CHAPTER 6

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BEHAVIORAL ACQUISITION METHODS WITH PRESCHOOL-AGE CHILDREN

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6.1 INTRODUCTION

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This chapter picks up where the previous chapter, devoted to the acquisition of syntax by infants, left off. In the first two to three years of life, infants demonstrate an impressive capacity to acquire the building blocks of syntax. They distinguish phonological forms that are frequently instantiated by words associated with functional categories from those associated with lexical categories, and appear to recognize certain clusters of functional words and their role as anchors in speech segmentation and the identification of phrases. They recruit the linguistic context in which a novel verb appears in the service of assigning a likely meaning to that verb based on event representation. They link word order and syntactic structure with semantic roles. They target aspects of the hierarchical syntactic structure for anaphoric dependence and coreference. They track non-adjacent morphosyntactic dependences. They appeal to syntactic structure to learn filler–gap dependencies.

All of these abilities are that much more impressive when one considers the modest productive repertoire of these little humans. As infants become more skilled at comprehending, processing, and producing language, the range of syntactic constructions that can be investigated becomes considerably more complex, and the range of methodologies that experimenters are able to employ to assess young children's developing syntactic knowledge broadens. The syntactic knowledge of preschoolers (children age

3–6) and the methodologies that researchers use to tap into this knowledge are the focus of this chapter.

As is the case with infants, experiments with preschoolers emphasizing production can return highly misleading results about children's underlying competence. As a result, many behavioral methods employed with this age group focus on investigating children's ability to access one or more interpretations associated with a target sentence via their assessment of the acceptability or appropriateness of a sentence in light of a particular context, or their selection or re-creation of a context that aligns with a sentence. However, some methods still creatively capitalize upon children's productions to gather informative data about children's capacity to produce certain constructions, and their reluctance or inability to produce others. In this chapter, I provide a broad summary of a number of aspects of young children's developing syntactic knowledge in the preschool years, highlighting methodological approaches used to uncover this knowledge.

In a number of cases, this syntactic knowledge lies more at the interface of syntactic and semantic knowledge, precisely because of the tight way in which these grammatical systems are interwoven and rely upon each other: Lexical entries of words do not only carry implications for individual word meaning, but also impact the ways in which those words compose or interact with other lexical expressions and the requirements for the syntactic structure in which they appear. The syntactic knowledge covered in this chapter ranges from knowledge of individual words and the interpretations they license, to covert and overt movement operations. The topics covered in this chapter thus fall into three main areas.

First, I begin by reviewing what children know about the meaning of individual words insofar as this knowledge is related to the syntactic constraints on their distribution and their interaction with other lexical items. I focus on a targeted set of lexical items, since their meaning and distribution are tightly linked to elements of the syntactic structure in which they appear: These include pronouns and reflexives and the binding constraints that are implicated by them, universal quantifiers and their scope-taking ability, propositional attitude verbs, raising and control verbs and structures, and 'tough' and control adjectives.

Second, I turn to children's interpretation of certain syntactic constructions and the factors that make it harder or easier for them to be interpreted, along with what the erroneous interpretations that children assign says about the grammar. In this section, I cover relative clauses and passive constructions. These two constructions are in fact linked to the topics covered in the next section; however, I have highlighted them here because of the particular attention that has been devoted to them as constructions *per se*, given variations within them and contrasts with similar declarative constructions.

Third and finally, I turn to what children know about constraints on overt and covert movement. For overt movement, I focus on *yes/no* polar questions that involve subject–auxiliary verb inversion and *wh*-movement. For covert movement, I focus on two grammatical mechanisms: the first, called *quantifier raising*, which is not, in fact, restricted to quantifiers, and the second, reconstruction. In each case, the questions are

whether or not children have the relevant movement operation in their grammar, and if so, if they deploy it in an adult-like manner and correctly interpret structures in which it is implicated.

Taken together, the experimental findings illustrate that even at a very early age, children demonstrate sophisticated syntactic competence that is not accurately depicted in their performance, and in many ways is on a par with that of adults in that they perform grammatical operations that target hierarchical structure and abstract representations. At the same time, their interpretations and productions often diverge from those of adults, but are far from haphazard, thereby seeming to reflect an underlying grammatical system that demonstrates characteristics shared across languages. A common theme that arises throughout the studies covered here is the question of whether the behavioral responses observed when children veer from the adult state are a direct reflection of children's still-developing syntactic knowledge or are the consequence of extragrammatical factors, such as an experimental task artifact, an immature sentence processor, or a growing ability to appeal to features of the discourse context. An important goal for researchers investigating each of these topics (and others) is to find the right kind of methodology, or complementary methodologies, that will help to pin down the answer to this question and paint a clearer picture of young children's syntactic knowledge.

6.2 Individual words: Syntactic constraints and interaction

6.2.1 Pronouns and reflexives

Pronouns are pervasive in natural language. They can easily pick out the speaker(s) of the utterance (*I*, *we*), the addressee(s) (*you*) or another salient individual perhaps associated with a particular grammatical gender (*he*, *she*) or an individual of non-binary or unknown gender (*they*), or group of individuals (*they*). Their short phonological form makes them easy to produce, and they can make reference to individuals without further precisifying their identity, so they make for communicative ease. However, the same ability to pick out a variety of individuals can be a sword that cuts both ways, since they cannot be interpreted without contextual support: They require a salient antecedent in the linguistic or extralinguistic discourse context. This topic can be explored further from a pragmatic perspective in terms of the presupposition of existence and accommodation, or from a semantic perspective in terms of indexicality. From a syntactic perspective, there are constraints on which other expressions within a sentence can serve as a potential antecedent.

The chapter on the acquisition of syntax by infants touched upon children's initial ability to appeal to *c-command* (Reinhart 1981) and *Principle C* (Chomsky 1981/1993; Reinhart 1983) in order to identify potential antecedents or rule them out. Principle C

states that a name (also known as an R-expression) must be free. That is, it cannot be c-commanded by a pronoun with which it is to be co-construed. A *c-command* relation is typically defined in terms of dominance. Given two expressions α and β, α c-commands β if every node that dominates α (or the lowest node that dominates α) also dominates β, but neither dominates the other. This constraint rules out the possibility of the subject pronoun and name in (1) referring to the same person, since the pronoun in subject position c-commands the R-expression in object position. The pronoun could, however, be linked to a sentence-external antecedent.

(1)   She$_{*i/k}$ is proud of Mary$_i$.

Researchers initially thought that children prohibit coreference between a pronoun and any subsequent R-expression in a sentence, since in **Act-Out Tasks** designed to probe their interpretation of sentences such as those in (2), children routinely manipulated props so that the pronoun was associated with an external referent (e.g. another animal) (Solan 1983; Tavakolian 1978). However, it has been argued that these results could have arisen from the pressure to resolve reference as soon as possible and/or from a preference to choose an antecedent not named in the sentence. Plus, an act-out task invites participants to select one way of realizing an interpretation, even if they might allow another one, and thus ultimately reflects preference. Thus, one cannot conclude from these results what is not allowed. Moreover, these constructions allow for an anaphoric relation in which the pronoun could, in principle, be associated with the experiencer that follows later, as in (2), and thus do not reveal anything about Principle C or coreference in cases in which it is not allowed. (See Guasti and Chierchia 1999/2000: 140–142.)

(2)   a. For **him** to kiss the lion would make **the duck** happy.
       b. That **he** kissed the lion made **the duck** happy.

Lust et al. (1980) reported that children who were presented with the sentences in (3) in an act-out task were more likely to allow for coreference in the case of backwards anaphora as in (a) than in (b), although they still allowed anaphoric relations in sentences like those in (b) a sizeable percentage of the time.

(3)   a. While **he** was playing with the lion, **John** was singing.
       b. **He** was playing with the lion while **John** was singing.

However, these findings still came from an act-out task. A better test of whether or not children know about constraints on coreference comes from tasks in which performance pressures are alleviated, coreference is contextually favored, and children are asked to assess whether or not a sentence containing a Principle C violation could in fact express this relation.

Such evidence comes to us from the **Truth Value Judgment Task (TVJT)** (Crain and Thornton 1998; Gordon 1996). In this task, one experimenter tells a story with props (small toys) or images on a screen. Another experimenter plays the role of a hand puppet, who watches the stories alongside the child. The premise is typically that the puppet

is learning, and may make mistakes, and needs the child's help to learn. At the end of the story, the puppet delivers a statement, and the child is asked to judge its truth value. However, children are not directly asked to do so. Instead, they are asked to choose an appropriate reward for the puppet/something desirable if the puppet is correct, and something not (or less) desirable if the puppet is wrong. In this way, the child sees the task as a game. But there is also a methodological advantage in that the experimenter can carefully control the form of a sentence and its associated interpretation, as well as the context of presentation, thereby determining the truth-conditions assigned to a sentence and how the syntax constrains meaning (or not).

In a TVJT designed to probe whether children allow for the pronoun and an R-expression it c-commands to be co-construed, Crain and Thornton (1998) presented sentences such as those in (4) in a game scenario, and found that preschoolers largely allowed for coreference in (a), but not in (b). As a point of comparison, in so-called *backwards anaphora* constructions, as in (5), children routinely permitted the pronoun to be associated either with a sentence-internal antecedent (an *anaphoric* relation) or with a salient discourse referent in the discourse (an *exophoric* relation).

(4)   a. **The Troll**$_i$ said that **he**$_{i/k}$ is the best jumper.

       b. **He**$_{*i/k}$ said that **the Troll**$_i$ is the best jumper.

(5)   While **he**$_{i/k}$ was eating a cookie, **the Troll**$_i$ played tennis.

In the experiment, each target trial designed to probe (4) had a similar structure. The story for the control and test sentences in (a) and (b), respectively, proceeded as follows. The participants are first introduced to a set of characters (Cookie Monster, a Troll, and Grover), who are about to participate in a jumping contest, judged by Robocop. Each competitor is supposed to take a turn jumping over some objects (a log, some barrels, a bench). Cookie Monster goes first and has only moderate success but a positive attitude. The Troll goes next and, full of bravado, jumps over all of the obstacles. Not to be bested, Grover then follows, and matches the Troll's success. When it is time for Robocop to judge, he judiciously takes his time, deciding between the last two jumpers who will be awarded the coveted prize (colored pasta). Robocop ultimately awards the prize to Grover, declaring him to be the best jumper. Grover graciously accepts his prize. However, the Troll protests, seizing some of the pasta prize for himself, declaring that Robocop is wrong and that *he* is the best jumper. Thus, it is true that the Troll thinks that he himself (the Troll) is the best jumper (not Grover, the other salient male jumper), but *not* true that Robocop (the other salient male character assessing the jumping) thinks that the Troll is the best jumper. This distinction is key for rendering a judgment of the sentences in (4), in which the binding constraints are implicated.

In subsequent examinations of children's knowledge of Principle C, Leddon and Lidz (2005) also found that children disallowed coreference between the pronoun and R-expression in constructions such as those in (6).

(6)   a. **He**$_{*i/k}$ was very proud of **Andy**$_i$.

       b. **She**$_{*i/k}$ put up the red painting of **Miss Cruella**$_i$.

Finally, Italian-speaking children who were presented with sentences such as those in (7) in a study conducted by Guasti and Chierchia (1999/2000), allowed coreference in ambiguous sentences such as the one in (a), but rejected coreference for sentences such as the one in (b)

(7) a. Mentre ballava, un pagliaccio suonava la chitarra.
While (he) was.dancing, a clown was.playing the guitar
'While **he** was dancing, **a clown** was playing the guitar.'

b. Andava sul cavallo a dondolo, mentre un musicista
(He) was.riding on.the rocking horse, while a musician
suonava la tromba.
was.playing the trumpet
'(**He**) was riding a rocking horse, while **a musician** was playing the trumpet.'

In a separate **Sentence Repetition task** using similar sentences with an anaphoric relation, these same researchers asked children to repeat a frog's utterance describing a scene to a bear, who was unable to see the events. They found that Italian-speaking children were more likely to revise sentences that were ungrammatical under coreference than sentences that were grammatical (although they revised both at relatively high rates). Thus, it appears that children largely demonstrate mastery of Principle C relatively early in development. However, the knowledge they exhibit is variable and task-dependent, and it is apparent that evidence gathered from tasks asking children to *demonstrate* an interpretation should be complemented by evidence from tasks in which they *assess* the availability of a favored interpretation that is either consistent with or violates Principle C. (On this point, see Gor and Syrett 2015.)

Principle C is not the only binding constraint. Two other constraints place limitations on the availability of co-construal between a name and an anaphoric expression. Principle A states that an expression like *herself* must be locally bound, that is, it must be c-commanded by an antecedent in the same clause. Thus, in (8), the reflexive *herself* can be coindexed with Mary in (a), but can only be coindexed with Jane in (b). By contrast, Principle B says that a pronoun must be free; its antecedent cannot c-command it. Thus, in (9), the pronoun cannot be coindexed with Maryellen in (a), but in (b), it can only be coindexed with Maryellen, not Rebecca.

(8) a. Maryellen$_i$ is proud of herself$_i$.

b. Maryellen$_i$ said that Rebecca is proud of herself$_{*i/k}$.

(9) a. Maryellen$_i$ is proud of her$_{*i/k}$.

b. Maryellen$_i$ said that Rebecca is proud of her$_{i/*k}$.

Chien and Wexler (1990) set out to test whether young children aged 2–5 years had these binding constraints as part of their grammar, and therefore whether they would demonstrate knowledge of them in an experimental task. In one version of an **Act-Out Task**, they asked children to perform actions with props in response to target sentences

as in (10). In another version, they asked children to follow the directions of a puppet and perform actions themselves.

(10)   a.   {Kitty/Snoopy} says that {Sarah/Adam} should give {her/him} a popsicle.

       b.   {Kitty/Snoopy} says that {Sarah/Adam} should give {herself/himself} a crayon.

The younger children allowed for an ungrammatical non-local antecedent with Principle A (reflexives), and many of the older children still did not demonstrate consistent knowledge of Principle B. When the experimenters controlled for the gender of the pronoun, children's performance increased, indicating that this morphosyntactic information helped to resolve reference. Chien and Wexler suggested that a pragmatic principle that disallows coreference, raising the question about the source of the non-adult behavior.

McDaniel, Smith Cairns, and Hsu (1990a) also found variability in performance among the binding principles. They asked preschoolers to act out sentences such as those in (11), and found that if children demonstrated mastery of the binding principles by performing successfully with any or all three types, they were not successful with Principle B prior to Principles A or C.

(11)   a.   Grover$_i$ is washing himself$_{i/*k}$.   Principle A

       b.   Grover$_i$ is washing him$_{*i/k}$.   Principle B

       c.   He$_{*i/k}$ is washing Grover$_i$.   Principle C

In a version of their task using **Picture Comprehension**, Chien and Wexler showed children a drawing, were introduced to the characters in it, and were asked a question about the relationship between the characters in the drawing, as in (12).

(12)   a.   Is Mama Bear touching {her/herself/Goldilocks}?

       b.   {Is every bear/Are all of the bears} touching {her/herself/Goldilocks}?

The experimenters compared names and universally quantified subjects (as in (b)), because quantificational phrases, unlike names, cannot be coindexed with another expression, and instead "bind" the other expression via c-command. Here, the youngest children still allowed a reflexive to have a non-local antecedent (in violation of Principle A), and many children also allowed for a pronoun to have a local antecedent (in violation of Principle B); but performance gradually improved with age, and was much better when gender features of the lexical items matched. The presence of a quantifier and a binding relation also improved performance.

Evidence that children do recognize that a universal quantifier in subject position binds a reflexive in object position, consistent with Principle A, comes from the results of a TVJT conducted by Leddon and Lidz (2005) (see also Leddon 2007), where participants were presented with sentence such as those in (13).

(13)   a.   Every dancer$_i$ put up the white painting of herself$_{i/*k}$.

       b.   Every hippo$_i$ was very proud of herself$_{i/*k}$.

In the story for the (a) sentence, a cow and three hippos are engaged in a rock-pushing contest. The hippos baulk and say that the rocks all look heavy, and say that they would be very proud of anyone who pushes their rock past the line. Miss Cow swaggers up to her rock and, though she initially struggles, she deftly pushes it across the line. The hippos express their collective pride in Miss Cow. When it is time for the hippos to push their rocks, they try, but only manage to push their rocks a little bit, nowhere near the line. They concede to only being a little proud of themselves. The puppet then delivers the target sentence in (a). If participants interpret 'herself' as 'Miss Cow', they should accept the sentence, but if they take 'herself' to be bound by the quantified phrase, they should reject the sentence. In the story for the (b) sentence, Miss Cruella announces to the dancers in her school that they have been elected the best dancers, and as a result, they get to put a painting of themselves up on the wall. Each girl must choose between a red and a white painting. But they each must also pick a picture of their teacher to put up, and here, too, they are forced to choose between a red and a white painting. Each girl ultimately puts up a white painting of herself and a red painting of Miss Cruella. Thus, when presented with the sentences in (b), they should reject the sentence if 'herself' is taken to mean 'Miss Cruella' and accept it if it is taken to mean 'the dancer'. Like adults, children routinely accessed bound interpretations of the reflexives, although not at the same "ceiling" level as adults.

The presence of a quantificational subject appears to be a key feature of evaluating children's knowledge of the binding principles. In a variation of the sentences testing Principle B, children largely interpreted the pronoun freely and not bound by the universal quantifier, although surprisingly, even adults frequently allowed the pronoun to be bound (Leddon and Lidz 2005).

(14)   a.   Every dancer$_i$ put up the white painting of her$_{*i/k}$.
       b.   Every hippo was a little proud of her$_{*i/k}$.

However, children's performance with Principle B is highly variable, and depends not only on the type of subject but also on design features of the task. In a TVJT, Thornton and Wexler (1999) found that in response to target sentences such as those in (15), following a story in which the bound reading is true, children accept the first sentence a significant percentage of the time, but routinely reject the second.

(15)   a.   Bert$_i$ brushed him$_{*i/k}$.
       b.   Every reindeer$_i$ brushed him$_{*i/k}$.

The fact that children routinely allow for a pronoun to be associated with an R-expression that c-commands it has been called the *delay of Principle B effect*. The fact that their performance improves and that they appear to demonstrate knowledge of the Principle when a quantificational phrase binds the pronoun has been called *Quantificational Asymmetry* (Elbourne 2005). Following up on critiques by Elbourne of previous experiments that seem to have led to a Quantificational Asymmetry, Conroy et al. (2009) incorporated changes into the experimental design, and demonstrated that this *Quantificational Asymmetry* is a task artifact.

Conroy et al. took care to match the design of the stories in the referential and quantificational conditions, ensuring that the potential antecedents were comparably available in both conditions, and promoted the accessibility of certain interpretations, making them central to the story plot in an equivalent way. As a result, with similar sentences to those investigated before, children and adults routinely rejected the bound (anaphoric) interpretation of the pronoun when there was a Principle B violation in both conditions. In a follow-up experiment using target sentences in which the pronoun appeared in possessive position and therefore allowed for the bound interpretation, as in (16), participants instead accepted the sentences, providing further support that their rejection of it in the previous experiment could be attributed to Principle B, and not to inaccessibility of the intrasentential antecedent and anaphoric reading in general.

(16)   a. Grumpy painted his costume.
        b. Every dwarf painted his costume.

Finally, in further manipulations of the story and a pronoun in object position, they once again elicited an asymmetry between a referential and a quantificational subject in terms of acceptance rates of the bound reading, further demonstrating that Principle B is a part of the child's grammar, and that task artifacts may mask this knowledge. (See also extensive discussion in Grimshaw and Rosen 1990 concerning task artifacts masking knowledge of the binding principles.)

6.2.2 Quantifiers and scope

Words like *every* and *all* are universal quantifiers that pick out the entirety of a set of entities. A long line of research on the acquisition of semantics has investigated whether or not young children know about the "maximal" meaning of these quantifiers, how they differ from the strongly distributive universal quantifier *each*, whether they quantify over objects or events, and how their meaning interacts with other components of the sentence such as an indefinite object, negation, or disjunction. Some of this semantics research implicates syntax, and one area in which the study of quantification lies at the syntax–semantics interface is with the scope-taking properties of quantifiers. A sentence such as (17) is ambiguous. It could either mean that every student was such that they did not get an A, or that it is not the case that every student got an A (leaving the door open for some students getting an A). The ambiguity arises from the interaction of the quantifier and negation operator at an abstract logical level. Scopal ambiguity is not restricted to universal quantifiers; similar ambiguity arises with indefinites (e.g. *some student(s)*), including numerical expressions (e.g. *two students*).

(17)   **Every student** did**n't** get an A.

Children typically seem to access the interpretation that corresponds to the surface scope of these logical elements, and have difficulty in accessing the interpretation where the position of the elements in the abstract logical representation is not *isomorphic* to

the surface syntax (Musolino 1998). This may seem like a semantic problem, in that the different interpretations arise from the interaction of logical elements. However, syntax is not absolved, because the availability of any given interpretation depends on the quantificational phrase taking "scope" relative to the negation operator. Scope is not determined by linear order in a flat string, but rather by the c-command relation in the syntax (as described above for pronouns and the binding principles).

In addition to syntax being implicated for scope-taking purposes, quantifiers have to move through the syntactic structure to take wide or narrow scope with respect to negation (a form of covert movement discussed in Section 6.4). These facts can be further illustrated with (18), where the quantificational indefinite phrase is in the object position. On the *surface scope*, it takes narrow scope with respect to negation, but after covert movement, it takes *wide scope*, or *inverse scope* in the logical representation.

(18)   The professor did**n't** give [**some/two**] **(of the) students** an A.

One might ask, then, whether children are guided by the linear order of the elements with respect to each other in the surface string, or whether they are guided by another relation. Lidz and Musolino (2002) provided convincing evidence that children are not relying upon linear order by comparing responses from English-speaking children and adults to those from participants who speak Kannada, a language that does not share the same word order. In the version of (18) in Kannada, the indefinite phrase would precede negation. Lidz and Musolino ran a **Truth Value Judgment Task** (described above), presenting children and adults with scenarios that made one of the interpretations true and the other false. Adults in both languages accepted the sentences, reflecting their ability to access both the isomorphic and non-isomorphic scope interpretations. Children, however, displayed a different pattern: regardless of their language, they consistently accessed the reading corresponding to surface scope (negation>indefinite) but not the inverse scope reading (indefinite>negation).

While Musolino, Crain, and Thornton (2000) initially argued that children's grammars are to blame for their being unable to generate the requisite representation to access the non-isomorphic interpretation, subsequent years of research have demonstrated that various experimental manipulations are successful in opening the gate to this interpretation. These manipulations include satisfying the felicity conditions of negation and providing a contrast of events, accompanied by contrastive focus (Musolino and Lidz 2006) (a manipulation that complements the findings on relative clauses reviewed in this chapter); inclusion of the partitive *x of the y* structure (Musolino and Gualmini 2004); increasing the salience of and satisfying the Question Under Discussion (Gualmini et al. 2008), and priming the abstract logical form (Viau, Lidz, and Musolino 2010). Thus, there is by now sufficient reason to think that children's grammars are not at all impoverished as far as these sentences are concerned, and that their apparently default inclination towards a non-adult-like interpretation is the results of an interaction of grammatical and extragrammatical factors.

6.2.3 Propositional attitude verbs

The chapter on acquisition methods with infants highlighted the ways in which the syntactic environment(s) in which a word (namely, a verb) appears can be informative about the meaning of the word. This hypothesis is known as *syntactic bootstrapping* (Gleitman 1990; Landau and Gleitman 1985). For example, the transitive frame in which the novel verb *gorp* appears in (19a) indicates that this verb takes two arguments (a subject and an object), distinguishing it from the verb in the intransitive frame in (19b), which appears only with a conjoined subject. (Both occurrences of *gorp* are accompanied by two NPs.) The occurrence of *gorp* in (19b) indicates that for this verb, an object is not obligatory, allowing it to have a meaning like 'laugh' or 'run' or 'collaborate', and also indicates that it cannot have the causative meaning that the occurrence in (19a) can have, since the transitive, but not the intransitive frame, can portray an event in which an agent acts upon a patient, perhaps even causing a change of state.

(19) a. Amelie is gorping Mary.
  b. Amelie and Mary are gorping.

Acquisition of verbs continues well into the preschool years, moving from primarily transitive and intransitive verbs that denote perceptible events to also include those that denote more abstract events or properties, such as *believe*, *think*, and *know*. The syntactic environments in which these verbs appear continue to play a role in narrowing the hypothesis space for their meanings, although it becomes crucial for the learner not to leap to conclusions about meaning immediately upon seeing that the verb takes a finite or nonfinite sentential (propositional) complement. As the sentences with the novel verb *gorp* in (20) illustrate, these syntactic environments support multiple verb meanings, allowing multiple clause-taking verbs to be candidates. For example, *believe*, *think*, *know*, and *hope* can all occur in the frame in (a), while *believe*, *want*, and *need* can all occur in the frame in (b).

(20) a. Amelie gorps that Mary is traveling to France.
  b. Amelie gorps Mary to be a safe traveler.

As in earlier acquisition, a cluster of frames and common meaning are central to classifying verbs according to concepts such as "desire" or "belief" (White, Hacquard, and Lidz in press), as illustrated in the sampling of frames presented in (21).

(21) a. Amelie [believes/thinks/knows/says/*wants/*needs] (that) it is raining.
  b. Amelie [*believes/*thinks/?knows/*says/wants/needs] it to rain.
  c. Amelie [*believes/*thinks/*knows/says/*wants/*needs] to someone that it is raining.
  d. Amelie [*believes/thinks/knows/*says/*wants/*needs] about rain.

Know is a factive verb, which means that it presupposes the truth of its complement (i.e. that it is true that it is raining). Even when the entire sentence is negated

or questioned (e.g. *Amelie does not know that it is raining, Does Amelie know that it is raining?*), this presupposition survives. However, to conclude from the co-occurrence of a verb and a tensed sentential complement that the complement must be true would most definitely lead the learner astray, since *think* and *say* also take such finite-clause complements, and are not factive. Negating or questioning those sentences certainly does not allow the presupposition to survive. The presence of this complement does not even entail belief on the part of the subject, since while *know* and *think* associate the grammatical subject with the belief that the complement is true (at least in the absence of negation), *say* does not. One can say anything without believing it or thinking it to be so! It is only upon comparing the patterns of occurrences of individual verbs across frames and various verbs within the same frame that the learner can arrive at distinctions among clause-taking verbs and a more fine-grained verb meaning.

Dudley et al. (2015) have demonstrated that 3-year-olds do not treat *think* as presupposing the truth of its complement, but differ in whether they do for *know*. While many 3-year-olds in their studies do not distinguish between *know* and *think* with respect to factivity, others do. For example, when shown a red and a blue box, and told (22), children search for the toy in the red box. But when told (23) either with matrix negation (a) or embedded negation (b), they search for the toy in the blue box, in line with adults. However, when presented with (24), the researchers observed some children treating *know* as non-factive (as with *think*), and others behaving in an adult-like fashion (searching for the toy in the red box).

(22)   Lambchop **thinks** that it's in the red box.

(23)   a.   Lambchop does**n't think** that it's in the red box. (matrix negation)

       b.   Lambchop **thinks** that it's **not** in the red box. (embedded negation)

(24)   Lambchop does**n't know** that it's in the red box.

What might contribute to children's difficulty with *know*? Dudley (2017) and Dudley, Hacquard, and Lidz (submitted) provide corpus data from the Gleason transcripts in CHILDES (MacWhinney 2000) demonstrating a lack of opportunities for children to encounter *know* in a frame in the input that would unambiguously indicate that the speaker presupposes the truth of the complement clause.

Three-year-olds typically have difficulty with false belief tasks that call upon them to deploy their *theory of mind* and recognize that another speaker does not share the same beliefs about the world that they do (Wimmer and Perner 1983). One hypothesis for this failure to succeed in such tasks is that they do not attend to the entire sentence when assessing its truth value. That is, for a sentence such as the one in (23a) above with *think*, children might appear to only attend to the complement clause, disregarding what Amelie thinks is true when assigning a truth value (de Villiers 1995; Diessel and Tomasello 2001). However, if such sentences are only investigated in contexts in which the complement clause is false, then we only have part of the picture. Lewis (2013) and Lewis, Hacquard, and Lidz (2012) showed that when the main clause is false, 3-year-olds

pattern with adults in rejecting the sentence, thus demonstrating that they are attending to the content of both the main and subordinate clause.

6.2.4 Raising and control verbs

While appeal to the surface syntax can be informative even for more abstract verbs, it can only go so far with another class of verbs known as *raising* verbs, some of which are illustrated in (25). These verbs pose a particular challenge to the learner in that their frame is "opaque." That is, it is not possible to easily deduce something about the subcategorization pattern or argument structure directly from the syntactic environment.

(25)   a. The conductor [**seems/appears**] to be upset.
       b. The pianist [**is likely/happened**] to play a piece by Mozart.

Whereas a learner who hears one of the grammatical sentences in (21) can deduce something about one of these verbs—namely that the subject is said to 'think', 'believe', 'know', etc., and that it takes a subject and a certain type of complement—the same cannot be said of the sentences in (25). The subject of these sentences is *not* one who engages in an event of 'seeming' or 'being likely', etc. The subject of these sentences is also not an argument of the verb. These facts are captured in (26), where the subject occurs in the object complement, and the subject is occupied by an expletive *it*. (See also Becker 2005.)

(26)   a. It [seems/appears] [that the conductor is upset].
       b. It [is likely/happened] [that the pianist played a piece by Mozart].

What adds to the challenge of learning these verbs, apart from the opacity of the frame, is that on the surface, their structure resembles that of another construction: the *control* construction. As shown in (27), the subject of the main clause is indeed semantically meaningful; it controls the subject of the non-finite clause. A sentence like the one in (a) cannot be translated to one with an expletive subject, as shown in (28). The only way this sentence makes sense is if *it* is anaphoric to a salient entity, such as a fundraising or awards committee.

(27)   a. The conductor wants to be recognized.
       b. The conductor$_i$ wants pro$_i$ to be recognized.

(28)   *It wants the conductor to be recognized.

Thus, when the learner encounters a new verb in a frame resembling that of (25) or (27), it is not immediately apparent whether the verb is a raising or a control verb.

Becker (2006) tested the hypothesis that learners begin by assuming that all verbs appearing in such a frame are control verbs. In a modified **Grammaticality Judgment Task**, Becker showed preschoolers pictures, and asked them to listen to a puppet's

description of the picture and decide whether it was "OK" or "silly." The puppet's statements included control and raising verbs, as shown in (29). Becker also manipulated whether the predicate was compatible (a) or incompatible (b) with the subject in a fully-crossed design. Only the 5-year-olds responded in an adult-like way, but 3- and 4-year-olds seemed to treat control verbs as *raising* verbs, responding that sentences such as the one in (a) were "OK." Evidence that the children were probably not just ignoring the verb came from a follow-up TVJT, in which child participants patterned as adults would.

(29)   a.   The flower wants to be pink.

     b.   The hay seems to be excited.

How then do children come to know that *want* is a control verb, and that the structure in (29a) is a control structure? Becker (2006) argued that children must rely upon multiple cues, including the type of predicate and event structure, expletive *it* subjects, and animacy of the subject. To test the potency of the last cue, Becker and Estigarribia (2013) presented adults with novel verbs in frames similar to the ones in (25) and (27) with either an inanimate or an animate subject, to determine whether animacy could prompt participants to disambiguate between raising and control verbs. Some participants read a definition favoring one type of interpretation, then a set of sentences such as the ones in (30), either (a) or (b). Others read the definition, and read a short story using such sentences. Still other participants were presented with both.

(30)   a.   The old man joops to be very tired.   (animate subject)

     b.   The book joops to be very long.   (inanimate subject)

Participants were then asked to deliver a judgment about which of two sentences containing the novel verb sounded better to them. The expletive *there* sentence in (31) is compatible with a raising verb analysis, while the pseudocleft construction in (32) does not allow for a raising verb to occur in it; a control verb, however, is permissible.

(31)   There joops to be a computer on the desk.   (expletive construction;

                                    raising OK)

(32)   What the fairy joops is to be small.   (pseudocleft; raising not OK)

Becker and Estigarribia (2013) found that when participants were presented with a raising-compatible definition but an animate subject, they were only "correct" about half of the time in choosing the expletive *there* construction over the pseudoflect. However, when the subject was inanimate, the success rate was near ceiling. Thus, adults can use animacy paired with the syntactic frame to somehow categorize the verb and make inferences about occurrences beyond the initial frame, suggesting that children, too, might engage in a similar process.

Complicating the learning of control verbs and control structures is the fact that there are different kinds of control structures, as shown in (33).

(33)   a.   Ariel told Ernie$_i$ pro$_i$ to buy an ice cream.
             (object control into complement)
       b.   Ariel$_i$ wanted pro$_i$ to push Peter Pan.
             (subject control into complement)
       c.   Ariel$_i$ kissed Ernie before pro$_i$ buying an ice cream.
             (subject control into adjunct)

Across a variety of tasks, children do not exhibit consistently adult-like performance with these control structures until well after 4 years of age, demonstrating mastery of control into complements before control into adjuncts (Cairns et al. 1994; Hsu, Smith Cairns, and Fiengo 1985; McDaniel, Cairns, and Hsu 1990b). (See Guasti 2002 and McDaniel and Smith Cairns 1990 for further details.)

Gerard (2016) provided evidence against a grammatical explanation of children's non-adult-like interpretation of adjunct control sentences by showing that in moving away from a task that called upon children to assess grammaticality or make a decision about characters' utterances, children became more adult-like in their responses. Gerard administered a **Coloring Task** using a method pioneered by Zuckerman et al. (2015) in which she presented children with two black and white drawings, indicating two sequential events, and asked participants to listen to a sentence, as in (34), then color one of the drawings accordingly using a touchscreen device.

(34)   Dora washed Diego before pro eating the red apple.

In one such trial, children were shown a picture of Dora spraying water on Diego, then a picture of Dora and Diego together, each with an apple. Participants' interpretation of pro was determined via which apple they chose to color: Dora's or Diego's. In this task, children exhibited a much higher success rate than in previous tasks, in particular a TVJT. Thus, as we have seen with other topics, the choice of methodology affects the conclusions one is able to make about children's grammatical knowledge of control structures, just as is seen with other syntactic phenomena discussed in this chapter.

6.2.5 Tough and control adjectives

While most adjectives can appear in prenominal (*white cat*) or copular position (*The cat is white*), some adjectives can appear in a wider range of constructions, including with a non-finite clause following, as in (35). In this sentence, the gymnastic coach is *not* the one who is "easy" or "tough." Rather the sentence is comparable to the one in (36), where the subject position is occupied by an expletive *it*, and the coach is the object of the verb. (This pattern is reminiscent of (25) and (26).)

(35)   The gymnastic coach is easy/tough to please.

(36)   It is easy/tough to please the gymnastic coach.

Still other adjectives appear with a non-finite complement, but for these, the grammatical subject is indeed the semantic subject, as shown in (37). The (a) sentence cannot

be transformed into either (b) or (c). This is because the construction in (a) is a control structure. The underlying representation is something like what is shown in (38).

(37)   a.   The gymnastic coach is eager to start practicing.

      b.   *It is eager to start practicing the gymnastic coach.

      c.   * It is eager for the gymnastic coach to start practicing.

(38)   The gymnastic coach$_i$ is eager [pro$_i$ to start practicing].

As with raising verbs, animacy also plays a role in the acquisition of tough adjectives. Becker, Estigarribia, and Gylfadottir (2012) and Becker (2015) showed children brief videos of an experimenter animating and voicing a small toy in a context that was compatible with both a tough and a control interpretation. In each video, the character uttered a novel adjective five times in the frame template in (39). Importantly, the children were assigned to either an inanimate or animate condition based on the animacy of the sentential subject.

(39)   The NP is **adjective** to VP.

(40)   a.   An apple is very daxy to draw.

      b.   Mr. Farmer is always greppy to help.

After each video, children were asked two *yes/no* questions, as shown in (41), one of which was compatible with a 'tough' interpretation, and the other with a control interpretation, as indicated. Each was thus grammatical under one interpretation, and ungrammatical under the other.

(41)   a.   Is it **adjective** to VP?   ('tough' adjective interpretation)

      b.   Is the NP **adjective**?   (no 'tough' adjective, e.g., control adjective)

Becker et al. found that children who heard novel adjectives appear multiple times with an inanimate subject, were more likely to categorize them as a 'tough' adjective than they were when novel adjectives appeared with an animate subject. They were also faster to answer grammatical questions than ungrammatical ones with novel 'tough' adjectives.

6.3 SYNTACTIC CONSTRUCTIONS

Certain constructions have been known over the years to produce non-adult-like responses from young children, raising questions about source of these behavioral responses—whether they are due to an immature grammar or to extragrammatical sources, such as felicity conditions of the discourse, parsing strategies, or cognitive overload. Two constructions in particular are relative clauses and passive constructions. The central question with both of these constructions has been whether children have the correct representation of the construction in order to interpret sentences featuring them correctly. For this reason, these constructions are presented separately from the

phenomena in the next section, although in all cases, there is claimed to be syntactic movement.

6.3.1 Relative clauses

Relative clauses modifying a noun, such as the ones illustrated in bold in (42), can pose a challenge to young children due to the conditions under which it is appropriate to express them, and the processing and structural demands they impose. For example, in (a), the relative clause modifies the subject (*the singer*), and there is a gap in object position following the verb in the relative clause (*greeted t*). As a result, the verb from the relative clause is juxtaposed with the main clause verb, inviting a potential "garden path" as the sentence processor tries to make sense of the structure correlated with the words encountered incrementally. The subject encountered in sentence-initial position must be associated with the second verb appearing later in the sentence, which makes parsing this sentence that much more challenging. In (42b), the relative clause modifies the object, and there is a gap in the subject position of the relative clause, to be filled by the object of the main clause (*the musician*).

(42)   a. The singer **that the dancer greeted** _ thanked the musician.
       b. The singer thanked the musician **that _ greeted the dancer**.

In a series of Act-Out Tasks, children who were presented with sentences such as (43) and toy props of a dog, a sheep, and a pig consistently acted out an interpretation in which the main subject was the subject of both the main clause and the relative clause (Sheldon 1974; Tavakolian 1981). This pattern led Tavakolian (1981) to propose that children lack the ability to represent relative clauses, and thus when confronted with a sentence with a relative clause, they reach into their grammar for another representation they *do* have—in this case, conjunction. Thus, they arrive at an interpretation of (43) that looks something like (44).

(43)   The dog pushed the sheep that jumped over the pig.

(44)   [The dog pushed the sheep] and [<the dog> jumped over the pig]

However, subsequent experiments demonstrated that this hypothesis is untenable, and years of research that followed showed that many children actually do accurately produce relative clause syntax between ages 2 and 4 (Diessel and Tomasello 2000; McKee, McDaniel, and Snedeker 1998), and correctly interpret relative clauses not only as test sentences, but as control sentences for investigations targeting more complex constructions (Syrett and Lidz 2011).

Why, then, would children have acted out sentences such as (43) in a non-adult way? Crain and Thornton offer a very convincing explanation based on pragmatics and processing. The relative clause presupposes two things. First, the event of (the sheep) jumping over the pig preceded the event expressed in the main clause assertion—that

the dog pushed the sheep. Second, the presence of the relative clause is taken to signal that there is more than one sheep, and the one that is the object/patient in the main clause can be distinguished from the others by having the property that it was the one that jumped over the pig. Thus, if there is only one sheep to choose from among the props, and children are asked to process the sentence incrementally and plan the events to act out, they are, in a way, "lured" into acting out an incorrect interpretation. Once children are given time to process the sentence and plan their response, and more animals are introduced (thereby satisfying the felicity conditions on the use of the relative clause), the number of adult-like responses increases (Crain, McKee, and Emiliani 1990; Hamburger and Crain 1982).

Diessel and Tomasello also argued that processing and pragmatic constraints are relevant to children's production of relative clauses. They conducted a search of CHILDES transcripts (MacWhinney 2000) to document children's early production of relative clauses between 1;9 and 5;2 years. Of the 300+ occurrences, the lion's share of relative clauses produced modified the "predicate nominal of a presentational copular clause" (PN) as in (45), followed next by relative clauses modifying an isolated NP or the object, as in (46).

(45) a. Is this something **that turn around**?   (Adam 3;5; PN)

      b. It's the one **you went to last night**.   (Peter 2;10; PN)

(46) a. The girl **that came with us**.   (Nina 3;1; NP)

      b. I want to see some ducks **that do that too**.   (Nina 3;2; OBJ)

Diessel and Tomasello accounted for the skew by pointing out that in most of the children's productions, the relative clause does *not* express presupposed information; rather, it asserts new information, and thus performs a different pragmatic function than the typical adult relative clause. What's more, most attested relative clauses expressed a single proposition such that the entire sentence could be paraphrased as a single proposition, as in (47).

(47) a. Here's a tiger **that's gonna scare him**.   (Nina 3;1; PN)

      b. =The tiger's gonna scare him.

Thus, relative clauses are part of children's early grammatical repertoire, but are subject to syntactic, pragmatic, and processing constraints, and thus variable performance (and perhaps interpretation of them when encountered) is expected as a result.

6.3.2 Passive constructions

An event can be described with either active or passive voice, as illustrated in (48).

(48) a. The hungry gorillas devoured the fruit.   (active voice)

      b. The fruit was devoured by the hungry gorillas.   (passive voice)

While children have been observed to produce some passives as early as 2.5–3 years of age (Jakubowicz 1989; Snyder and Stromswold 1997; Budwig 2001), they do not typically exhibit consistent and accurate production and comprehension of passives until around well after age 4 (Borer and Wexler 1987; Horgan 1978; Messenger, Branigan, and McLean 2012a). And often, when children are asked to act out passive sentences, they often perform an active interpretation instead (Brooks and Tomasello 1999; Harris and Flora 1982; Horgan 1978; Lempert 1990; Maratsos et al. 1985; Messenger et al. 2012b; Pinker, Lebeaux, and Frost 1987; Sudhalter and Braine 1985). This delay in the spontaneous production and comprehension of passives may suggest that the requisite grammatical knowledge is not yet in place in early childhood. However, there are three reasons to conclude that grammatical immaturity is *not* the cause, and that children's knowledge of passive constructions is better their performance indicates, and may be masked by task demands. (See Baldie 1976; Crain, Thornton, and Murasugi 2009; and Armon-Lotem et al. 2015.)

First, there is crosslinguistic variability in the production and comprehension of passives, in that children in some languages consistently produce passives correctly as early as 2 years of age (see e.g. Allen and Crago 1996 for Inuktitut; Demuth 1989 for Sesotho). Assuming that children acquiring any language should exhibit roughly the same course of grammatical development, it should not be the case that children acquiring these languages acquire the passive years before those acquiring languages such as English, French, German, and Hebrew do. Ironically, children have been observed to "get worse" in their interpretation of passives over the course of development (Bever 1970; Maratsos 1974), which of course cannot be due to a decline in linguistic knowledge, but may instead be linked to increased grammatical knowledge, knowledge of relative frequency of the active and passive constructions in the input, or processing factors.

Second, children as young as 3 years of age can be primed to produce passive constructions. Bencini and Valian (2008) administered a **Syntactic Priming Task** in which they described drawings of transitive events to children with either active or passive sentences, as in (49), prompting them to **repeat** the sentence.

(49)   a. The wagon is carrying the presents.   (active)
       b. The presents are carried by the wagon.   (passive)

Children were then encouraged to independently describe similar pictures. Children showed no effect of priming with active sentences, but a significant effect of priming with passive sentences—a result to be expected if the default is already to produce active sentences, while the ability to produce passive sentences is nascent but needs additional support to manifest itself. The results therefore indicate that young children are able to form abstract representations of passive constructions (a finding that complements syntactic priming results from Thothathiri and Snedeker 2008 with double-object and prepositional-object dative sentences). (See also Messenger et al. 2012b and Turner and Rommetveit 1967.)

Third, there are semantic factors that facilitate production and comprehension of passive constructions. Maratsos et al. (1985) administered a **Binary Forced-Choice Picture Selection Task** in which they compared sentences such as those in (50), where (a) illustrates a 'physical action passive' and (b) a 'mental verb passive' in which the subject and object are experiencer and 'stimulus', respectively. Children were significantly better with passives such as (a) than those like (b).

(50)   a. Grover is held by Ernie.
        b. Batman is liked by Superman.

This pattern of children performing better with actional passives than mental passives has been replicated across other studies (de Villiers and de Villiers 1985; Fox and Grodzinsky 1998; Messenger et al. 2009; Pinker, Lebeaux, and Frost 1987; Sudhalter and Braine 1985). (Although see Hirsch and Wexler (2004) for English, and Demuth, Moloi, and Machobane (2010) for counterevidence and no effect of the actional/non-actional distinction.) There is, to be sure, an effect of input, in that passives are less frequent than actives in child-directed speech (and speech in general), and that among passives, non-actional passives are not as frequent, a pattern Gordon and Chafetz (1990) found support for in a search of the three Brown (1973) CHILDES transcripts. Children are, however, better at producing passives with verbs they have heard in the passive construction (Gordon and Chafetz 1990; Pinker, LeBeaux, and Frost 1987).

Using a **Binary Forced-Choice Pointing Task** in which children viewed videos of two events unfolding on a computer screen and asked to point to one when presented with a target sentence, Dittmar, Lieven, and Tomasello (2014) found that young children age 2–3 performed better with novel verbs than with familiar verbs (which were not necessarily found in the passive form). Moreover, children as young as 3 who are presented with novel verbs in full passive constructions are able to reproduce them (Tomasello, Brooks, and Stern 1998), providing further evidence that not only does the type of passive construction matter, but the verb itself matters. Children also appear to perform better with passives in which the arguments are animate (Lempert 1990).

Finally, passives can take different forms. Apart from the difference between adjectival and verbal passives discussed in the syntactic literature (e.g., *the artist is **satisfied** with the painting* vs. *the document was **forged** by a counterfeiter*), there are also *get* passives and *be* passives, as shown in (51).

(51)   a. The culprit [got/was] caught.
        b. The little boy [got/was] tagged (by the older boy).

Although previous researchers have found that children may produce *get* passives early (Crain, Thornton, and Murasugi 2009) and may also perform better with *get* passives than with *be* passives (Harris and Flora 1982; Marchman et al. 1991), this is not always the case. In a **Binary Forced-Choice Picture Selection Task** comparing comprehension of *get* and *be* passives in 3- and 4-year-old children, Gotowski (2018) found no

advantage of *get* passives. This difference in findings may point to the power of different methodologies and/or the importance of contextual support for interpretation and production.

6.4 Overt movement in questions and covert movement

In natural languages, two types of movement can be distinguished, based on whether we can detect that movement took place in the surface string: *overt* movement, in which a linguistic object is displaced in the surface structure relative to the position in which it is interpreted, and *covert* movement, in which movement is said to take place at a level of interpretation in which it is not observed on the surface. The first of these two types of movement can be readily observed in questions: subject/auxiliary verb inversion in *yes/no* questions and movement of the *wh*-phrase in *wh*-questions. The second type, which cannot be observed on the surface, comes in two forms: quantifier raising and reconstruction. In all four of these cases, children have been observed to have the requisite mechanisms as part of their grammar, but diverge from adults in noticeable ways. The similarities with and differences from adults with respect to these types of movement are outlined below.

6.4.1 *Yes/no* questions

Yes/no (or "polar") questions in English are typically formed by inverting the subject and the verb heading the matrix VP, as shown in the comparison between the question in (a) and the base declarative form in (b) in (52) below. That the verb is not the *first* verb in the declarative sentence, but is the head of the main clause is illustrated in (53), which features a restrictive relative clause modifying the subject. The auxiliary verb in the relative clause does not move; the auxiliary verb from the main clause does. (Moreover, the verb also does not just move to the front of the sentence. It moves to a position immediately before the subject, as can be illustrated by inserting an adverbial clause at the beginning of the sentences.) Thus, the formation of *yes/no* questions relies upon appealing to the hierarchical syntactic structure, and not linear precedence.

(52)   a. Is the girl playing basketball?
        b. The girl is playing basketball.

(53)   a. Is the girl who can dance playing basketball?
        b. The girl who can dance is playing basketball.

Crain and Nakayama (1987) employed a **Question Elicitation Paradigm** to investigate whether young children generate a structure-dependent or structure-independent

hypothesis about the formation of *yes/no* questions. Children were shown pictures that featured two salient entities, differing in a key property (thereby satisfying the felicity conditions of the use of the relative clause in the subject position, as mentioned earlier). They were instructed to ask a puppet a question about one of the entities. For example, *Ask Jabba if the boy who is watching Mickey Mouse is happy* or *Ask Jabba if the boy is happy can see Mickey Mouse*. Children produced a range of question forms, many of which were indeed ungrammatical, as attested in (54). A number of these questions appeared to involve insertion of a sentence-initial *is* as in (a) and (b), but others veered off course in other ways, implicating tense, as in (c) and (d).

(54)   a.   Is the boy can jump?
       b.   Is the boy who is watching Mickey Mouse is happy?
       c.   Did you did came home?
       d.   What did you got?

Importantly, however, children never simply preposed the first auxiliary verb, leaving a gap in the relative clause. Thus, Crain and Nakayama argued that children adopt a hypothesis about *yes/no* question formation that appeals to the syntactic structure, and not (just) linear order. This argument was later bolstered by Gualmini and Crain (2005) in their investigations of the scope of negation with disjunction. (See also the summary of work on *one* anaphora in the Chapter 5.)

6.4.2   *Wh*-questions

Questions such as those in (55) involve displacement of the *wh*-phrase from its base position—for example, from the subject position (a), the object position (b), or an adjunct position (c). Stromswold's (1995) analysis of 12 CHILDES transcripts revealed that children begin producing their first subject and object questions with *who* and *what* some time between the age of 1;8 and 2;8, with *which* questions following at least a year after the onset of these questions.

(55)   a.   Who is drawing a picture?
       b.   What is the girl drawing?
       c.   Why is the girl drawing a picture?

While children begin producing simple *wh*-questions early, they also demonstrate an ability to access multiple interpretations of biclausal sentences with *wh*-adjunct questions, as in (56). These "short" and "long-distance" interpretations suggest that children (like adults) allow for successive-cyclic movement of the *wh*-phrase from its base position through the structure to the front of the sentence (de Villiers, Roeper, and Vainikka 1990; Weissenborn, Roeper, and de Villiers 1991).

(56)   **When**$_i$ did the boy **say** t$_i$ he **hurt** himself t$_i$?

Such evidence comes from experiments using the **Questions after Story** paradigm.

In this task, children are told a brief story in which two salient events occur at different times and locations. In the corresponding story for (56), for example, the boy hurts himself when falling from a tree earlier in the day, and then recounts the accident in the tub to his parent later in the evening. After the story, the experimenter asks the child the target question, which the child then answers. The child's answer reveals at least one interpretation that is made available by the grammar, ostensibly reflecting grammatical constraints (or not) in the generation of this response. As an illustration of the constraints on movement, children do *not* appear to allow multiple answers to questions such as (57), where the medial *wh-* 'how' question induces a barrier to *wh*-movement. (The relevant position in the syntactic tree is already occupied by a *wh*-word, thereby blocking movement from further down in the structure. The *when wh*-phrase must therefore originate higher than the embedded CP.)

(57)   **When**$_i$ did the boy **say** t_i **how**$_k$ he **hurt** himself $t_{*i/k}$?

Omaki et al. (2014) extended the results beyond the matrix verb of *say* and testing children (and now adults as well) in English and in Japanese/to languages that differ in their word order, as shown in (58).

(58)   a.   Where did Lizzie tell someone that she was gonna catch butterflies?

       b.   Doko-de Yukiko-chan-wa   choucho-o   tsukamaeru-to itteta-no?
            where-at Yukiko-DIM-TOP pro butterfly-ACC catch-COMP   was.telling-
            QUES[1]
            'Where was Yukiko telling someone that she will catch butterflies?'

Omaki et al. (2014) found that English-speaking participants preferred answering the embedded clause question with *say*, but the matrix clause question with *tell someone* or *say to someone*, while Japanese-speaking participants preferred answering the embedded clause question—a difference they attributed to the fact that children actively associate the fronted *wh*-phrase with the first VP in the sentence, indicating that the sentence parser is seeks to complete the filler–gap dependency at the first possible site. The parser encounters the matrix verb (*tell*) first in English, but the embedded verb (*catch*) first in Japanese. The results also show that for both children and adults, the parser is also influenced by properties of the verbs, a finding complementing evidence by Snedeker and Trueswell (2004) in children's incremental processing of syntactically ambiguous garden path sentences.

Not all children's productions and interpretations are adult-like, though. In fact, children have been observed in elicited production tasks to produce *wh*-questions such as those in (59) (Thornton 1995), which English-speaking adults do not produce.

(59)   a.   Which Smurf do you think who has roller skates on?

       b.   Which animal do you think what really says 'woof woof'?

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[1] DIM = diminuitive form; TOP = topic marker; ACC = accusative case; COMP = complementizer; QUES = question marker

Grolla and Lidz (2018) have argued, based on the results of an elicited question production task paired with motor and cognitive inhibition tasks, that the production of such medial questions is not due to an impoverished grammar, but is instead due to the influence of an immature production system, since an increased number of medial questions is more likely to be observed in children with a limited inhibition capacity (as demonstrated when participants are asked to press a key on the opposite side of a keyboard relative to where an image appears on a screen).

However, accessing medial *wh*-questions seems not to be exclusive to production. De Villiers et al. (1990) found that children often answer the medial *who* question in questions such as (60) (i.e. by responding who to help, not how the asking took place).

(60)   How$_i$ did he ask t$_i$ who he should help t$_{*i}$?

To probe if children were simply inclined to answer the last salient question in the sentence, de Villiers and Roeper (1991; 1995) tested children with questions such as those in (61) which included a relative clause that should induce a barrier to *wh*-movement.

(61)   a. How did the man who hurt his leg get home?   (subject relative)

      b. How did the man rescue the cat who broke her leg?   (object relative)

      a. How did the boy drink who sneezed?   (subject relative, *extraposed*)

In the story preceding the sentence in (61c), two brothers went to a circus. A clown tickled one boy's nose with a feather, leading him to accidentally sneeze and blow the clown's wig right off. Afterwards, the boys drank some milk, and the boy who sneezed drank his milk with a straw, while his old brother drank his straight from the carton. Thus, the answer to (61c) should be 'with a straw,' but if children are drawn to answer the last question, they should say, 'the little boy.' Children routinely answered the subject and object relative clauses correctly, demonstrating implicit awareness of barriers to movement. This difference in responses to questions (60) and (61) led de Villiers and Roeper to argue that what children do in the case of the former is licensed by the grammar, and is consistent with partial questions in other languages, such as German. Thus, children must learn to wean away an interpretation that is not licensed in the language they are acquiring, but is part of the cross-linguistic grammatically licensed inventory. Indeed, while children's productions such as those in (59) diverge from adults in English, they are reminiscent of Irish, and are consistent with an approach to *wh*-movement that assumes successive cyclic movement with the *wh*-phrase leaving a trace as it moves through the structure—a trace that may exhibit overt agreement (see also, van Valin, 1998).

An asymmetry between production and comprehension of *wh*-questions is also observed with *why* questions. Very young English-speaking children do not always invert subject–verb word order when producing *why* questions, as illustrated in (62) from Adam (Brown 1973; MacWhinney 2000), even as they invert word order with many other *why* and with other *wh*-questions, and perform *do* support with *why* questions

(see Labov and Labov 1978; Thornton 2004). However, even when children's production of these *why* questions is non-adult-like in the lack of inversion, they are still able to access both interpretations of ambiguous *why* questions such as the one in (63) (Conroy and Lidz 2007).

(62)   a. Why four men are eating it?   (Adam file 48, line 298)
        b. Why you live where I live?   (Adam file 53, line 2389)

(63)   Why did Joe say Monster ate his sandwich?

Questions can also give rise to another kind of ambiguity arising from the interaction of a *wh*-phrase and a quantificational phrase. In the *wh*-questions in (64), a universal quantifier appears in either subject (a) or object (b) position.

(64)   a. [**What/Which toy**] did [**every/each**] **child** pick?   (subject quantifier question)
        b. [**Who/Which child**] picked [**every/each**] **toy**?   (object quantifier question)

The difference in syntactic configuration yields differences in the kind of answer licensed for each question type. In response to either question, one could respond with what is known as a "single answer (i.e. identifying the single token or type of toy that every child picked in (a) or identifying the child in (b)). However, in (64a), there is an additional type of response that is licensed: a pair-list answer. In this case, one could respond by listing for each child what toy they picked.

In a **Question after Story task**, Roeper and de Villiers (1993) demonstrated that children allow pair-list answers for both question types, leading them to conclude that children lacked the structural constraints on movement of the object quantifier questions. However, features of their stories in their Question after Story task and their use of the unmarked *who* in the two questions may have induced children to respond with pair-list answers. A replication by Yamakoshi (2002) using a similar design, and hinted at the subject–object asymmetry predicted by the theoretical literature, but adopted a coding strategy that may have presented an inaccurate picture of the rate of pair-list answers in both question types.

Achimova et al. (2017) therefore incorporated the requisite revised design features into a Question after Story task, including use of *which N* instead of *who*, and ran the experiment both with children and with adults. The type of universal quantifier was also manipulated, in order to see if the distributivity of *each* induced pair-list answers. The results demonstrate that children do have a subject–object asymmetry in the rate of pair-list answers licensed by subject and object quantifier *wh*-questions, but that they are not sensitive to the strong distributivity effects of *each*, a finding also produced across experiments elsewhere. (See Syrett 2015a for discussion.)

6.4.3 Quantifier raising

Universal quantifiers such as *every* have already played a prominent role in topics covered earlier in this chapter, because of what children have to learn about their quantificational meaning and how they interact with other elements in the sentence to yield distinct interpretations. Yet another aspect of their meaning concerns their role in the interpretation of sentences such as (65).

(65)   Anna read **every book that Nathaniel <u>did</u>**.

This sentence means that for every book that Nathaniel read, Anna read that book as well. Thus, the word *did* is a placeholder for a Verb Phrase similar to the one encountered elsewhere in the sentence. It therefore resembles a sentence such as the one in (66), where one simply looks back to the VP antecedent in the first conjunct, and "inserts" this meaning into the site of the missing VP in the second conjunct. By 4 years of age, children are able to interpret instances of VP ellipsis such as this one, and are sensitive to structural constraints on the interpretation of ellipsis (Foley et al. 2003; Matsuo and Duffield 2001; Syrett and Lidz 2011).

(66)   Anna read every book and Nathaniel <u>did</u>, too.

In (65), the situation is a bit more complicated, though, since the site of VP ellipsis is actually contained in the antecedent VP. It is for this reason that the construction is called *Antecedent-Contained Deletion (ACD)*. Consequently, there is no way to fully resolve the interpretation as long as the structure remains as it is. In order for this meaning to be generated, the quantificational phrase in bold must raise to a higher location in the structure, outside of the VP, in a configuration such as the one in (67), thereby allowing the VP to be copied into the site of VP ellipsis (Fiengo and May 1994; Kennedy 1997; Larson and May 1990; May and Keyser 1985).

(67)   Anna [every book that Nathaniel read]$_i$ read t$_i$.

This grammatical mechanism is called *quantifier raising*. Quantifier raising (QR) is claimed to already be necessary for other semantic reasons (in a generative framework), one of which is to allow a quantificational phrase in object position to compose with a transitive verb that takes it as an argument, because there is a semantic type mismatch between the two elements. So apart from generating and interpreting constructions such as (66), children would have to have QR as part of their grammar regardless. Evidence that young children are able to perform the operation of QR comes from a number of **TVJTs** in which children are presented with sentences that require the quantifier-raising operation in order to generate either a grammatical or the intended interpretation, in contexts that favor another interpretation (Gor and Syrett 2015; Kiguchi and Thornton 2004; Lidz et al. 2004; Syrett and Lidz 2009; 2011; Syrett 2015b; 2015c).

Lidz et al. (2004) presented participants with sentences such as those in (68), where the quantificational phrase was either in subject position (a) or object position (b).

(68)   a. **Every dancer$_i$** kissed Kermit before **she$_{i/k}$** went on stage.

b. Kermit kissed **every dancer$_i$** before **she$_{i/k}$** went on stage.

In each supporting context, there were three dancers, and another salient female, a singer. When the quantifier is in subject position, as in (68a), it can bind the variable in the *before* clause, because the subject is in a higher position than this VP adjunct, or it can allow it to be free and be associated with an external antecedent, thereby making the sentence ambiguous. When the quantifier is in object position, as in (68b), the VP adjunct is in a higher position than the quantificational phrase, and so one might assume that the quantifier cannot bind the variable. Indeed, it cannot from this position, but it can once the quantificational phrase undergoes QR to a position that is higher than the VP adjunct. From this position, binding is therefore possible. Lidz et al. (2004) showed that both children and adults access both interpretations of both sentences, presumably indicating that children have QR as a part of their grammar.

Perhaps more convincing evidence (which does not rely on acceptance of the target statement, and a confound of a potential Yes response bias) comes from studies investigating ACD constructions, as in (65). Syrett and Lidz (2009) reasoned that if young children do not have the QR operation in their grammar, then when faced with an ACD sentence, they will have to arrive at some way of interpreting it. Notice that in (69), there is a relative clause attached to the direct object as part of the quantificational phrase. The previous research on relative clauses indicated that when children cannot interpret a restrictive relative clause (for whatever reason), they opt for a representation that is part of their grammatical repertoire: coordinated conjunction. Thus, Syrett and Lidz compared participants' performance with ACD sentences like (69) to coordinated conjunction sentences like (70) in contexts that made the first true and the second false, and contexts that had the opposite truth values (because, for example, there was no overlap in the race cars that were driven). Children showed very different acceptance rates for the two constructions, in a way that aligned with the adult grammar.

(69)   Lady Bug drove every race car that Mister Bug did.   ACD

(70)   Lady Bug drove every race car, and Mister Bug did, too. Conjunction

Further evidence of the QR operation as part of the child's grammar comes from their interpretation of ACD constructions that involve pronominal reference and the binding principles. Kiguchi and Thornton (2004) presented participants with sentences like those in (71) in contexts that falsified the interpretation generated by QR and evaluated how the pronoun was construed.

(71)   a. Darth Vader found her$_{*i/k}$ the same kind of treasure that the Mermaid$_i$ did.

b. Dora gave him$_{i/k}$ the same color paint the Smurf$_i$'s father did.

c. He$_{*i/k}$ jumped over every fence that Kermit$_i$ tried to.

Participants were observed to reject coreference in (71a), but that could have been either because of a Principle C violation on the surface (since the pronoun c-commands the

R-expression) or a Principle B violation after QR (since then the R-expression would c-command the pronoun).

However, participants allowed coconstrual in the (b) sentences, even with the pronoun c-commanding the R-expression (which can be illustrated by substituting in *every boy* and *his* in place of the two expressions, allowing for a binding relation), thereby indicating that the phrase *the same color paint…* must QR to a position higher than the pronoun. And since the R-expression is in the possessive position of the DP, it cannot c-command the pronoun, allowing for the pronoun to be free in its domain. Assuming the quantification phrase QRs to a higher position, sentences like the one in (c) illustrate that the landing site is still lower than the subject position (e.g. *v*P), since QR does not salvage coconstrual here (Fox 1995; Merchant 2000).

Syrett and Lidz (2011) provided evidence that children are not restricted to only one possible landing site by demonstrating that they can access multiple readings of the ambiguous subject (a) and object (b) control structures that feature embedded non-finite clauses in (72). In order to access the embedded reading, the quantificational phrase must at least QR out of the innermost VP (*drive…*, *read…*), and in order to access the matrix reading, it must QR past the outermost VP (*want…*, *ask…*).

(72)   a. Miss Piggy wanted to drive every car that Kermit did.
       b. Clifford asked Goofy to read every book that Scooby did.

Even more striking is the fact that children can access multiple readings of sentences such as those in (73), which feature a finite embedded clause, providing clear justifications for both the embedded and matrix readings, and accessing each even when it is disfavored by the experimental context (Syrett and Lidz 2011; Syrett 2015c).

(73)   a. Fozzie said that Miss Piggy drove every car that Kermit did.
       b. Clifford said that Goofy read every book that Scooby did.

The availability of the matrix reading clearly indicates that children are QRing out of a tensed embedded clause.

This finding may be surprising in a framework where it assumed that tense is a barrier to movement. However, experimental manipulations reveal that for some adults, too, the matrix reading is robust under the right discourse conditions and when processing load is alleviated. For example, many adult participants access the matrix reading of sentences such as the one in (74), where the embedded subject is a pronoun and there is no overt complementizer (although this manipulation appears not to be necessary) (Syrett 2015c). What's more, having QRed out of the matrix VP, some adults even allow the quantificational phrase to QR past the sentential subject to an extra-wide scope position, when this interpretation is supported by the context (Syrett 2015b).

(74)   Woody$_i$ said he$_i$ jumped over every frog that Jessie did.

(75)   Someone said that he could jump over every frog that Jessie did.

Thus, in the case of ACD sentences, experimental judgment data from children help to shed light on the nature of grammatical mechanisms, even in adults.

6.4.4 Reconstruction

Not only do certain phrases raise covertly in the structure for reasons such as to resolve type mismatch or to generate other readings, but some phrases covertly reconstruct into their original position in order to be interpreted. Such is the case with sentences such as the one in (76).

The target sentence is in (76a). This sentence cannot be assigned the reading that every pirate put a gun into his own barrel. The reason is that the Prepositional Phrase must first be reconstructed into its base position, as shown in (76b). Then the quantificational phrase moves covertly, generating the configuration in (76c). In this configuration, the pronoun c-commands the trace of the moved element, the intended antecedent, barring coreference. (Even if one considers that there is no reconstruction, and that the moved PP in (76a) leaves a copy in the base position, there is still a Principle C violation between the pronoun and its intended antecedent.)

(76)   a. In the barrel of every pirate, he put a gun.

   b. base position:
       He put a gun in the barrel of every pirate.

   c. Position of quantificational phrase after QR:
       [every pirate]$_i$ he put a gun in the barrel of t$_i$

Children in a TVJT conducted by Guasti and Chierchia (1999/2000) consistently rejected coreference in such sentences, presumably indicating that they were able to reconstruct the prepositional phrase. By contrast, they consistently accepted both anaphoric and exophoric readings of ambiguous sentences such as (77). Adults behaved similarly.

(77)   The monkeys hid the treasure of each child while he was sleeping.

The operation of reconstruction has been observed to behave differently for different types of configurations. For sentences with moved predicates, such as (78), reconstruction appears to be obligatory, as shown in the different indexing patterns between (78a) and (78b).

(78)   a. Bill$_i$ knew how proud of himself$_{*i/k}$ John$_k$ was __.

   b. Bill$_i$ knew how proud of John$_k$ he$_{i/*k}$ was __.

However, for objects, which are arguments of the verb, reconstruction appears to apply differentially, depending on whether Principle A or Principle C is relevant, as illustrated in the sentences in (79). Reconstruction seems to be optional for Principle A, allowing for either coreference pattern in (79a), but it is obligatory for Principle C, as it is with predicates, allowing for only one coreference pattern in (79b).

(79)   a. Bill$_i$ knew which picture of himself$_{i/k}$ John$_k$ liked __.

   b. Bill$_i$ knew which picture of John$_k$ he$_{i/*k}$ liked __.

In a TVJT task that also incorporated a **Questions after Stories** element, Leddon and Lidz (2005) and Leddon (2007) tested children on sentences where reconstruction

was obligatory, as in (80) and (81). These were variations of the declarative statements in their TVJT described earlier. After some trials, the children were asked a question. Before the question, the experimenter listed the characters in the story, with the syntactically disfavored antecedent listed last, in order to be boosted in salience.

(80) a. Which painting of [Miss Cruella$_i$/herself] did she$_{*i/k}$ put up ___?

     b. How proud of [Miss Cow$_i$/herself] was she$_{*i/k}$ __?

(81) a. Which painting of her$_{*i/k}$ did every dancer$_i$ put up ___?

     b. How proud of her$_{*i/k}$ was every hippo$_i$ __?

In questions with *herself*, as in (80), children (and adults) consistently responded in a way that reflected a bound interpretation of reflexive. However, in questions with the pronoun, as in (81), the results were less crisp. Adults consistently responded in a way that reflected reconstruction, forcing the pronoun to be interpreted exophorically. Children responded in this way with the argument questions (as in (81a)), but not with the predicate questions (as in (81b)). With the latter, they patterned at chance level. (See Chapter 2 of Leddon 2007 for further discussion.)

However, in a variation of the task with target sentences featuring a quantified subject and reflexives that should be bound or pronouns that should be interpreted freely (as in (82)), children patterned in a manner more consistent with what would be predicted by reconstruction and Principles A and B, accessing the bound interpretation of the reflexive the vast majority of the time and only accessing the bound interpretation of the pronoun a small percent of the time. Adults demonstrated the same pattern, only more pronounced.

(82) a. How confident in [himself$_{i/*k}$ /him$_{*i/k}$] was every whale$_i$ __?

Combined, these results underscore the importance of investigating a range of lexical elements within a target construction, the role of experimental methodology, and the variability in grammatical knowledge manifested both within and across tasks, which may be tied to grammatical knowledge or other factors.

6.5 CONCLUSIONS

In this chapter, I have reviewed a variety of syntactic phenomena, ranging from individual words and their syntactic constraints, to individual syntactic constructions, to grammatical mechanisms that require movement in the syntactic structure. Throughout the summary of these phenomena, I hope to have illustrated a number of key points. I emphasize three here.

First, the researcher interested in investigating syntactic knowledge and development in young children has a number of tried and true methodologies and paradigms at their fingertips. The choice of methodology/-ies can have enormous implications for

the conclusions one makes about a child's grammar and the role of extragrammatical factors, so complementing multiple methods may yield the most success. The choice of methodology is always conditioned by the phenomenon under investigation, the tools and participants available, and the research question being asked.

Second, syntax does not work alone. Many of the studies reviewed have showcased the tight connection between syntax, semantics, and pragmatics. It is therefore highly desirable to be attentive to, and to incorporate into the experimental design, satisfaction of felicity conditions and features of the discourse, such as common ground between the speaker and hearer and knowledge of what is presupposed. In addition, lessening the cognitive load and facilitating sentence processing may help to bring out certain readings that were thought not to exist. At the same time, the availability of certain readings may be an outcome of the incremental processing of a target sentence.

Third, the young child between 3 and 6 years of age displays an impressive repertoire of syntactic knowledge. Where this competence appears to diverge from that of adults, additional (creative) experimentation has often called into question the contribution of an immature grammar, and revealed the role of factors outside of the syntax. Children's errors in production and interpretation are not only amusing, but are also especially informative of their developing knowledge. However, they cannot always be taken at face value. Future research should home in on those cases where children consistently access non-adult-like interpretations, and should determine the source of these aberrations. The answers to these questions will reveal the degree of continuity in language development, shed light on the nature of the errors observed in adults and neuroatypical populations, and inform us about the viability of claims emanating from syntactic theory.

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