by the atomic particles* (fifth, 10;0)
- *they can't be broken, can they, by stepping on them?* (guy)
- *people like that # are paid by the state* (inamt5)
- *I'll be wacked by her dog* (jebmt7, 9;1.13)
- *you're going to be hit by every single family you go to* (job)
- *Graeme's already been hit by somebody else* (job)
- *she really is kind of taken back, by it* (kao)

- *she was fascinated by that* (katie)
- *that was caused by a giant airplane* (moore189)
- *she was bothered the other day by a picture* (n48)
- *it really is interesting to me that she's not bothered by these objects at all* (nath15)
- *not to be insulted by a daughter who is not dry behind the ears* (nath15)
- *the basket is being held up by the balloon* (nina01)
- *that was given to you by David and Ellie* (nina07)
- *he's been crashed into by the car* (oliver2)
- *the particular place that I'm funded under is funded directly by the state* (rosmt1)
- *he won't be run over by the cars* (shem37)
- *the people are gonna be rolled over by the steam+roller* (shem40)
- *this one is being touched by that one* (st1)
- *is this fruit being touched by any other fruit?* (st1)
- *the earth is held by the force of gravity* (third, 8;0)
- *it is made by the Los Angeles City Council* (third, 8;0)
- *we got a dog um that was hit by a car* (third, 8;0)
- *you were really scared by it* (tre16)
- *that was made by good people* (tommt1)
- *I was being attacked by a baby* (v2-0903)
- *all this stuff that (i)s run by batteries in this house don't make no sense* (w3-1429)

- *my car was almost lifted off the ground by the wind* (zener)

Appendix B

TVJ Warm-up Items

1. The dog was making dinner and said to the cat, "Can you help me stir?" The cat said, "Okay." The dog said, "The drinks don't need to be stirred, but the soup does." So the cat helped the dog by doing that.
   The cat stirred the soup (T)

2. The horse and the cow both liked to play outside. The cow asked, "Should we play under the tree or near the fence?" The horse said, "I want to be out in the sunshine, and under the tree there's only shade." So they went to play by the fence instead.
   The horse played (near the fence/under the tree) (T/F)

3. The farmer was having a bad day. He was getting everything confused! Instead of putting food on his plate for lunch, he put a book on a plate. When he tried to eat it, he realized what he had done, and put the book away.
   The farmer tried to eat a book (T)

4. The pig and the zebra came to Shrek and said, "We're having a contest to see who can jump the highest." Shrek said, "Okay, I'll be the judge." So first the pig jumped really high. And then the zebra jumped really high, too. Shrek said, "Wow—that was close, but I think the pig jumped higher."
   Shrek said the (pig/the zebra jumped higher) (T / F)

Appendix C

Active RO/OC Ttems

C.1 Want

1. Tigger talked to Winnie the Pooh and said, "Patrick is having a really bad day and you should cheer him up. I think a kiss would make him happy, but I don't want to kiss him. Will you go give him a kiss?"
   What did Tigger do?
   He wanted Winnie the Pooh to kiss Patrick (T)

2. One day, the nurse and the policeman were talking when the policeman's dog started barking. The nurse said to the policeman, "Your dog is making too much noise! You should make him stop." But the policeman said, "No, I'm going to let him keep barking."
   What did the nurse do?
   She wanted the policeman to stop the dog (T)

3. The lion, the tiger, and the hippo went on a long walk. Afterwards, the lion said, "Man, that walk was great!" But the hippo said, "My feet hurt from walking so far. Can one of you rub my feet for me?" The tiger said, "I'm too tired. The lion should do it for you."
   What did the tiger do?
   He wanted the hippo to rub the lion (F)

C.2 Need

1. Kermit talked to Clifford and said, "I need some help. Can you please go feed my cat? She's hungry, but I don't have time to do it right now." Clifford said, "No, I'm really busy, too, so I don't have any time to do it, either."

What did Kermit do?

He needed Clifford to feed the cat (T)

2. The hippo said to the giraffe, "My stomach hurts. I need to go see the doctor and find out why I'm sick." The giraffe said, "Okay. Get well soon!" So the hippo went to the doctor.

   What did the hippo do?

   He needed the giraffe to see the doctor (F)

3. The cat was being very mean to the dog—she was biting him! When the policeman saw the cat doing that, he said, "You are being a very bad cat! I need nicer behavior from you. Don't bite the dog anymore! Give him a kiss instead."

   What did the policeman do?

   He needed the cat to bite the dog (F)

C.3 Ask

1. The farmer had lots of animals to take care of. He was really busy! One day, he asked his friend the policeman, "I'm really busy. Can you help me go comb the horse's hair?" The policeman said, "Sure. How do I do it?" The farmer said, "It's easy. Just comb out the tangles in his tail."

   What did the policeman do?

   He asked the farmer to comb the horse (F)

2. Dora said to the zebra, "I'm having a party on Friday and you should come. Will you call the sheep for me and invite her to my party, too? I like the sheep a lot." The zebra said, "Okay."

   What did Dora do?

   She asked the sheep to call the zebra (F)

3. Dora wasn't feeling very good. She came to Patrick and said, "I have a really bad

cold. What should I do?" Patrick said, "I'm not sure. Have you gone to see the doctor yet?" Dora said, "No." Patrick said, "Will you visit the doctor and get some medicine? I don't want to catch your cold."

What did Patrick do?

He asked Dora to visit the doctor (T)

C.4 Tell

1. Elmo said to Cookie Monster, "You know, I've been drawing pictures of the pig all day, and now I need something else to draw. Do you have any ideas?" Cookie Monster said, "Yesterday, I drew pictures of the pig, too. Then I decided to draw pictures of the goat. You should do that, now, too."

   What did Cookie Monster do?

   He told Elmo to draw the pig (F)

2. The pig and the goat were bored, and didn't know what to do. The pig asked the farmer, "What should we do for fun?" The farmer said to the pig, "Why don't you chase the goat around for a while?" So that's what they did.

   What did the farmer do?

   He told the pig to chase the goat (T)

3. Kermit talked to Shrek and said, "You know, I've never taken Clifford for a walk before." Shrek said, "Well, I've done it, and it was really fun. Actually, Clifford needs to go for a walk right now, but I'm too busy. You go take him this time."

   What did Shrek do?

   He told Kermit to walk Clifford (T)

C.5 Fillers

1. It was the bear's birthday, and he had a party with lots of fruit and a cake. The cow said to the bear, "Who made this delicious cake?" The bear said, "My mom

made it."

What happened?

The cow asked about the (cake/fruit) (T/F)

2. The nurse had a cat and a dog who liked to eat her food when she wasn't looking. One day, she made a very tasty sandwich and left it in the kitchen for a minute. When she was gone, the dog and the cat slipped in and the dog ate her sandwich. When she came back, she saw that the dog's face was covered in mustard. She got very mad and put the dog in time-out for eating her food.

   What did the nurse do?

   She knew it was the (dog/cat) who ate the sandwich (T/F)

3. The horse and the giraffe decided to race around the tree to see who was the fastest. The farmer was the judge for the race, and he said, "On your mark, get set, go!" So the horse and the giraffe both ran off as fast as they could. They were both really fast, and came across the finish line at nearly the same time. Then they asked the farmer who won the race, and the farmer said, "Oh, it was really close, but I think the horse was faster."

   What did the farmer do?

   He said that the (horse/giraffe) won the race (T/F)

4. Tigger and Winnie the Pooh were walking along when a cow got in their way and wouldn't move. Tigger got mad and started yelling at the cow, "Hey cow, get out of my way!" But Pooh said, "Yelling won't help. You have to ask nicely, and then he'll move."

   What happened?

   Pooh said (asking nicely/yelling) would make the cow move (T/F)

5. The lion and the tiger were eating fruit. There was a banana and an apple. The lion watched the tiger eat the banana, but then he had to go home. After the lion

left, the tiger decided he was still hungry, and he ate the apple.

What did the lion do?

He saw the tiger eat the (banana/apple) (T/F)

Appendix D

Matrix Passive Items

D.1 Test Items

1. The farmer had to send someone to the store to get him some bread. The goat couldn't go because she was doing homework and the sheep was busy playing a game, so the farmer sent the pig to the store.

   The pig was sent by the farmer (T)

2. This woman wanted to draw a picture of someone. The nurse was busy, and she had already drawn a picture of farmer, so she decided to draw the policeman.

   The woman was drawn by the policeman (F)

3. The farmer had to choose one animal to take with him on his trip. The cow was too old, and the horse was too big to fit in the car, so he picked the sheep.

   The farmer was picked by the sheep (F)

D.2 Fillers

1. The bear, the rhino, and the bird were playing with a wheelbarrow, and the bear asked, "Who wants to be pushed in the wheelbarrow?" The bird said, "I don't need to be pushed, I can fly really high by myself." The rhino said, "You can push me in the wheelbarrow." So the bear did.

   The bear pushed the (rhino/bird) (T/F)

2. The baby horse finished dinner and wanted dessert. His mom said, "You can either have a doughnut or you can have some cake." The horse said, "I don't like cake. I think I'll take the doughnut." So his mom gave him the doughnut and he ate it up.

   The horse ate the (doughnut/cake) (T/F)

Appendix E

Embedded Passive Items

E.1 Want

1. The goat was playing with the tiger and the bear, and she said, "Let's play a tickling game. I'll tickle myself, and the bear can tickle the tiger." Everyone agreed, so the goat tickled herself, and the bear tickled the tiger.
   What did the goat do?
   She wanted the tiger to be tickled by the bear (T)

2. Patrick said to Dora, "Today I'm drawing pictures of all my friends. Can I draw a picture of you?" Dora said, "Oh, I don't feel like having my picture drawn today. Why don't you go draw Clifford instead?"
   What did Dora do?
   She wanted Clifford to be drawn by Patrick (T)

3. The policeman had a horse that was so big! He loved his horse, but he was worried that if anyone else saw it, they would want to take it away and put it in a zoo. One day, while the policeman was riding the horse, he saw the farmer walking nearby. But the policeman rode away as quick as he could, so that the farmer wouldn't see them.
   What did the policeman do?
   He wanted the horse to be seen by the farmer (F)

E.2 Need

1. Kermit said to the Shrek, "I was supposed to make dinner for Clifford, since he can't make it for himself, but I'm too tired. I need some help. Can you make dinner for him?" Shrek said, "Sure, I can do that," and went and made dinner for

Clifford.

What did Kermit do?

He needed Clifford to be fed by Shrek (T)

2. Winnie the Pooh said to Tigger, "Somebody should call Elmo and invite him over to play with us. Do you have his telephone number? Can you call him up?" Tigger said, "Yes, I can call Elmo," and he went to call him and invite him over.

   What did Winnie the Pooh do?

   He needed Tigger to be called by Elmo (F)

3. One day, Dora wanted to take pictures of her friends. She photographed Elmo, and then she wanted to photograph Cookie Monster, but she realized her camera wasn't working anymore. So she said to Elmo, "Can you use your camera and photograph Cookie Monster? That way I will have all the photos I needed to take."

   What did Dora do?

   She needed Cookie Monster to be photographed by Elmo (T)

E.3 Ask

1. Elmo said to Cookie Monster, "Dora really loves hugs. Can you go and hug her? She'll give you a big hug back." Cookie Monster agreed, and went and gave Dora a big hug.

   What did Elmo do?

   He asked Dora to be hugged by Cookie Monster (F)

2. One day the nurse saw the dog and cat making peanut butter sandwiches. The cat was pretty clean, but the dog had gotten peanut butter all over him! "Oh no!" said the nurse. "Look how dirty the dog is! Cat, I need some help getting the dog clean. Will you please lick all the peanut butter off the dog?"

   What did the nurse do?

   She asked the cat to be licked by the dog (F)

3. The goat said to Shrek, “I haven’t had a bath all day, and I’m really dirty. Can you wash me?” Shrek said, “I have to take a bath too, so I don’t have time to give you one. Can you get the cow to do it? She’s probably got time.” The goat said, “Alright,” and went to talk to the cow.

   What did Shrek do?

   He asked the goat to be washed by the cow (T)

E.4 Tell

1. The bear said to the lion, “I’m bored. What should I do for fun today?” The lion said, “I know! You should go ride the horse today.” The bear said, “Okay! That sounds like fun.”

   What did the lion do?

   He told the horse to be ridden by the bear (F)

2. One day, the policeman used some new soap when he was taking a bath. When he got out of the bathtub, he asked his wife, “Do you like how my new soap makes me smell?” His wife said, “I can’t smell anything different. You should go have the dog smell you, he has a much better nose than I do. Just be careful and try not to sniff him, since he smells like a dirty dog these days.”

   What did the policeman’s wife do?

   She told the policeman to be sniffed by the dog (T)

3. The dog, the cat, and the pig were playing outside in the woods, and they all got lots of mosquito bites. “Ow, these are really itchy!” said the cat. “Yeah,” said the dog, “and I can’t reach to scratch the bites on my back.” The pig said, “Hey, cat, you have nice long fingernails. You should scratch the dog’s back for him.”

   What did the pig do?

   He told the cat to be scratched by the dog (F)

E.5 Fillers

1. The farmer had a garden with lots of flowers and vegetables in it. One day he was out in the garden, and said, "Should I pick vegetables or flowers today?" But when he looked at the flowers, they weren't big enough, so he left them alone and picked some vegetables instead.

   What happened?

   The farmer picked some of the (vegetables/flowers) (T/F)

2. One day, the cow had corn and carrots for lunch. When he ate some corn, he smiled and said, "Wow, this corn is really tasty! Okay, now I'll try this carrot." But when the cow took a bite of the carrot, he made a face. He said, "Ew, this carrot doesn't taste good at all."

   What happened?

   The cow seemed to like the (corn/carrot) (T/F)

3. The lion was eating a hot dog and some fries when the tiger came up to see him. The tiger said, "Wow, that food looks really tasty. Can I have some?" The lion said, "Well, hot dogs are my favorite, but you can have the French fries." The tiger said, "Thanks!" and ate them right up.

   What did the lion do?

   He gave the (fries/hot dog) to the tiger (T/F)

4. The cat said to the horse, "You know, I've never met the zebra before. What does he look like? Is he white with black spots?" The horse said, "No, silly! The zebra isn't black and white polka-dotted, he's black and white striped."

   What happened?

   The horse said that the zebra had (stripes/spots) (T/F)

5. Patrick went to the museum and saw lots of neat things. When he got back, Cookie Monster asked him, "What did you see at the museum?" Patrick said, "I

saw paintings, and I saw robots, and I saw dinosaurs." Cookie Monster asked him, "What did you like best?" Patrick said, "I think the dinosaurs were my favorite."

What happened?

Patrick liked the (dinosaurs/robots) best (T/F)

Appendix F

Semantic Anomaly Items

F.1 Warm-up Items

Stimulus	Target Answer
The apple wants to be red	#
This book is about a tree	OK
The chair tries to be heavy	#
The mice want to eat the cheese	OK
The ball needs to take a nap	#

F.2 Want

1. The boy's mother was making a cake, but he didn't know what kind. He really wanted a chocolate cake, though.

   The boy wanted the cake to be chocolate

2. The girl liked her coat from last year and wanted to wear it, but it didn't fit anymore.

   The girl wanted the coat to fit her

3. This woman wanted to go inside her house. She only had one key with her, and didn't know if it was the right one, but she hoped that the key would work.

   She wanted the key to open the door

F.3 Need

1. The teacher got so many heavy books at the library that she couldn't carry them all.

   The teacher needed the books to weigh less

2. The cat really wanted to get up on the bed, but when she tried to jump up on it, she couldn't, since the bed was too tall.

   The cat needed the bed to be shorter

3. Big Bird needed to write a very important letter, but his pen wouldn't write.

   Big Bird needed the pen to write

F.4 Ask

1. Bert and Ernie were listening to music together, but Ernie didn't like the music. He said to Bert, "Can you turn that music off?"

   #Ernie asked the music to stop playing

2. The girl wanted to climb a big tree, but there were only short ones near her house. She said, "Why can't these trees be tall so I can climb them?"

   #The girl asked the trees to be tall

3. The boy was throwing a ball up and down when it got stuck in a tree. He said, "Oh no! Why can't my ball fall back down so I can keep playing with it?"

   #The boy asked the ball to fall back down

F.5 Tell

1. Elmo was putting away his toys, but the toys were too big to fit into his toy-box. Elmo looked at his toys and said, "If these toys were smaller, I could put them away, but they're too big."

   #Elmo told the toys to be smaller

2. The girl's daddy was making soup, and the girl said, "I want carrots in the soup!"

   #The girl told the soup to have carrots in it

3. Bert drove around with Ernie in their car one day. Bert said, "Let's make the car go even faster!"

   #Bert told the car to drive faster

F.6 Fillers

1. The cat was making cat noises.

   The cat was (meowing/#barking)

2. This little boy put on some shoes so that he could go out and play.

   The (boy/#shoes) wanted to go outside

3. This woman wanted to draw a picture of a house with some crayons, but she wasn't sure if she could draw it. She decided to try anyway.

   The (woman/#crayons) tried to draw a picture

4. This woman bought some apples and took them home on her bike.

   The (woman/#apples) rode a bike

5. The mommy didn't know what to make for breakfast. When she saw a loaf of bread, she thought she might make toast.

   (The mommy thought about making toast/#The bread thought about being toast)

F.7 Adult Fillers

Item	Target answer
The chef wanted her restaurant to get a 4-star rating	OK
The bush wanted to be full of berries	#
Molly needed to take a vacation	OK
The sugar cube needed a cup of coffee	#
The computer needed to take a nap	#
The editor asked to read a draft of the article	OK
The guidelines asked to be followed	#
The police officer asked to see her license	OK
The sales clerk told him where to find the book	OK
Neil told a story about the year he lived in Spain	OK
The spaghetti told them to boil the water	#

Appendix G

Grammaticality Judgment Items

G.1 Warm-up Items

Stimulus	Target Answer
Herself is carrying bags	*
The sheep is standing under the tree	OK
The stick is be near the tree	*
The man is reading a book	OK
The dog am black and white	*

G.2 Want

1. This girl's mommy gave her a bag with something tasty inside. The girl said, "I hope it's cookies!"

   The girl wanted there to be cookies in the bag

2. Big Bird wanted to draw, but his box of crayons was empty. He wished he had some crayons.

   Big Bird wanted there to be crayons in the box

3. Dora heard her phone ring. She wondered who was calling her, and thought, "It would be nice if it was my friend Boots. I want to talk to him."

   Dora wanted it to be Boots on the phone

G.3 Need

1. The woman bought some ice cream at the grocery store. When she got in the car, she realized she needed to turn on the air conditioning so the ice cream wouldn't melt.

   The woman needed it to be cooler in the car

2. The chef needed lots of food to feed all her friends lunch, but she ran out of sandwiches before everyone got one.

   The chef needed there to be more sandwiches

3. This farmer grew vegetables on his farm, and they needed rain. He said, "If it doesn't rain soon, my vegetables might die."

   The farmer needed it to rain

G.4 Ask

1. This girl wanted to play in the snow, but it was a warm, sunny day. She went outside and said, "Why cant it snow today? I wish it would snow!"

   **The girl asked it to snow*

2. The boy was tired after playing all day, and he asked his mom if he could go to his room and sleep.

   **The boy asked it to be time for bed*

3. The policeman wanted to keep everyone safe, so he asked them to walk on the sidewalk instead of in the street.

   **The policeman asked there to be people on the sidewalk*

G.5 Tell

1. The girl was walking around outside and got really cold. She said, "I sure wish it was warm outside today!"

   **The girl told it to be warm*

2. Sponge Bob wanted to have a party. He told Patrick, "Come to my house for a party tonight!"

   **Sponge Bob told there to be a party at his house*

3. The woman said to her husband, “Let’s decorate the house a little. You should put some flowers on the dining room table.”

   **The woman told there to be flowers on the table*

G.6 Fillers

1. Elmo walked out of his house.

   *He (went/*goed) outside*

2. There was water falling out of the sky.

   *(It was/*They were) raining.*

3. Here’s some fruit on the table. There’s an apple and a banana and a lemon.

   *(The food/*She) was laying on the table*

4. Here is one green crayon, and here is another one.

   *There are two (*with of) green crayons*

5. The cat drank milk out of bowls: one, two, three bowls. *The cat (drank three bowls of milk/*three bowls drank milk of)*

G.7 Adult Fillers

Item	Target answer
It wasn't Jessica who wanted to go running	OK
There wanted to be a knock at the door	*
It wanted to be time for lunch	*
There weren't any chores that needed to be done	OK
It needed of a book on the table	*
There needed to be any more left	*
It was intimidating to ask for her phone number	OK
There were 2 students who asked for extra credit	OK
There asked to be 3 bedrooms in the house	*
There told to be nothing good to watch on TV	*
It's nice to be told that you're smart	*

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