8 How children learn language

Introduction to Part III

Part II primarily addressed the Argument for Mental Grammar, looking at the principles for language use that mature speakers carry around in their heads. However, we constantly kept in mind the Argument for Innate Knowledge, and we therefore made an effort to separate the aspects of mental grammar that have to be learned from those that are given to the language learner in advance.

The evidence we drew on in Part II came from the structure of mental grammar itself, in two ways. First, from the range of possibilities for grammatical features across the languages of the world, we get an idea of the menu presented by Universal Grammar. Second, the fact that grammatical structure is so abstract with respect to speech (and sign) shows us that language acquisition has to go far beyond just memorizing and reshuffling inputs one has heard. Much of the organization has to come from inside the brain.

We will now go into more direct evidence for the Argument for Innate Knowledge, looking at the process of language learning in normal children (this chapter) and in a wide variety of more unusual cases (Chapters 9 and 10). We will also look at different kinds of language loss due to brain damage (Chapter 11). The goals throughout will be (1) to figure out which aspects of language are learned and which innate; and (2) to factor language ability into the parts specific to language and the parts which can be accounted for by more general intelligence.

In turn, the point of all this is to establish a baseline in terms of which to think of human nature. If language consists of this complex mix of learned and innate, special-purpose and general-purpose, and if in language learning the effects of nurture are strongly guided by nature, then there is reason to look for similar organization in other abilities as well.

Basic stages of language acquisition

Let's start looking at language learning in terms of the simplest observable phenomena—what babies and young children say. Of course, the earliest vocalization is crying, which, as any parent will tell you, comes in many varieties. Though it obviously communicates, it isn't language by any means. The kind of information it conveys is more akin to tone of voice: essentially, emotional state.

Sometime in the first couple of months, babies develop a kind of vocalization usually called "cooing": "goo" or "gmp" sorts of sounds, or quiet whooping. This gradually gives way at about six months to a stage called "babbling," in which the baby makes a large range of meaningless sounds, often forming strings of syllables. Frequently, babbling children even make sounds that aren't present in the language of the environment.

The consensus on babbling is that it is basically a stage in which the baby is playing with its vocal tract, with no particular linguistic intention. Even deaf babies are observed to babble; on the other hand, not all babies do it (my older daughter didn't, to my deep disappointment). Still, there are hints of proto-linguistic behavior. Babies often babble in response to being spoken to, suggesting that they are catching on to the idea of taking turns speaking in conversation. And a couple of months into babbling, the strings of sounds begin to be uttered with intonation patterns characteristic of speaking, so that the baby almost seems to be talking.

As this period progresses, the baby's phonetic output gradually comes to be "tuned" to the language of the environment—and deaf children tend to fall silent. Ruth Weir and Jean Aitchison have reported research that demonstrates this tuning. Recorded babbling of an American, a Russian, and an Arab baby was played to mothers. The American mothers could often identify the American baby, the Russian mothers the Russian baby, and the Arab mothers the Arab baby. But none of them could distinguish between the remaining two babies. So the babies, even though they weren't saying anything meaningful, were evidently making noises that sounded like the language they had been hearing around them.

(Incidentally, deaf children exposed to sign start "babbling" with their hands, in a way very much parallel to spoken babbling, experimenting with handshape and movement.)

Sometime between ten and twenty months (with girls tending to be on the earlier side, boys later), babies really start to talk, albeit in single-word utterances. The words in their vocabulary include names

like "Mommy" and "Cindy," object words like "spoon" and "car," pointing words like "that," action words like "eat" and "push," properties like "hot," directions such as "up" and "down," greetings like "bye-bye," and, of course, "no." There are no function words like "a," "is," or "to"; there are no inflections like plural and past tense. The child's vocabulary may grow to fifty or seventy-five or a hundred words over a period of six months or so. You can list the words your child knows, and each new word is a milestone: "Hey, Beth said 'turtle' today!" Despite the limitations of this one-word stage, a surprising amount gets communicated this way.

After a few months of this kind of talk, perhaps at two years of age or a little before, children start to put together two-word utterances, things like "Mommy sock," "drink soup," "no eat." Even though there is nothing like an adult grammar yet, we see fairly consistent use of word order, in a sort of stripped-down version of adult order. For instance, a child at this stage won't say "Mommy throw ball," because it's too long. But we may well hear the more reduced versions "Mommy throw" and "throw ball"; while the opposite orders, "throw Mommy" and "ball throw," are unlikely.

Around the same time, all of a sudden the child's vocabulary takes off. The parents can't keep track anymore of the words their child knows. The standard estimate is that a five-year-old knows on the order of 10,000 words. This means that between the ages of two and five (three years, about a thousand days), the child has averaged ten new words a day, or close to one every waking hour! Since a word may take a period of time to master, this also means the child is probably working on dozens of words at a time.

After maybe another few months of two-word utterances, we begin to see a steady growth of grammatical complexity along with vocabulary growth. The child starts constructing gradually longer and more complex sentences, and function words and inflections begin appearing. By age five the child is speaking with a very good approximation to adult grammar, though there are numerous wrinkles to be ironed out and complexities to be added by age ten or so. (And vocabulary learning continues throughout life, though at a less frenetic pace.)

I should add that this is the standard story, and there is a fair amount of variation, including anecdotes of children who don't speak at all till they are three or four, then start talking in whole sentences. (On the other hand, if *my* child didn't talk by the age of three, I would start getting worried.)

It is also worth mentioning that children who are exposed to a

second language—say because they have moved to a new country—don't take as long to learn the new language. They tend to become relatively fluent within a year or so. This suggests that some of the protracted stages of language learning from ages one to four or so should be attributed to maturation of the brain—growth in the ability to learn language—rather than to the inherent difficulties of the language being learned.

In Chapter 3, we pointed out how little of this gradual growth of language ability can be attributed to teaching. To be sure, adults and even older children will teach individual words. (But one an hour? I doubt it.) In addition, adults tend to speak to children more clearly and in simpler sentences than they use with other adults. So to some extent, children don't have to deal with the full daunting complexity of the language all at once.

We also noted, though, that children get very little grammatical correction, and are liable to ignore or resist correction when it does take place. Here's another famous example, cited by Martin Braine.

CHILD: Want other one spoon, Daddy.
FATHER: You mean, you want the other spoon.
CHILD: Yes, I want other one spoon, please Daddy.
FATHER: Can you say "the other spoon"?
CHILD: Other . . . one . . . spoon.
FATHER: Say "other."
CHILD: Other.
FATHER: "Spoon."
CHILD: Spoon.
FATHER: "Other spoon."
CHILD: Other . . . spoon. Now give me other one spoon?

This shows that the child is not just imitating—the imitation is, as it were, filtered through the child's own (unconscious) version of the language. In other words, we are seeing evidence of a mental grammar—maybe not the same as an adult's, but a mental grammar nonetheless—which governs the child's use of patterns.

So the real problem of language acquisition is not just to describe the child's behavior, but to induce from this behavior the nature of the unconscious grammar that guides it, and to discover how this grammar changes as the child matures. In the rest of the chapter, I'll describe some of the things we can find out about the development of the grammar. As usual, I'll only be able to skim over a few representative phenomena, in the hope of giving the flavor of the results of a flourishing body of research.

Children know more than they say

Impressionistically, one-and-a-half-year-old children understand an amazing amount of what you say to them—even if their speech consists only of one-word utterances and their spoken vocabulary contains only fifty words. That is, their comprehension is way ahead of their production. Some rather simple experiments show this in striking fashion.

First, consider their phonology. Where I have written whole words in transcribing babies' utterances above, I was not showing you any of the simplification that they wreak on the pronunciation. Typically clusters of consonants may be simplified ("spoon" is pronounced "poon") and final consonants may be omitted ("bus" is pronounced "buh"). The articulation of consonants may be altered to make them more like other consonants in the same word: "truck" may become "guck," where "g" and "k" are articulated in the same place in the mouth.* Some of the simplification is undoubtedly due to lack of adequate motor control of the vocal tract, since the child can be shown to perceive the adult sounds. For example, a child who says "guck" for both "truck" and "duck" won't have any problem distinguishing trucks from ducks on demand.

There are other cases that are even more intriguing. The linguist Neil Smith writes that his son consistently substituted "f" for "th," so that "thick" came out "fick." But it wasn't that he couldn't pronounce "th," since at the same time he used "th" instead of "s," so that "sick" came out "thick"! So there is evidently some system in place that goes beyond motor control alone.

A final complication is that children often don't hear what they're doing. If you deliberately pronounce a word the way your child does, he or she will get mad at you and tell you to say it right. If you tell your child to say "duck", not "guck," most of the time you'll get "guck" and a blank stare. Perhaps it's like not being able to hear your own accent. The point is, even at beginning stages, the child seems to grasp much of the sound system of the adult language, but maps it into motor control in an eccentric or degraded fashion.

* This is the standard account of why "truck" may be pronounced "guck." Recent research by Clara Levelt, examining a large number of such mispronunciations by children learning Dutch, suggests that it is actually the vowel that affects how the consonants are pronounced. On Levelt's account, vowels made in the back of the mouth, such as the "uh" in "truck," tend to pull adjacent consonants back to "g" and "k"; vowels made with lip-rounding, such as "oo," tend to change adjacent consonants to "b" and "p," which are also made with the lips.

Such phonological facts are easily observable. Testing syntactic understanding takes more sophisticated tests. It can be shown, though, that children as young as the one-word stage (seventeen months, say) appreciate some of the subtleties of syntactic structure.

Here's one kind of experiment, developed by Kathy Hirsh-Pasek and Roberta Golinkoff. Let's sit a very young child down in front of two side-by-side TV screens. The left-hand screen shows, say, Big Bird tickling Cookie Monster; the right-hand screen shows Cookie Monster tickling Big Bird. And out of a loudspeaker between the two screens, a voice says, "Look! Big Bird is tickling Cookie Monster!" (We have already made sure the child can identify Big Bird and Cookie Monster.) What happens? It turns out that the child will look much longer at the left-hand screen, which correctly depicts what the sentence describes. That is, the child appreciates the fact that in English the actor reliably precedes the verb and the patient follows it. Remember, not all languages have this order, so the child has to have learned something about *English*. And this effect can be observed as young as seventeen months—in many children barely the onset of the production of one-word utterances.

Experiments designed to elicit children's syntactic knowledge often involve using some nonsense word in a sentence. The child doesn't get upset about this—people are *always* using unfamiliar words. But because *we* know the child has never heard this word before, we can tell that the child's response is due to knowledge of the syntactic pattern in which the word is used.

An experiment of this genre, devised by Nancy Katz, Erica Baker, and John Macnamara, has to do with the distinction between names and common nouns. Suppose I hand you a doll and say one of the sentences in (1). (I'll use all capitals so as not to bias your interpretation.)

(1) *a* This is DAX.
b This is a DAX.

In the first case you will probably take "DAX" to be the name of the doll; in the second, because of the indefinite article "a," you will probably take "DAX" to be a word for doll or for some special kind of doll.

Children in the one-word stage—again as early as seventeen months—can be shown to know this too. How? We take the doll back and put it with a bunch of other things—blocks, toy cars, and, crucially, another doll. Then we say:

(2) *a* Could you give me DAX?

or

b Could you give me a DAX?
(depending on whether we first said (1a) or (1b))

In the a. case they will tend to hand you the same doll you gave them in the first place—that is, the doll named DAX. But in the b. case they are as likely to give you one doll as the other: you are asking them for any old DAX. So they evidently know that an indefinite article signals a common noun, and its absence signals a name—more than a year before they will be using indefinite articles themselves.

There is a second part to this experiment. Suppose that instead of doing it with dolls we do it with, say, packages wrapped with a ribbon. This time, we don't find any difference between "DAX" and "a DAX." In both cases the children are likely to give you back either package. Did something go wrong? No: actually they are pretty clever. They apparently know that *packages don't have names*—only people (and people-like things such as pets and dolls) do. As a consequence, they interpret "DAX" as a common noun in both the a. and b. cases. So, not only do they know how to tell names and common nouns apart and how to respond differently to them, they know which sorts of things ought to have names and which shouldn't.

Experiments like these show that children have some grasp of the grammatical patterns of the language quite a while before they can use them in their own speech. They also show that children use this grasp to help them figure out what we're trying to tell them, even when they don't know all the words we've uttered. This is an important key to how they can learn all those words without being taught: using a combination of their understanding of the context in which a sentence is uttered plus the syntactic pattern of the sentence, they can often formulate fairly precise guesses about the meanings of unknown words.

Evidence for rules in sentence production

How can we tell whether children are using a rule of mental grammar in *producing* speech—how do we know they're not just imitating what they've heard? One way is by observing them saying things they've never heard.

There are at least two methods for doing this. One is analogous to the experiment we just discussed, using nonsense words.

Remember when we formed plurals of unfamiliar words like "shmeggeggie" in Chapter 4? Our ability to do this, immediately and reliably, showed that we don't just memorize all the plural nouns: we have a principle in mental grammar that permits us to form plurals productively. Jean Berko asked children to do the same thing, with a protocol like this:

EXPERIMENTER: This is a wug. [Pointing to a cartoon of a cute little bird-like object.] Now there is another one. There are two of them. There are two . . .
CHILD: Wug.

This child obviously doesn't know the pattern for forming plurals yet. Very roughly, about three-quarters of the four- and five-year-olds tested gave the correct answer "wugs" (with the ending pronounced *z*), while nearly all the six- and seven-year-olds got it right. Since they couldn't ever have heard the words "wug" and "wugs" before, they had to use a principle of mental grammar to construct the latter from the former. And we see that this rule is not reliably available for speech production till the age of six or so.

Now recall a complication in the plural rule: when the noun ends in "s," "z," "ch," or "j," the ending is pronounced *uhz*, as in "glasses," "churches," and so forth. It turns out that children are much slower to learn this part of the rule. Only about a quarter of the four- and five-year-olds thought the plural of "tass" was "tasses," or the plural of "gutch" was "gutches." (The most frequent incorrect answer was to leave the word unchanged.) And just over a third of the six- and seven-year-olds got it right. So this extra complication in the plural rule takes a good deal longer to be acquired than the simple part.

Interestingly, at the same time that the children couldn't produce a plural for the novel word "gutch," they could fairly reliably produce the plural "glasses" for "glass." That is, this was a word whose plural they *had* heard, so they could retrieve it from memory. What they couldn't do was produce a plural on the spot using the rule. So we can clearly see the difference between learning words by memorization and constructing words by using rules of mental grammar.

Another way to discover a child's mental grammar is to observe *systematic mistakes*: things the child says that show a consistent pattern different from adult speech. For instance, in learning to form wh-questions, children often go through a number of different stages. Here are some samples, reported by Edward Klima and Ursula Bellugi.

Stage 1 (around two and a half years):
What book name?
Why you smiling?
What soldier marching?
Stage 2 (around three and a half years):
What he can ride in?
Which way they should go?
Why kitty can't stand up?
Stage 3 (around five):
Where will you go?
Why can't kitty see?
Why don't you know?

Stage 1 looks like a simplification of adult English, in which the auxiliary verb before the subject ("What *is* the book's name?") is simply omitted. Yet when auxiliary verbs appear in Stage 2, we see that the child doesn't know where to put them: they are put directly *after* the subject, as in a normal declarative sentence. Finally, in Stage 3, the adult order is achieved.

The crucial point is Stage 2. Here all the necessary verbs are present in the sentence, but in the order they would appear in the corresponding declarative sentence ("He *can* ride in something"; "They *should* go a different way"; "Kitty *can't* stand up because . . ."). From this we surmise that the child has a mental grammar—the utterances are grammatically systematic—but hasn't figured out the adult mental grammar yet. Again, this stage can't possibly be learned by imitation, because there are no sentences like this in the environment to imitate.

Parallel stages are found in the acquisition of negative sentences. Here are some of the patterns, again from Klima and Bellugi's work.

Stage 1
No the sun shining.
No a boy bed.
No sit there.
Stage 2
He no bite you.
I no want envelope.
I no taste them.
Stage 3
I didn't did it.
You didn't caught me.

These are progressively closer approximations to the adult pattern: each reveals a different mental grammar for dealing with negative sentences. In Stage 1, the principle is just to stick "no" in front of the sentence; in Stage 2, "no" goes where "not" appears in adult grammar, but without any auxiliary verb like "did." In Stage 3 the auxiliary is there all right, but the verb still appears in the past tense instead of the untensed forms "do" and "catch." These are all possible grammatical principles for languages of the world—but they aren't English. So the child at any of these stages must have constructed a mental grammar, since the systematicity of the utterances can't be a consequence of imitation.

A last classic case involves the acquisition of the English past tense. Most English verbs form the past tense by adding a regular ending spelled "-ed" and pronounced *d*, *t*, or *uhd*, depending on the final sound of the verb (more or less parallel to the pronunciation of the plural). But there are about 180 verbs that have an irregular past tense—remaining unchanged ("put," "fit"), changing the vowel ("held," "rang," "wrote"), or worse ("caught," "brought," "went"). Initially, children often learn some of the irregular past tense verbs correctly. But then suddenly they seem to regress, saying things like "comed" and "holded." Then sometimes there appear some real monstrosities like "helded" and "wented" before gradually the incorrect forms are replaced by correct ones again.

Stage 1 walked, played, came, went
Stage 2 walked, played, comed, goed, holded
Stage 3 walked, played, camed, wented
Stage 4 walked, played, came, went, held

What seems to be going on is this: At Stage 1, children are learning past tense verbs as separate words. They haven't yet figured out that there is a relation between the words "walk" and "walked"—they're as different as "Sue" and "suit." So they just copy the adult pronunciation.

But then they (unconsciously) realize that "walked" can be analyzed as "walk + past tense"—that is, it isn't a separate word at all but, rather, a complex pattern. They then apply this pattern to everything in sight: to form past tense, add "-ed" to any old verb. So the child can now forget about all those previously memorized forms and make them up from scratch. *Voilà*: Stage 2. This child is using a rule of English correctly, but hasn't yet realized that there are exceptions.

In Stage 3 we see an unsuccessful attempt to deal with the exceptions: the child knows you have to do *something* different with the irregular verbs, but doesn't yet know what. Relics of this stage can persist late into childhood. We're familiar with correcting eight-year-olds who still say "brang" or "catched" or "rung." But finally most people get the irregularities figured out.

Again the interesting stage is Stage 2, for here we see a rule of mental grammar—a correct one this time—which is creating things the child has never heard. And children say these in preference to the correct forms that they *do* hear.

Conclusions

There are four general points I want to take from this discussion:

1. Children understand a great deal more than they can imitate, showing that they have constructed grammatical patterns.
2. Children *don't* just imitate what they've heard. They are always coming up with novel utterances, which are patterned—implying that they have a mental grammar.
3. The patterns of their utterances are to some extent stripped down from the adult patterns, in particular leaving out function words and inflections, and shortening utterances to within narrow limits of a few words.
4. BUT—Their patterns have their own life, a life that cannot be induced from the input.

So where are the patterns coming from? From the menu of Universal Grammar.

And—in line with our larger theme—if we look hard enough, how much other learning is like this?