Valian, V. (2016). When children don't say what they know: Syntax acquisition and executive function. In D. Barner & A.S. Baron (Eds.), *Core knowledge and conceptual change* (Chapter 15, pp 261--276). Oxford, UK: Oxford University Press.

15

When Children Don't Say What They Know

SYNTAX ACQUISITION AND EXECUTIVE FUNCTION

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INTRODUCTION

"Want lollipop."

What does a 2-year-old who says "Want lollipop" know about the syntax of English? She has failed to include a determiner for "lollipop"—presumably "a." She has failed to include a subject—presumably "I." She has produced an active sentence rather than a passive ("lollipop is wanted"). Does she lack the determiner category? Does she not realize that English requires subjects for declaratives (unlike imperatives)? Is her grammar missing the rules that would produce a passive?

I will use three case studies—determiners, subjects, and the active–passive relation—to argue that children's syntactic knowledge is greater than it appears to be on the surface. Even when most of children's speech consists of two-word utterances, I suggest, their grammars already contain genuinely syntactic categories, plus operations that combine and move those categories in ways that are isomorphic with the adult grammar. A countervailing view is that, early in acquisition, children's syntax consists only of a few basic procedures for putting words together; only later, perhaps around age 5, do children have something approaching formal syntax (as, e.g., Ambridge & Lieven, 2011, propose).

Here is why it is important to choose between those two interpretations of 2-year-olds' limited output: If children's grammars are abstract and formal from the beginning of combinatorial speech, as I propose, that puts constraints on the possible mechanisms by which children can acquire language and carries implications for what is innate in

language. Early abstractness lends credibility to the idea that basic features of syntax are innate. If basic syntax is not innate, there must be very powerful learning mechanisms that can provide abstract representations at a very early age.

Most of children's early errors are errors of omission rather than commission. Children's utterances are short and spare, fitting Roger Brown's (1973) description of them as telegraphic speech. But just as the telegram sender or memo jotter has a richer grammar than is apparent from their written words, so, too, I will argue, does the child. The *reductio* of my position is that the 2-year-old knows everything, and that is clearly false!

My proposal is that there are two things that the child doesn't know. One part concerns content: 2-year-olds don't know syntactic details, such as the fact that *a* can only be used with singular count nouns. There may be more basic aspects of syntax that the child does not represent, but I suggest that it is surprisingly difficult to find any. The other part concerns process: The 2-year-old speaker has difficulty coordinating all the different processes required to talk fluently and in full sentences; he or she is not well-practiced at the executive functions that speaking and listening require. Although executive functions with respect to language have been discussed primarily in terms of bilingual processing (for review, see Valian, 2015), they are also involved in monolingual processing. Executive functions are discussed later in more depth, but in language they at least include planning, working memory, and integrating. Executive functions develop over childhood and adolescence at different rates, though 2- and 3-year-olds have been studied less than older children (Davidson, Amso, Anderson, & Diamond, 2006; Huizinga, Dolan, & van der Molen, 2006).

On the view presented here, even very young children's grammars are continuous with those of adults (Pinker, 1984). When language acquisition theorists speak of *continuity*, they mean that the categories and syntactic structures that the child has are commensurate with, though not necessarily identical to, the adult's. In the case of categories, the lack of identity would be due to the skeletal nature of children's categories. Children's categories are not specialized for any particular language. A skeleton for the determiner category is that determiners take nouns (or noun phrases) as their complement. Syntactically, that is all there is to know about determiners. Adults, unlike children, not only have the skeleton but, for each language they know, have flesh on the skeleton. Adults know the identity of the determiners in their language; they know the restrictions on the use of each of them, such as that *a* can only precede singular count nouns, while *the* can precede any common noun; they know that in some cases it is appropriate to say "a" and in other cases it is appropriate to say "the"; they know that sometimes it is not appropriate to use a determiner (as in "form is easy; meaning is hard" (Naigles, 2002); they know how to pronounce *a* and *the*, and they know how to incorporate *a* or *the* with a following word to fit the prosodic structure of English. Adults also know that some words—those with low information value—can acceptably be omitted if time is at a premium. Determiners frequently convey little information and may be absent in adults' memos and texts. Children

have to learn all of that piece by piece. What they do not have to learn is that determiners form a constituent with noun phrases.[1]

With respect to process, children confront the problem of coordinating and integrating the different aspects of speaking and listening. *Executive function* is a cover term to refer to such higher-level cognitive organization (see Miyake & Friedman, 2012, for more detail). At a minimum, speaker–listeners integrate phonology, prosody, syntax, semantics, and pragmatics—both within an utterance and across utterances. Speaking, in particular, requires planning, coordinating, and updating in order to formulate and produce a message. Speakers take into account the prior discourse, the context, and the audience. Speakers choose lexical items; they put those items together according to the syntax of their language; they provide a prosody for the utterance; they pronounce each lexical item according to the phonology of the target language; they choose among alternate ways of conveying their message; they keep track of where they are; and so on. When talking to others in a conversation, speakers must take turns with the other participants, coordinate their gestures with their speech, and switch back and forth between talking and listening. They revise each of those procedures as necessary.

As effortless experts in our native language, it is difficult for us to notice how profound the complexity of speaking and listening is, but any adult who is learning a new language acutely experiences the difficulty of coordinating the different levels of language. Anyone who has given a talk when very nervous knows that emotional states can interfere with a process as automatic as inhaling in synchrony with natural prosodic boundaries. Even in the normal course of talking, competent speakers can get lost as they are producing an utterance, ending up in a place they had not intended. Or speakers can realize that their initial syntactic choices will not work out because they have not thought far enough ahead. Consider the non-sentence, "There are a lot of things that I don't know why I do them." Once one has chosen "There are a lot of things," one has difficulty finding a grammatical way out. Speaking and listening are skilled, integrative activities that require practice. By underestimating what is involved in competent, fluent speech, one can misattribute the sources of a child's limited output to lack of syntactic knowledge instead of limited executive functions.[2]

In addition to overt categories, grammars also contain "invisible" categories, such as elements that are like pronouns but are not pronounced, the so-called null subjects in languages like Italian, where overt subjects are not required for full grammaticality. One cannot grammatically say "eat pasta" as a declarative without a pronominal subject, while it is completely grammatical and even preferable to say "mangio pasta" in Italian. In order to prevent "wild" grammars, with empty categories run rampant, there are restrictions on what the unspoken elements in a language can be. Children may have the stock of those empty categories, without knowing which ones are instantiated in their target grammar. What children learn is the particular combination of features in the target language that do or do not license empty categories. With respect to categories, then, continuity implies that adult categories are lineal descendants of children's

skeletal categories; they are not different in kind, only in detail. If continuity is correct with respect to categories, the skeleton is there; it remains only to put the flesh of detail on it.[3]

Languages are not composed only of categories but also of operations[4] (sometimes called rules) that move elements from one position to another under specified conditions. For example, movement takes place in passive sentences in English. In a sentence like, "The hammer is cracking the egg," the hammer is both the subject of the sentence and the agent or instrument of the action of cracking. The egg is the direct object of the verb and the object of the action. In the passive form, "The egg was cracked by the hammer," the hammer and the egg have the same semantic (or thematic) roles as in the active but they have different syntactic roles. The same semantic role can be present in different syntactic positions. A competent speaker knows that syntactic roles and semantic roles can be flexibly related to each other and knows the operations that effect that flexible relation. A competent speaker also understands the role of morphology in English in signaling a passive—*be* + *en*/*ed*, optionally followed by a *by*-phrase.

In what follows, I will discuss three examples of children's early syntactic development: determiners, null subjects, and passives and actives. In each case, I will suggest that the child is continuous with the adult. The differences between the child and the adult do not involve syntax, even though the differences seem to be manifested syntactically. When English-speaking children aged 2 or 3 say things like, "Want lollipop," instead of "I want a lollipop," it is not because they lack the determiner category, or do not understand that their language requires subjects for declaratives, or have no mental representation for passives, but because there are extrasyntactic limitations that are responsible for the child's restricted output. For any aspect of syntax, my approach is to see how far we can get by simultaneously a) establishing *diagnostic tests* that the child should pass if the child represents the basic syntax correctly and b) determining the *nonsyntactic limitations* that could explain the child's non-target output. If both conditions are satisfied, we can conclude that the child's syntax contains the aspect in question. This should be a fruitful research strategy because it provides for explicit tests of knowledge limitations and use limitations. For determiners, subjects, and the passive, I examine how well that strategy works.

The fundamental idea is that the child is in a dilemma: She has the syntactic knowledge in question, but only limited executive functions. She cannot plan, maintain working memory, and integrate the different components of speaking and listening as well as a mature speaker can. Something has to give; the child has to cut corners. The child can use at least two methods to figure out what not to include in her utterances. She can use information structure and exclude low-information elements, such as determiners that are not essential for meaning. She can use already established prosodic structures to fit her utterance to, resulting in a failure to include elements that do not fit the prosodic template, such as initial pronominal subjects.

DETERMINERS

Children's use of determiners (words like *a, the*, demonstratives, possessive pronouns, and the like) has received extensive attention from researchers, from infancy through age 3. It is the most-studied syntactic category, which may seem surprising: Determiners lack the referential richness of nouns and verbs. What are the *diagnostic tests* that indicate that 2-year-olds (and younger children) have an abstract category of determiners? First, 2-year-olds show rule-based diversity in their use of determiners. For example, they use *a* and *the* jointly with a variety of nouns, neither restricting nor applying their determiners to any semantic or arbitrary class (Meylan, Frank, & Levy, 2013; Valian 2009, 2013, 2014; Valian, Solt, & Stewart, 2009; Yang, 2013; Yang, Wadsworth, & Valian, 2014).[5] This suggests that *a* and *the* are in a syntactic equivalence class for children: They are items that take noun phrases as their complement. Even stronger evidence for an equivalence class is the fact that 2-year-olds use all the determiners they know, not just *a* and *the*, but also *this, another*, and other determiners, with a wide range of nouns (Valian et al., 2009). Children's diversity of use is what we would predict if children are fully productive (Yang, 2013).

Second, 14-month-olds pass a different test of equivalence. Fourteen-month-olds generalize from the pairing of a known determiner with a nonce noun to other determiners with that newly acquired noun, but do not generalize to phonetically similar nonce words that have been paired with pronouns (Shi & Melançon, 2010). Thus, infants acquiring French know that if the determiner *le* appears before the made-up word *crale*, the determiner *ton*, but not the pronoun *tu*, can also appear before it, even though they have never heard *ton* with *crale*. In a head-turning procedure, children trained on *le crale* look differentially when presented with *ton crale* and *tu crale*, showing that *le* and *ton* are members of a class, but *ton* and *tu* are not.

Third, children around age 2 use filler syllables to substitute for a range of determiners—in European French (Veneziano & Sinclair, 2000), Canadian French (Tremblay, 2005), and Italian (Bottari, Cipriani, & Chilosi, 1993/1994). Children's ability to substitute a single filler syllable for more than one determiner demonstrates that they have an equivalence class of determiners.

If children indeed have an abstract notion of determiners, we must figure out why they markedly underuse determiners before nouns. Executive functions are relevant because children must first look up the appropriate words in their lexicon and then integrate their meanings. For children, that task appears to require controlled, rather than automatic, processing. The contrast in infants' behavior when they hear utterances with a correct determiner, no determiner, or an incorrect word substituting for a determiner provides relevant evidence (Gerken & McIntosh, 1993; Kedar, Casasola, & Lust, 2006; Zangl & Fernald, 2007). Consider in particular the experiments by Zangl and Fernald (2007) with children aged 18 months, 28 months, and 36 months. The differences in how the children in different age groups performed suggest an increasing mastery of the cognitive processes required simply to match a noun with a picture and show how executive functions interact with language structure.

Children heard utterances with eight familiar nouns (such as *doggy* and *ball*). Each target word was used three times, once with an actual determiner (such as *the*), once with a made-up determiner (such as *ko*, chosen to be determiner-like), and once with no determiner. For example, the child would hear "Look at the doggy," "Look at ko doggy," and "Look at doggy." The experimenters measured how quickly and how long the child looked at the correct pictorial match for the noun when shown two simultaneously displayed pictures.

The 18-month-olds were slower overall to orient to the correct picture than were the 24- or 36-month-olds, a finding suggesting less skill at word identification. The 18-month-olds oriented more quickly and looked longer when a legitimate determiner or no determiner was used than when a nonce determiner was used. Thus, 18-month-olds are thrown off by hearing an unfamiliar determiner before a noun but recognize a noun as quickly whether it is or is not preceded by a genuine determiner.[6] Like 18-month-olds, 24-month-olds oriented most quickly and looked longest when a genuine determiner or no determiner was used, compared to the nonce condition. But the later part of the looking period showed longer looking when a nonce determiner was used. That pattern might suggest that 24-month-olds are not only more adept at noun identification than 18-month-olds but also slightly puzzled by the presence of an unknown morpheme before a noun.[7]

The 36-month-olds oriented more quickly than both younger groups, showing greater skill at word identification overall. Beyond that, these children, unlike the younger groups, were completely indifferent to the determiner condition. They oriented equally quickly and looked equally long to the correct noun no matter what preceded it—a correct determiner, a nonce determiner, or nothing. The 3-year-olds' look-up procedure for the very familiar nouns that were used in the study was so well practiced—so close to automatic—that a real determiner led to no advantage. The 3-year-olds did not need the cue that a real determiner provided.[8]

To test whether highly practiced word identification was responsible for the 36-month-olds' behavior, Zangl and Fernald (2007) gave another group of 3-year-olds the same task but with nouns the children had never encountered before. Novel nouns were paired with pictures of novel objects. If children are faced with nouns they have only recently learned, the value of a real determiner over a nonce determiner should assert itself, even if the children are skilled at lexical look-up with known words. Using new nouns should increase the task demands so that controlled, rather than automatic, processing would be required.

After the children had learned the new noun–picture pairings to criterion, they then participated in a looking task that used a real determiner or a nonce determiner before a familiar noun (*shoe* or *car*) or a new noun (*dax* or *kreeb*). As would be expected, children were faster to orient to familiar nouns and to real determiners. In addition, however, in this context where children had to handle both familiar and new nouns, the nonce determiner led to slower identification even for familiar nouns. The entire identification procedure went from being automatic to controlled. Under controlled processing, the 36-month-olds were now more like 18-month-olds, thrown off by a nonce determiner that

other 36-month-olds, who had only faced familiar nouns, were unfazed by. Even a task as seemingly undemanding as pairing a noun with a picture requires executive functions.

Similar results come from a study that compared the first looks of English-speaking 18- and 24-month-olds, depending on whether the child heard a real English determiner, no determiner, a small nonreferential (function) word (*and*), or a real Spanish determiner before the noun (Kedar et al., 2006). Eighteen-month-olds were equally likely to have a correct first look to the target whether they heard a real English determiner or no determiner, compared to hearing the wrong function word or the Spanish determiner. Two-year-olds were more accurate overall than 18-month-olds, and were most accurate with the real English determiner. Here we see that 2-year-olds have better processing skills—better ability to identify a target under optimal conditions with a real determiner and a familiar noun—than 18-month-olds have.

The tasks used in both experiments (Kedar et al., 2006; Zangl & Fernald, 2007) required the child to integrate disparate pieces of information: They needed to look up the words from the utterance and match the abstract representation of the meaning with one of the two pictures they were presented with. That is what made the task a (minimal) executive function task. Not surprisingly, older children could perform the needed executive functions better than younger children could, as seen by how quickly they oriented to the correct picture. Grammar also seems to have played a role, in that a real determiner was a better cue for a newly learned noun than a nonce determiner. These two studies are evidence that, for young children, a seemingly simple task requires controlled processing and is helped or hindered by noun and determiner familiarity.

If children are in fact limited in their ability to coordinate the different processes involved in speaking and listening, longer or more complex messages should have a bearing on inclusion of elements. Inessential words and morphemes should be dropped. In line with that expectation, third-person singular *-s* is less likely to be included by 3-year-olds in five-word sentences than in three-word sentences, particularly if the verb occurs medially rather than sentence-finally (Mealings & Demuth, 2014).[9]

Vocabulary limitations are also relevant. Two-year-olds' determiner vocabulary is considerably more impoverished than their parents'. Two-year-olds from the Valian corpus (21 children ranging in mean length of utterance (MLU) from 1.53 morphemes to over 4 morphemes in spontaneous conversation with their parents) have between 5 and 21 determiner types; their parents use 19 to 28 types. The lower the child's MLU, the fewer determiner types he or she knows. This is an extra-syntactic limitation with consequences. The size of children's determiner vocabulary predicts how often children use determiners ($r = .80$). Even for adults, the size of their determiner vocabulry moderately predicts their frequency of use ($r = .48$). If the child has a determiner "concept" for which she does not have a word, using no determiner is one likely result.

Finally, limited executive functions should push the child to rely on prosodic templates. English prosodic feet tend to be mono- or disyllabic. Disyllabic feet tend to have a trochaic stress pattern: A stressed or strong syllable is followed by an unstressed or weak

syllable. "See me after lunch" is an imperative with three feet: *see me, after*, and *lunch*. The word *lunch* is a strong syllable that can appear on its own. Weak syllables in English tend not to appear alone and tend not to appear as part of an iambic foot, where the stress is on the second syllable. The imperative "Get a life," for example, has two feet, *get a*, and *life*. If the language were iambic, the feet would be *get* and *a life*. Children are more likely to include a determiner if it can be pronounced as part of a disyllabic trochaic foot than if it is unfooted (Demuth & McCullough, 2009). Compare "it's a bag" with "he's kicking a dog." The first sentence has two feet, where *a* is the second weak syllable of a foot with the stress on the first syllable. In the second sentence, *a* is prosodically stranded because *kicking* is already a two-syllable trochee. Children are more likely to produce a determiner in the first type of sentence than the second type. Cross-linguistically, the age at which children begin producing determiners varies in part as a function of cross-linguistic differences in the phonological properties of determiners (see Demuth, 2014, for a summary of the relevant data).

To summarize, when using the two-part strategy described earlier, we find that a) children pass diagnostic tests for the determiner category and b) children show that their executive functions are less efficient and that their determiner vocabulary is deficient. Thus, although children fail to include determiners in all the contexts in which they are required, that failure is not a syntactic failure. The data support the hypothesis that children's grammars are continuous with adults'.

NULL SUBJECTS

Recall that some languages, like English, require overt subjects for full grammaticality, while others, like Italian, do not. How best to understand the linguistic properties that determine whether and when overt subjects are required is still a matter of inquiry (for discussion, see Biberauer, Holmberg, Roberts, & Sheehan, 2010; Camacho, 2013; Kučerová, 2014). That makes it difficult to hypothesize the specific formal syntactic properties that children should represent early in development. The properties will be part of the inflectional and agreement system, but the specifics are not clear. To learn whether English requires subjects, or to learn that Italian does not, the child must represent features having to do with tense and agreement. To the extent that children seem to know the status of subjects in their language at an early age, we can infer that they represent the features that determine that status. In this approach, the existence of overt (and null) subjects in different contexts is a byproduct of more fundamental features of language. Neither languages like English, that require subjects, nor languages like Italian, that do not, are the default. (See Valian, 1990, 1993, for other reasons that there should be no default with respect to null subjects.)

One diagnostic test for those features should be an early cross-linguistic difference in the extent to which children use subjects. For example, English-speaking children should

use subjects more than do Italian- or Portuguese-speaking children. And they do (Valian, 1991; Valian & Eisenberg, 1996). In addition, to the extent that 2-year-olds produce embedded clauses, where subjects are absolutely required in English for both grammaticality and acceptability, children supply subjects for them (Valian, 1991). And on the rare occasions that expletive subjects, which exist only in languages like English, are required, children produce them (e.g., the *it* of "it's raining"; Valian 1991).[10]

Evidence for immature executive function is extensive (see Chevalier, 2015, and Valian, 2016, for review). First, children in all languages include subjects less often than adults do and increase their use as they develop (Valian, 2016). That is so even if the child's language, like Italian and Chinese, does not require subjects for full grammaticality. If what is causing a lower rate of subject production in children is a lesser ability to perform the executive functions necessary for fluent speech, rather than an absence of the formal properties that determine the type and distribution of subjects, then all children, no matter what language they speak, should include subjects less often than adults do.

Second, as with the third-person singular *-s* that we reviewed earlier, we should expect length effects. Children should use fewer subjects in long sentences than in short ones. That is also the case, both in spontaneous production (Valian, 1991) and in imitation (Valian, Hoeffner, & Aubry, 1996).

Third, we should expect that giving a child a second opportunity to imitate a sentence will increase the child's inclusion of subjects. On the second time around, the child will already have performed a lexical look-up and will have established an overall meaning for the sentence, leaving more resources available for repeating the subject. Children do repeat subjects more frequently on their second imitation than on their first (Valian & Aubry, 2005).

Fourth, an interaction of extrasyntactic factors and executive function is evident from the fact that 2-year-olds are more likely to imitate a subject if the direct object is highly predictable from the verb's semantics than if it is less predictable (e.g., "the cat is eating some food" vs. "the cat is eating a sock"). The same is true for the verb and the direct object itself. Highly predictable direct objects require fewer conceptual resources than do less predictable direct objects (Valian, Prasada, & Scarpa, 2006).

Fifth, children can accommodate their limited executive function by taking advantage of information structure. Subjects, particularly subjects that a speaker can suppose the listener is aware of through prior discourse or joint attention, are often unnecessary for full intelligibility. Thus, the child should be particularly likely to leave subjects out when they contribute little information value. In Inuktitut, a language that does not require subjects, children aged 2 to 3½ are more likely to include a subject when it refers to an entity new to the discourse than to an old referent (Allen, 2000). In addition, such children are more likely to include a subject for a new referent if they and their conversational partner are not jointly looking at an object, demonstrating conversational sophistication (Skarabela, Allen, & Scott-Phillips, 2013). English-speaking children imitate expletive subjects (such as the *it* in "it's hot outside") less often than they imitate referring pronominal subjects,

and in turn imitate pronominal subjects less often than they imitate full lexical subjects (Valian & Aubry, 2005; Valian, Hoeffner, & Aubry, 1996). Expletive subjects, which do not exist in most null-subject languages, are a paradigm case of an element that is not informationally necessary; in contrast to referential pronouns or nouns, they carry no semantic or conceptual information at all. Children do imitate expletives, but less often than they imitate words with more content.

The availability of a prosodic template also plays a role in the likelihood that a child will include a subject, as was the case for determiners. Children produce fewer pronominal subjects in contexts where they do not fit the trochaic prosodic template of English (Demuth, 1994; Gerken, 1991, 1994). Pronouns are typically unstressed. If they are the first word of a sentence they are prosodically stranded and less likely to be pronounced.

To summarize, when using the two-part strategy, we find a) evidence that children know whether their language requires subjects and b) ample evidence that limited executive function and extrasyntactic factors play a role in children's imperfect inclusion of subjects. The data support the continuity hypothesis.

THE PASSIVE

Passives may be full (e.g., "the rabbit was chased by the goose") or truncated (e.g., "the rabbit was chased"). Neither English-speaking children nor adults produce sentences in the passive very often (unless they are adult academics). A sample of spontaneous speech from 12 four-year-olds found no full passives (Huttenlocher, Vasilyeva, & Shimpi, 2004). The proportion of full passives in the four-million word corpus of adult spoken British English is only .000007 (Aston & Brunard, 1998). The rate in adult speech to children is .00005—slightly higher but still very infrequent (Gordon & Chafetz, 1991). On the other hand, in Sesotho, where the passive is frequently used by adults, it is present in children's speech before age 3 (Demuth, 1989).

Is the absence of full passives in English-speaking children's speech due to their having no mental representation for the structure or due to the fact that the structure is rare altogether? Priming experiments are one way to answer that question. In a priming task with children, the child hears a priming sentence (or sentences) that describes a picture, then sees a new picture, the target, and is asked to describe it. In abstract priming, there is no overlap between the lexical items in the priming sentence and those that would most naturally be used to describe the target. The extent to which the child's description of the target uses the same syntactic structure as the priming sentence is a measure of priming. Such a priming experiment requires executive control, or the integration of several cognitive processes. The child has to understand the priming sentence, understand the picture the sentence is describing, and recognize the sentence as a description of the picture the child is seeing. When the child sees a new picture, she has to understand that her job is to describe that picture. She has to "read" the picture—that is, figure out what is going

on in the picture. She has to associate the key features of the picture with stored lexical items. The child has to put those lexical items into sentential form. She has to produce the sentence.

Priming experiments make assumptions about the participant. One is that—*ceteris paribus*—speakers will prefer to reuse a recently heard syntactic structure over composing a new one, because a reuse requires fewer cognitive resources. Things are not, however, always equal. An infrequent structure, like the passive, will be dispreferred exactly because it is less frequent and therefore requires more cognitive resources to produce than a structure the participant uses frequently and is very familiar with. Priming of infrequent structures thus has to contend with the general dominance of frequent structures. Another assumption is that speakers have to *have* a mental representation of the structure in question in order to reuse it. If a speaker does not understand the structure of a passive, the person will not be able to reuse that structure to describe a new picture that has different elements than those used in the first picture. A third assumption is that the participant knows the meanings of all the words in the priming sentence and has the vocabulary necessary to describe the target picture.

From the point of view of a highly practiced adult speaker, the task is transparent and easy. From the point of view of a 3-year-old, however, the task is neither transparent nor easy. Lexical look-up—associating the meaning of the lexical items with key features of the picture—is itself a challenging process. Producing a description of a new picture is challenging. Integrating the different facets of the experiment is challenging.

Several priming experiments failed to find evidence of the passive with 3-year-olds (e.g., Savage, Lieven, Theakston, & Tomasello, 2003) but did find it with older children (e.g., Huttenlocher et al., 2004, for 4-year-olds; Savage et al., 2003, for 6-year-olds). Others showed priming of the full passive in children younger than 4, but only with intensive input (de Villiers, 1984) or training (Brooks & Tomasello, 1999).

The two-part strategy described earlier would require a) that the child give positive evidence, in the form of priming, of being able to flexibly map semantic roles onto syntactic roles and b) that a reduction in the cognitive demands of the task allow demonstration of priming at younger ages than those typically reported.

Two experiments suggest that the failure to demonstrate priming of the passive in children aged 3 to 3½ is due to executive function limitations rather than syntactic limitations. Bencini and Valian (2008) constructed an experiment to reduce the lexical look-up demands involved in priming and to ensure that children processed the priming sentence. Before every two priming sentences, the experimenters showed the child line drawings of the objects and actions in the priming and target pictures. For the objects, children were asked to name the pictures, such as a chair and a blanket. For the actions, the experimenter asked the child to point to "covering," "bouncing," and so on. The reasoning was that reducing the difficulty of an extrasyntactic part of the task would reduce the executive control needed to perform it. Children were also asked to repeat the priming sentence, to ensure that the child had actually paid attention to it and processed it.

With those two features, our young 3-year-olds who were primed with passive sentences produced more full passives than did those primed with eight active sentences and more than those who received no priming at all.[11] Thus, the difference between earlier findings against the possibility that 3-year-olds can represent the passive and our findings showing that children's grammars do include the structures necessary to produce the passive was whether or not the cognitive demands of the task had been reduced. Similarly, Shimpi, Gámez, Huttenlocher, and Vasilyeva (2007) found success in priming of the passive (where both full and truncated passives were accepted) in 3-year-olds, but only when the children had to repeat the priming sentence. In a condition where children heard the priming sentences in a block but did not repeat them, there was no priming. Only when the children heard and individually repeated the sentences was there priming.

To summarize, children pass the diagnostic test of priming of the passive, indicating that their grammars allow them to represent both active and passive sentences. But priming does not occur when the task is too cognitively demanding. As with determiners and subjects, children's grammars seem continuous with adults'.

CONCLUSION

We looked at three aspects of syntax—determiners, subjects, and the passive—to examine whether children's limited or absent production should be attributed to lack of syntactic knowledge or extra-syntactic factors. In all three cases we showed that children passed the diagnostic tests we provided and that children's lacunae could be attributed not to syntactic deficits but to a combination of limited executive functions and extra-syntactic factors. Children appear to have an abstract formal grammar as soon as they are producing combinatorial speech. Their grammars are continuous with those of adults. But there is a lot for children to learn, even if they have the bare bones at the outset of combinatorial speech. They have to acquire a richer vocabulary, they have to learn details about how lexical items behave, they have to develop all the other parts of the grammar, and they have to expand their ability to integrate the tasks involved in speaking and listening. There's a lot that children don't know, and a lot that they are not very adept at. In addition, children do not necessarily understand the structure of the experiments we ask them to participate in or understand what they are being asked to do. One 2-year-old in an imitation experiment understood that she was being asked to do something: She opened her mouth after the experimenter said the sentence, but no speech came out. There was a missing link that she was unable to supply. We had no way of finding out what her linguistic knowledge was because she had no way of retrieving that knowledge.

There exists a line of research to understand the effects of utterance planning on productions (e.g., McDaniel, McKee, & Garrett, 2010; Rispoli, 2003; Wijnen, 1990). McDaniel et al. propose that "the architecture of the child and adult formulators are very much the same. Sentences are planned in similar ways and the planning points are

the same. The difference between children and adults lies in the amount of advance planning they undertake, and possibly in the levels of simultaneous planning they can sustain during sentence formulation" (p. 92). That is an excellent description of the differences in executive function between children and adults. I have suggested how we can get beyond what the child doesn't know to the abstract skeleton that constitutes her syntax.

ACKNOWLEDGMENTS

My sincere thanks go to those who commented on this chapter: Martin Chodorow, Laura Lakusta, Mary C. Potter, Sandeep Prasada, Paul Rozin, and Laura Wagner. I wish I could have satisfied all of them! I gratefully acknowledge support from a PSC-CUNY grant.

NOTES

1. More technically, determiners take noun phrases (NPs) as their complement. The determiner phrase (DP) structure is complex and can vary cross-linguistically. But the skeletal structure assumed here can be applied to any language. Whether overt determiners exist in every language is controversial. Not all languages have articles. All languages do seem to have demonstratives; if demonstratives are considered to be determiners, then all languages have determiners.

2. The innateness of a representation is orthogonal to the ease with which one can use or process it.

3. Notice that this is not the same as saying that the child has a "predisposition," which suggests a graded tendency. Rather, it is a hypothesis that the child has a mental representation, the structure of which is similar to the adult's.

4. The term *operations* as used here has no connection with the similar term in Piagetian theory.

5. For a challenge to the conclusion that children have an abstract determiner category, see Pine, Freudenthal, Krajewski, and Gobet (2013). For a response to the challenge, see Yang et al. (2014).

6. Since nouns need not always be preceded by a determiner, particularly nouns like *doggy*, which can be used as proper nouns as well as common nouns, the children's indifference to the presence or absence of a determiner may not be surprising. Four of the eight nouns in the experiment were ones that may be used without a determiner in some contexts: *doggy, kitty, birdie*, and *baby*.

7. My interpretation here slightly differs from Zangl and Fernald's (2007).

8. Note that if only 3-year-olds had been tested, these data might have suggested that the children had no representations of determiners. But the data from the 2-year-olds show that children are more dependent on their syntactic knowledge when they have less familiarity with the nouns they are hearing.

9. Longer sentences are also more complex, even if they are only adding an adjunct.

10. A truth-value judgment experiment is at odds with this conclusion (Orfitelli & Hyams, 2012). It is possible that the cognitive challenges of the task prevented the younger children from displaying their knowledge.

11. Since the active is by far the preferred structure for children, those primed with the active did not differ in their production of actives from those who received no priming at all.

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