Chapter 37. First language acquisition

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37.1. Language learning versus language acquisition

Learning a first language is unlike most other forms of learning. One obvious reason for this is that a lot of the learning we do – for instance at school – is done via the medium of language. Obviously, language itself cannot be learned in this way. So for a long time there has been a sense that language learning requires, in some sense, a special explanation. In particular, since often there is no conscious effort on the part of parents and caregivers to teach children language – and where there is such an effort, there is little evidence that it has much effect – the term **language acquisition** is often preferred to **language learning**, when discussing a child's first language. There have been many different accounts for language acquisition; much of the difference between them relates to one key question. Is language acquisition primarily due to innate abilities possessed by human beings, or is it more a result of learning from the environment? In (over-)simplified terms, is language acquisition a process of 'nature' or 'nurture'? In this chapter, we will take a general overview of the process of language acquisition, and then go on to consider three examples of theories for language acquisition. The student of the English language is particularly fortunate in that the vast majority of research into language acquisition has been done on English-speaking children. For this reason, although the discussion below covers many points that are relevant to the acquisition of any language, the particular details of this chapter all relate to English.

37.2. Checkpoints in language learning

In this section, we will look at an overview of some of the major transitions that take place as a child learns English, covering between them the most important developments in the course of language learning. They include the transition from natural, 'biological' sounds to phonetic sounds, the transition from non-meaningful vocalization to words with meaning, and the transition from single words to grammatical structure.

37.2.1. From sounds to speech sounds

The earliest sounds that children produce are non-linguistic in nature. Crying is present from birth, stimulated by physical or psychological discomfort or distress. A baby may cry for a variety of reasons – when it is hungry, in pain, angry, or when it desires attention from a caregiver. There are other very early sounds that children make, such as burping, swallowing and sneezing. A child has little or no conscious control over the production of these sounds. By the age of two months cooing and laughter are added to this repertoire of sounds. It is within the production of these non-linguistic sounds that we can discern the earliest consonants and vowels.

The famous Russian linguist Roman Jakobson (1941) suggested that in the earliest stage of acquiring consonants, children would produce a very wide range of consonant sounds – in fact, all the possible sounds of all the languages of the world. So, for example, Jakobson's theory suggested that a baby in an English-speaking environment might produce click consonants, or pharyngeal consonants, at the outset, even though these sounds are not found in English. However, it is very hard to support this view when we look at children's actual production. The raw fact seems to be that children don't produce as wide a variety of sounds as Jakobson suggested they would. In fact, it is probable that they **cannot**: the vocal tracts of very young babies are shaped more like those of non-human apes than those of adult humans.

For this reason the earliest consonant sounds are most likely to be velar or glottal consonants (such as [h], [w], [k] or [g]). However, although these consonants are **produced** first, children may not be able to **make distinctions** among these consonants – that is, use them to indicate differences between words – at the earliest stages. The consonant distinctions that children find easiest to make are those among the front oral plosives such as [p], [b], [t] and [d], and nasals such as [n] and [m]. Other consonant distinctions appear to be more difficult and may be learnt later. The last distinctions to be learnt are usually distinctions between fricatives (e.g. [s] versus [ʃ] or [f] versus [θ]) and those involving affricates ([tʃ] and [dʒ]) and the 'liquid' sounds [ɹ] and [l]. Indeed, children can continue to have problems with some of these consonants long after they have otherwise finished learning the language, up to the age of ten or so in some cases. The sounds that children have difficulty distinguishing in their production seem to be those that require the finest control of the vocal tract.

It is harder to investigate the order in which vowels are learnt, for several reasons. Firstly, vowels are acquired within a much shorter period of time. While it can take until the age of five or six before all the consonants of English are mastered, vowels are typically mastered much earlier, by about age three. Secondly, vowels are in any case much less discrete than consonants: while consonants are clearly distinguishable in terms of place of articulation and manner of articulation, vowels exist on a continuum. So studying the distinctions that the child makes at any given point is much harder for this reason. However, some work has been done to investigate what distinctions among vowels the child gets control over first. For example, Jakobson suggested that the first vowel contrasts are between low front [a] and high front [i].

As well as the sounds that children are able to produce, however, we must also consider the development of their **perception** over time. When we think about comprehension of speech sounds, the central point to consider is whether a child is able to perceive a difference between pairs of similar speech sounds. It turns out that the speech sounds that children are exposed to in their environment, and that they learn to produce, can also affect their ability to perceive this kind of phonetic distinction. For example, it has often been observed that native speakers of Japanese who learn English as adults may find it difficult to distinguish between [l] and [r] – both in their own production and in their comprehension of others' speech. This is because, in Japanese, these sounds are not treated as distinct from one another functionally: they are treated as two variant pronunciations of the same sound, and there can never be any words in Japanese distinguished only by the difference between [l] and [r] (unlike, say, *red* versus *led* in English). Interestingly, but perhaps not surprisingly, Japanese-learning infants under the age of one year *can* hear a difference between [l] and [r] (see Kuhl et al. 2006). This suggests that babies are equipped, to begin with, with an ability to discriminate all kinds of human speech sounds. But as they 'tune in' to the language that they are learning, they lose the ability to distinguish speech sounds that are either not present or that are not used to

indicate meaningful differences between words in their language.

37.2.2. From pre-words to words

Babbling
When speech sounds are first connected together into larger phonetic units, it takes the form of **babbling** (also known as 'vocal play'). Babbling is the production of repeating strings of alternating consonants and vowels, such as [bababa] or [gəgəgə], and occurs in children from around the third or fourth month of life. Even deaf children have been found to babble – this aspect of language acquisition, at least, is clearly an innate part of development. Babbling arises as children get greater control over their vocal tract. It also seems that children enjoy this form of vocal play! At first, babbling tends to involve glottal, velar, and labial consonants, but later the sounds [b], [d], [m] and [n] will become more important. This fits with the general picture of the development of consonants. The main difference between babbling and speech is that babbling is not meaningful. Children are not intending to communicate when they babble, and in particular they are not using the strings of speech sounds as communicative symbols that have meaning to others. That is not to say that adults do not sometimes attribute meaning to the babble that a child produces. In some cases a child's 'first words' may actually be babble that has been interpreted as meaningful by a caregiver, e.g. such words as *Dada*, *Mama*, or *Baba*.

Vocal gestures
So how does the child move from this type of pre-word phonetic string to the use of meaningful words? A number of researchers have suggested that there is a 'halfway' point in this transition. At this stage, the child becomes capable of using precursors to words – phonetic units which are more stable in form than babbling, and which seem to have some kind of meaning. The meaning is, however, rather vague. Rather than them having a specific reference, we tend to observe children using these phonetic units consistently in the context of performing a particular action. They are more like a gesture than a word. So we could describe these precursors as 'vocal gestures', although different researchers have used a range of terminology to describe them. For instance, Dore et al. (1976) describe these units as **phonetically consistent forms**, whereas Halliday (1975) describes the same things as **proto-words**. The meaning of a vocal gesture is restricted to the context in which it is used. When a vocalization takes on a meaning that is independent of its context, we can actually begin to class them as linguistic symbols – early words.

First words
Once a child is capable of using words with meaning – although they may still not pronounce them precisely in an adult manner – they will start learning words for things in their immediate environment. In fact, most of a child's very early vocabulary will be made up of terms for things they are likely to encounter in their everyday lives. So words for people, body-parts (especially those associated with the face), food, clothing, pets, toys and household items are all prominent in the first couple of hundred words that a child learns. As we will see below, these earliest words do tend overwhelmingly to be content words, not grammatical words – grammatical words emerge later. It has been claimed that nouns especially are very prominent in the early vocabulary, with verbs being somewhat less frequent. The nouns in question are almost always concrete rather than abstract nouns.

However, this tendency, which is usually called the **noun bias**, does not seem to be a universal phenomenon that can be found across all languages. For example, it seems that

children learning Chinese do not have a strong preference for nouns in their early vocabularies. One explanation that has been put forward for this cross-linguistic difference is that nouns are more frequently produced in English than in Chinese – since the structures of Chinese grammar make it more likely than in English for verbs to be used in sentences without one or more grammatically associated nouns.

ADVANCES BOX 37.1

Research on the psychological processes of word learning

Nobody would dispute that children learn words from their linguistic environment. Since words vary across languages, they cannot possibly be innate. However, people argue about the mechanisms that support children's acquisition of the meaning of words. One important view is the **lexicalist constraint-based approach** (e.g. Markman and Wachtel 1988). From this perspective, children's word learning is guided by specific hypotheses, or what we might informally call rules-of-thumb for guessing word meanings. These hypotheses are only used for this process and are thus domain-specific – they apply *only* to language. Another important approach is the **social-pragmatic account**. In this perspective, 'the process of word learning is constrained by the child's general understanding of what is going on in the situation in which she hears a new word' (Tomasello and Akhtar 2000: 182). That is, children use their general understanding of speakers' communicative intentions – and in particular, what thing in the context those speakers are paying attention to as they speak – when they try to figure out the meaning of new words.

Let's look at some experiments that have been done to look at word learning in action, and consider which of these viewpoints fits better with the evidence. These experiments typically involve teaching children a word they do not already know in a controlled, laboratory condition, and observing what assumptions the children make about the meaning of the new word. To make sure that the children have not already learned the word being used in the experiment, it is typical to use either made-up words, or complex adult vocabulary that toddlers are very unlikely to have previously encountered.

According to the lexicalist constraint-based approach, one of the hypotheses which guide children's word learning is the **Whole Object constraint**. This is simply the theory that children assume that new words generally refer to *whole* objects rather than parts of objects. For example, in an experiment by Markman and Wachtel (1988), an experimenter showed three-year-old children an object that would be novel for them (e.g. a picture of a lung). Then the experimenter gave them a new word (e.g. *trachea*) and asked them to point to the *trachea*, indicating that it could be either the whole object (circling the lung) or just a part of it (circling the actual trachea). Most of the children indicated that they thought that the new word (*trachea*) referred to the whole object (lung) – indicating that their guesswork about what the new word meant was done according to the Whole Object constraint. However, when the experimenter first gave them the word for the novel object (by saying 'This is a lung, we all have two lungs in our chest and use them to breathe') and then asked the children to point to the *trachea*, most children chose the actual trachea. In this case, a different hypothesis seems to have guided the children: **Mutual Exclusivity**. According to the Mutual Exclusivity hypothesis, children assume that objects only have one label. Therefore, when the novel object has already received a label (*lung*), they will search for another object or part of object for the other new label (*trachea*).

The problem with Mutual Exclusivity is that children are usually surrounded by a large number of objects for which they haven't yet learned a label. Especially at the beginning of the word-learning process, the Mutual Exclusivity assumption would not be very helpful because children know almost no words and any new word they hear could refer to any of the objects for which they don't yet have a word.

An alternative possibility is that children will tend associate a new word with the object in the environment that the speaker is focusing their attention on when they say the word – which, as we noted above, is the view taken by the socio-pragmatic account. In an experiment by Baldwin (1993) children were presented with two novel objects and one new label. At the point when the experimenter introduced the new label, she was playing with one of the novel objects, while the child was playing with the other novel object. At 16 months, children would assume that the unknown word referred to the novel object they were playing with themselves. However, only two months later, most children would instead assume that the unknown word was a name for the object that the *experimenter* was playing with. So the ability to use the speaker's focus of attention to guide guesswork about word meanings may develop at about 16-18 months. One important difference between this account, and an account based on hypotheses like Mutual Exclusivity, is that following other people's focus of attention is *not* an ability used only in the word-learning process. Instead, it is a general skill – one that children can be observed to use for things other than learning words. For example, infants also demonstrate an understanding of focus of attention in their comprehension and production of pointing gestures.

37.2.3. From words to sentences

When children produce their first words, at around the age of nine months to a year, they initially produce these words one at a time. Over time, they begin to put words together to produce longer utterances; at this point, we begin to see evidence that they are using basic (but increasingly complex) morphology and syntax.

The notion of holophrase

The earliest utterances consist of a single word. These utterances are sometimes called **holophrases**, a term which means 'whole sentence'. This raises the question of the degree to which the child possesses the concept of the sentence. One view of holophrase utterances is that they are partial representations of adult sentences – sentences with all but one of the words 'missed out'. This implies that the structure of a sentence is understood by the child, but left unspoken, due to the child's limited abilities. For example, if the child says *Clock*, what they really have in mind is something like *There's a clock!* or *Where's the clock?*, but they are only able to produce the most important word. It is difficult to support this view. Of course, adults frequently produce one-word utterances that can be interpreted as abbreviations of full sentences – but with an adult speaker, we have good evidence that they are capable of producing the full sentence if they wish. We don't have such evidence for child speakers. So on balance, it is better to see grammatical development as a process which builds up complicated structures from the initial one-word utterances, rather than as a process of gradually leaving out fewer words from a sentence structure which the child has in mind from the start.

Two-word utterances

Somewhere around 18 months old, children move on to what is sometimes called the **two-word stage** of grammatical development. This is not an overnight change. Firstly,

children of course do not cease to produce single-word utterances when they acquire the ability to produce longer utterances. Even adult language contains many one-word sentences! Secondly, because there is a grey area in telling the difference between two one-word utterances produced in quick succession, and an actual two-word utterance, there cannot be a sharp division between the stages. This **juxtaposition** of separate utterances may in fact be an important intermediate step.

The two-word stage has been of great interest to many researchers because it is only with multi-word utterances that there is scope to investigate the early emergence of syntax. However, it has proven very difficult to provide a single characterization for all the utterances produced at the two-word stage. Different theories have been proposed. For example, Brown and Fraser (1964) suggested that early multi-word utterances are basically **telegraphic** – adult utterances with grammatical words like *of*, *and* or *the* missed out. This explains utterances like *Sweater chair*, *Mommy sock*, or *Baby table*, but not the many two-word utterances that *do* contain grammatical words, such as *No down*, *She here*, *There high*, or *More noise*. The alternative theory of 'pivot grammar', proposed by Braine (1963) and McNeill (1966), hypothesizes that children have two classes of words: pivot words and open words. Pivot words are restricted to one position in the utterance – first or second – and cannot occur alone. Instead they occur with open words, which can occur in either position, or alone. So a child might produce a set of utterances such as *More milk*, *More juice*, *More read* and *More teddy*, where each utterance 'pivots' around the fixed first word *more*. A comparable set with a second-place pivot might be *Juice gone*, *All gone*, *Daddy gone*. But again, this theory does not account for all the utterances produced by children in the two-word stage (you might be able to see why utterances like *Outside more* and *No more*[1] are problematic for this approach). There is also the problem that it is not clear how a child would transition from using a pivot grammar to using adult grammar. So the theory of pivot grammar is not ultimately satisfying as an explanation for usage of young children. However, a recent account by Tomasello (2003: 114-117) of early utterances based upon *pivot schemas* seems promising as an explanation for children's utterances at this stage. Tomasello's account is important as it preserves the insights of the pivot grammar approach, without the difficulty of a strict separation between pivots and open-class words. We will explore Tomasello's ideas again later in the chapter.

Grammatical morphemes

After the two-word stage, longer and longer utterances are produced by children. However, there is not just an increase in length – there is also an increase in grammatical complexity, as grammatical morphemes (including inflectional affixes and closed-class grammatical words) begin to occur in children's utterances. Brown (1973) investigated the order in which the grammatical morphemes were acquired in different children. He found that the order was fairly consistent in all three children that he looked at; the average order of acquisition that Brown reports is given in Table 37.1.

	Type of grammatical morpheme
1	present progressive (*-ing*)
=2	the preposition *in*
=2	the preposition *on*
4	plural inflection (*-s*, *-es*)
5	irregular past tense verbs
6	possessive *'s*
7	uncontractible copula (*is*, *am* and *are*)
8	articles (*the*, *a* and *an*)
9	regular past tense verbs (*-ed*)
10	regular third person forms (*-s*, *-es*)
11	irregular third person forms (*has, does*)
12	uncontractible auxiliary verb *be* (*is*, *am* and *are*)
13	contractible copula (clitic forms like *-'s* and *-'re*)
14	contractible auxiliary verb *be* (clitic forms like *-'s* and *-'re*)

Table 37.1. Order of acquisition of 14 grammatical morphemes (adapted from Brown 1973: 274)

The reason that the grammatical morphemes appear in children's speech in that particular order seems to be related to complexity. Some morphemes are more complex than others because they represent, in cognitive terms, more difficult ideas. For instance, the shades of meaning represented by the past tense morpheme or a definite article are cognitively more complex than the straightforward locational meanings indicated by the prepositions *in* and *on*. Arguments of this sort can be made to explain many of the relative orderings that Brown observed. So the easiest morphemes are acquired first. By contrast, the frequency of the different morphemes in the child's input does not seem to have much effect on the order of acquisition: more frequent morphemes are not acquired earlier.

Questions and negatives

There are numerous types of questions (interrogatives) in English. The simplest type, which is the earliest to develop in children, consists solely of using a declarative sentence with a rising intonation. The other types – use of subject-auxiliary inversion and then use of *wh*-words – develop later, in stages. McNeill (1970) described the stages by which questions develop as follows. First is the use of rising intonation alone. Then, in a second stage, children begin to use *wh*-words at the beginning of an utterance to form a question such as *Where my shoes?* It is at the third stage that subject-auxiliary inversion emerges; but there might still be problems in the ordering of auxiliary verbs in *wh*-questions, with utterances such as *Where my shoes are?* instead of *Where are my shoes?* being produced. Finally, fully adult interrogatives are produced. Concerning the order of acquisition of the different *wh*-words, Tyack and Ingram (1977) found that *what* and *where* were used comparatively early on, but *why* and *how* were more likely to be used as a child grows older. This seems to be related to complexity: **things** and **places** are concrete notions and thus conceptually much simpler than abstractions such as **reasons** or **manners**.

Klima and Bellugi (1966) found that, as with interrogatives, children learn to use negatives by starting off with simple forms and gradually moving on to more complex forms. The first stage of using negatives is to place the word *not* or *no* outside of an utterance, in utterances such as *No go movies*, *No sit down* or *Not sleepy*. In the second stage, the child starts to include the negative inside the sentence in utterances such as *I no want book* or *I no like it*. It is also at this stage that negative auxiliary forms such as *can't* start to appear. In the final

stage of development, the remaining differences between the child's usage and adult negatives disappear.

One thing which emerges from looking at the acquisition of both questions and negatives is the importance of juxtaposition as a step towards the acquisition of a complex grammatical structure. As we saw before, the very origin of multi-word utterances may be in the juxtaposition of single-word utterances. Here, we see that the juxtaposition of a question word or a negative word with an utterance is often an initial step towards the integrated interrogative and negative sentence-types.

ADVANCES BOX 37.2

Individual differences in syntactic development

Observational and experimental research has convincingly demonstrated that all children do not always learn language in exactly the same way, or at exactly the same speed. This can be particularly evident in their acquisition of syntax beyond the early stages that we explored in section 37.2.3. These individual differences can often be traced to differences in the children's input – and in particular, the **frequency** with which they encounter examples particular grammatical structures.

Intuitively, we might expect that the more chances a person has to hear some grammatical structure being used, the more easily and more completely they will be able to use that structure themselves. There is evidence that this is actually the case – even, in fact, for adults! Dąbrowska and Street (2006) found variation in different groups of adults' understanding of **passive** sentences, such as *the soldier was protected by the boy*. They found that postgraduate students were much better at picking out the agent (*the boy*) than adults without any higher education. One plausible explanation for this is that passive sentences are used fairly frequently in written texts, and are especially frequent in the academic texts that postgraduate students spend a lot of their time reading – but they are rare in spoken language. Thus, adults with more passives in their language input are, as a result, likely to be better at interpreting passives. So even adults' linguistic knowledge is affected by their language experience.

What about children? We can indeed observe that children's input has an effect on their acquisition of grammar – especially the more complex, and later-acquired, types of syntactic construction, such as passives (e.g. *the monkey was pushed by the lion*) or **relative clauses** (e.g. *that's the monkey that the lion pushed*). Huttenlocher et al. (2002) demonstrated that children's use and comprehension of such complex sentences is positively related to the frequency of these sentence types in their input. That is, the higher the proportion of complex sentences in their caregivers' speech, the better the children are at producing and comprehending the same kinds of complex sentences. This is a clear example of a frequency effect leading to an individual difference.

Children also show individual differences in (social-)cognitive skills that can interact with their acquisition of syntactic structures. For example, Arosio et al. (2012) found that only children with relatively high working memory were able to correctly interpret complex sentences such *The fairy who the policemen have pushed*. Similarly, Brandt et al. (2016) were able to demonstrate that children's understanding of **complement clauses** (e.g. *I think (that) the sticker is in the red box*) showed developmental links with their understanding of others' knowledge and perspectives. That is, children who were able to understand these complement

clauses were *also* more likely to understand the notion that other people might have knowledge or beliefs different to their own knowledge and beliefs (understanding this idea is an important socio-cognitive skill which children must learn as they grow up!).

Overall, these individual differences and effects of input frequencies suggest that children's acquisition of syntactic rules and constructions – and especially those that take them beyond the basics of grammar – depends on what they hear from their caregivers, and on how well they can process this input.

The fact that differences in input can lead to individual differences in language acquisition is important when we consider the question whether language, and grammar specifically, is largely innate ('nature') or largely based on learning from the environment ('nurture'). It is difficult to make sense of these individual differences if we assume that the acquisition of syntax is largely innate: the syntax should be equally innate for everybody! On the other hand, if syntax is *not* primarily innate, then it makes sense that differences in language input can cause children to acquire language in different ways.

37.3. Theories of language learning

In this section, we will look at three important theories explaining the process of language acquisition which was described in outline above.

37.3.1. Chomsky's Universal Grammar

Without question, the most broadly influential theory of language acquisition is the one originally proposed in the late 1950s by linguist Noam Chomsky. Chomsky proposes that large parts of the human language capacity are, in fact, not learned from experience but **innate**: built into the human brain from birth. This type of theory is often called a **nativist** theory.

The overturning of behaviourism
Chomsky's theory first came to wide attention when he wrote a very critical review (Chomsky 1959) of a book supporting another theory. This was the psychologist B. F. Skinner's book *Verbal Behavior*, which presented a **behaviourist** approach to language acquisition. Behaviourism is a school of psychology which seeks to explain how animals and humans behave in terms of a small number of very basic learning mechanisms. In this approach to language acquisition, everything (not just language) is learned from exposure to the environment. The child is **conditioned** to associate a particular environmental **stimulus** – let's say, a chair – with a particular **response** – let's say, the sound [ʧeə] – by repeatedly encountering them together. A parent could **reinforce** this association by rewarding the child for producing the right response (i.e. the correct word), or punishing them for producing the wrong response. Environment-based theories such as this were widely thought, at the time, to explain language learning completely. But in his 1959 review, and subsequent works, Chomsky developed an argument that not only behaviourism, but any approach relying solely on learning from the environment, cannot account for language acquisition. For instance, in arguing against behaviourism, Chomsky pointed out that language is not produced simply as responses to predictable stimuli. When we encounter a chair, we **might** say *chair*, but we might also say *The upholstery needs cleaning*, *Oh, I fancy a nice sit down*, *It doesn't go with the décor of this room*, or any number of other things, and this is not predictable in the way

that behaviourist stimulus-response links are. This is a major flaw in Skinner's account. Chomsky's proposed alternative to a behaviourist approach is that important components of language are **not** learned from the environment but rather are innate.

Evidence for innate grammar

The elements of language that Chomsky believes simply cannot be learned are, primarily, the abstract rules of grammar that underlie sentence structure. Chomsky proposes that there exists, within the mind, a module devoted specifically to grammar, which contains the core elements of human syntax. It is this module, which Chomsky calls **Universal Grammar** or UG, that allows a child to learn grammatical structures which would be impossible to learn just by the behaviourist learning mechanisms of association, conditioning and imitation. What evidence is there for the existence of UG? Chomsky is a syntactician, and Chomsky's theory of language acquisition is the same theory as his theory of syntax: that is, his proposal that there is an innate UG is mostly based on his analysis of the grammar of adult language, and likewise the innate UG explains why adult syntax is the way it is. So, much of Chomsky's evidence for UG is drawn from analyses of syntax, rather than the study of children's language use. See Illustration Box 37.1 for a detailed explanation of the **Argument from Poverty of the Stimulus**, one of the most important arguments for the idea that grammar cannot be learned from the environment; another syntax-based argument is the idea that certain aspects of syntax are universal, found in every language, and this cannot be explained unless those aspects of syntax are innate. However, other researchers have supplied other lines of evidence. For example, Bickerton's research on the creation of creoles from pidgins has been used as evidence for a UG. When the children of speakers of a pidgin language – which is not a 'proper', grammatical language – expand it into a creole, they do it by adding grammar to the vocabulary of the pidgin. Since they could not have learnt that grammar from their parents' pidgin – which doesn't **have** a grammar – they must have got the grammar from their UG (pidgins and creoles are explored further in chapter 13). Pinker (1994) has also presented evidence for UG. For example, Pinker points out that there are developmental disorders, including some known to be genetic, that affect linguistic development but not non-linguistic cognition (e.g. non-verbal IQ); there are also disorders that impede general cognition without affecting language use. This suggests that language is a distinct system within the brain, controlled by distinct genes in the human DNA code.

ILLUSTRATION BOX 37.1

How poor is the stimulus?

One of the most important arguments for an innate UG is that the grammars of actual adult languages **cannot** be learned. One aspect of grammar that Chomsky has claimed cannot be learned is **structure dependency**. This is the idea that all syntactic rules are based on the structure of the sentence, not just on the order of the words. Chomsky has often exemplified this with English question formation. In English questions, the auxiliary verb is moved to the beginning of the clause. Compare the declarative sentence in [37.1], and the corresponding interrogative in [37.2]: you will see that the auxiliary *is* has moved from its original position, indicated by ___:

[37.1] This man **is** insane.
[37.2] **Is** this man ___ insane?

However, a declarative sentence might contain a subordinate clause, as in example [37.3],

where [square brackets] indicate the subordinate clause. In this case, it is always the auxiliary verb of the main clause that is moved, not the auxiliary verb of the subordinate clause. So [37.4] is a grammatical sentence of English, but [37.5] is not:

[37.3] The man [who **is** insane] is smiling.
[37.4] **Is** the man [who **is** insane] ___ smiling?
[37.5] * **Is** the man [who ___ insane] **is** smiling?

This is an example of structure dependency, because knowing which auxiliary verb should be moved requires an awareness of the syntactic structure of the sentence – which bits are the main clause, which parts are the subordinate clause, and so on. Chomsky argues that children learning English have no way of learning that the formation of questions is structure-dependent in this way, because the examples they would need to learn it – sentences like [37.4] – are incredibly rare. Chomsky has even said that a person might go their entire life without being exposed to such examples (Piattelli-Palmorini 1980: 40). But adult speakers of English clearly **do** know that question formation follows this structure-dependent rule. If adults know it, but children can't possibly learn it, then it follows, in Chomsky's argument, that this aspect of grammar – like many others – is innate. This, in brief, is what is called the **Argument from Poverty of the Stimulus**: at least some key aspects of language must be innate, because the **stimulus** (language input) that we have to learn it from is not sufficient to learn it (it is **impoverished**).

This argument has not gone uncriticized. In particular, Chomsky's assertion that sentences like [37.4] are incredibly rare has been scrutinized by Pullum and Scholtz (2002), who found many example sentences of exactly this type in a range of different text corpora. For example, they found the following three examples in a corpus of utterances addressed to a child between the ages of one and three:

[37.6] Where **'s** the little blue crib [that **was** in the house before] ___ ?
[37.7] Where **'s** the other dolly [that **was** in here] ___ ?
[37.8] Where **'s** the other doll [that **goes** in there] ___ ?

In examples [37.6] to [37.8], the question is marked by a *wh*-word as well as by the movement of the auxiliary, but the sentences illustrate the same grammatical principle. Pullum and Scholtz cite other examples both with and without *wh*-words, found in corpora of genres such as news text and drama. They calculate that a child could potentially hear around 7,500 questions like those in [37.4], [37.6], [37.7] and [37.8] before they reach the age of three. This is obviously far more than Chomsky's argument allows for.

We might ask, does the argument from poverty of stimulus stand up in the light of evidence like this? Pullum and Scholtz's results are not unique: Sampson (2005: 77–89) has found additional corpus examples of the relevant type of sentence. The debate over this, and many other aspects of Chomsky's controversial theory, continues.

UG and the acquisition process

As we noted, for Chomsky it is grammar that is impossible to learn: the words of a language must be learned from the environment, naturally. However, not all languages have exactly the same grammar. So there must be some environmental effects on grammar as well. To explain this, Chomsky proposes that the linguistic knowledge contained in the UG is split into principles and parameters. **Principles** are the universal elements that are the same in all languages; **parameters** are like 'switches' which can be set to either on or off. The grammar

of any given language depends on the interaction of its parameter settings with the principles. When a child is acquiring language, they absorb example sentences from the speech around them. This **primary linguistic data** is then processed by the UG module in the mind: it is used to learn the words of the language, and it is used to set the UG parameters to the right settings for the grammar of the language the child is learning. The result of the UG processing the input data is an adult grammar. For Chomsky, this is the end-point of language acquisition.

37.3.2. Learning through interaction

In strong contrast to Chomsky's theory is the approach sometimes called **interactionist** or **social constructivist**. This is, in fact, a range of approaches to the study of language learning, linked by a shared emphasis on the social environment of the child – in other words, their interactions with their caregivers and others around them. One of the earliest examples of a theory of this type is that of psychologist Lev Vygotsky.

Vygotsky and social learning
Vygotsky lived and worked in the Soviet Union, and his ideas did not become widely known in the West until decades after his death in 1934. Vygotsky stresses the importance of the social environment for cognitive development, including the development of language. Vygotsky proposed the notion of the **Zone of Proximal Development (ZPD)**. This is the idea that, at any given stage in a child's development, there some things that the child can accomplish unaided, and there are other things that they cannot accomplish at all. Between these, however, is the 'zone' of things that the child cannot accomplish alone, but can accomplish if helped by a more knowledgeable person. In terms of language, for instance, a child at the one-word stage is capable, unaided, of producing single-word utterances; they are not capable, in any way, of producing long stretches of coherent, cohesive language; but with appropriate support and assistance from an adult speaker, they can participate in a structured conversational interaction. So, for a child at this stage, such an interaction is within the ZPD. Crucially, it is by this very process of participating in interactions that they are not capable of coping with alone that a child **becomes** capable of managing such interactions on their own.

Another important aspect of Vygotsky's view of language is that it implies that aspects of a child's cognitive development – including language – initially take place not within the child's mind, but within the child's social context. Only later do they take root within the child's mind. As Vygotsky puts it, 'any function in the child's cultural development appears on the stage twice, on two planes, first on the social plane and then on the psychological' (1966: 44). In terms of language, this means that the crucial site of activity for language acquisition is not the brain of the child – as proposed by nativist theories such as Chomsky's – but rather the interaction between children and their caregivers. Language within the mind is a later phenomenon: in fact, for Vygotsky, it is the process of internalizing the originally-external language skills that gives rise to our ability to think-in-words.

The role of the caregiver
So what is special about a child's interaction with their caregiver? When we observe how adults typically interact with children in their care, we see that they often behave in such a way as to provide particular kinds of support to the child, shaping the interaction to allow the child to develop gradually as a communicative partner. As Vygotsky suggested, the interaction is usually structured at a level just slightly above what the child is currently capable of. This behaviour on the part of the adult was termed **scaffolding** by Bruner (1979).

What might scaffolding consist of? Snow (1977b) observed that when children are very young, and not capable of understanding linguistic communication, adults will still tend to treat them as conversational partners. For example, mothers will very often talk to small babies who cannot understand or respond in any way. Not only this, but they will react to the babies' random movements and vocalizations as though they had communicative intent – mothers may impose a meaning on whatever noise or motion the baby has produced, and incorporate it into the 'conversation' that they are building. This is a form of scaffolding: clearly, at this stage, the mother is doing all the work. As the child learns language, however, the mother has to do less and less scaffolding work – for example, the child's vocalizations come to have intended meaning, so the mother no longer has to impose a meaning.

One important way in which an interaction may be scaffolded involves repetitive or ritualized routines, where sets of events tend to occur in a particular order, such as feeding the child, going to bed, reading a favourite book, and especially games like give-and-take or peekaboo. Because these interactions may be repeated dozens or hundreds of times in a child's early life, the child has the opportunity to learn what happens in these routines by heart. The adult can run these routines in such a way that all the child has to do to participate is produce the appropriate conventional response at the appropriate time. These routines then provide a good context for the child to come to understand the way in which interaction works, and observe the relationships between sounds, meanings and actions. This is all made possible by the adult's scaffolding behaviour.

CDS: English for the child

We might also describe as scaffolding the behaviour of adults who use a special, simplified register when communicating with children. This register is often called **child-directed speech (CDS)** or, more colloquially, **motherese**. What are its main features? On the level of prosody, CDS has been found to involve the use of a higher pitch than normal, exaggerated intonation using a greater range of pitch, and slower, clearer pronunciation of words. There are also syntactic differences to normal language. Utterances tend to be shorter, and to contain fewer subordinated clauses. Fewer verb forms are used, and there are more utterances without verbs. Finally, there tend to be more content words, and fewer grammatical words, in CDS than in normal speech. And at the level of discourse, it is notable that CDS tends to contain more interrogatives and imperatives, and also more repetition, than normal speech.

CDS clearly constitutes a simplified register, and thus a form of scaffolding; there is, in fact, evidence to suggest that caregivers tailor their use of CDS features to match the abilities of the child they are interacting with (see Snow 1977a). It would be easy to imagine that the use of CDS is a direct cause of language acquisition: that by providing these samples of simplified language, caregivers provide children with the equivalent of explicit language lessons. However, we must be cautious in drawing any such conclusion. It has actually proven extremely difficult to find empirical evidence directly linking the use of CDS by caregivers – or any other pattern of interaction – to the development of any particular aspect of language acquisition by children.

37.3.3. The usage-based approach

A more recently developed framework for thinking about language acquisition, which can be contrasted both with Chomsky's UG theory and with the interactionist theory, is **usage-based linguistics**. This is a set of related theoretical approaches to language that have been developed especially since the 1980s; they are united by a concern for how patterns of

language *as it is used* relate to, influence, and can be used to explain the ways in which language is learned and processed. Many researchers have investigated child language from this perspective, but we will focus here on one well-known example: the account of language acquisition put forward by Michael Tomasello (2003). The key feature of Tomasello's theory is that, like Chomsky's, it relates language acquisition to a general theory of language. But Tomasello uses a very different theory of language, and as a result ends up with a very different view of language acquisition – one that draws on a lot of psychological research into how young children learn.

Tomasello's explanation of language acquisition is linked to the theory of **Construction Grammar**. This is an approach to grammar, within the framework of usage-based linguistics, that argues that any individual speaker's mental grammar actually consists of a learned collection of constructions. **Constructions** are meaningful units of grammatical patterns that can be combined with each other and with words to build utterances. Tomasello argues that these patterns can be learned from the language that a child observes – that is, from *usage* – by a gradual process of abstraction from concrete patterns, in which the child makes use of cognitive skills that are *not* specific to the language acquisition process (unlike Chomsky's proposed UG).

First, the child learns to work out what adults mean when they talk to the child, and uses this basic cognitive skill (called **intention reading**) to learn the meanings of utterances they hear. This means that the earliest multi-word stretches of language that the child is able to comprehend and to produce are learnt *as units*. The child does not have any knowledge initially of the grammar of these word sequences. Instead, their understanding of grammatical organisation emerges slowly from the examples of meaningful utterances they have heard and produced. The key point here is that the patterns of grammar are secondary to meaning in the child's path to learning their first language.

For instance, let us take the basic structure of English clauses – where the general rule is that a subject is followed by a verb (which may in turn be followed by other elements of the clause). How would Tomasello's approach account for the learning of this structure? Initially, the child learns to use combinations of subject with verb simply by hearing and imitating concrete examples of utterances containing a subject and verb. At this stage, the child doesn't know that there is any such thing as a 'subject' or a 'verb' – it is all just words. But over time, the child will start to notice formal and functional similarities between various utterances of this type that they have learned. They will notice, for instance, similarities among sets of utterances which contain the same second element, but with different initial elements. Thus they will come to understand that the second word that unites this set of utterances has a slot in front of it, into which a whole range of other words can be inserted.

Given time, they will come to possess a range of these 'word-plus-slot' structures – but critically, their knowledge at this stage is **item-based**. They do not yet understand that there is a single general 'subject-plus-verb' construction: rather, they know a number of different item-based constructions, each with a different verb at the core of it. Subsequently, by a process of **analogy** based on noticing the similarities among the different item-based constructions, over time these structures are grouped together as instances of the same abstract 'verb-plus-subject' structure. In this way, the inventory of constructions that make up adult grammatical knowledge is gradually acquired. At the same time, the basic cognitive skill of **distributional analysis** – learning based on the positions in which different words do and do not occur – allows the child to work out categories of words in the language they are

acquiring. For example, the child might notice that there exists a category of words that can go into the abstract 'subject' slot – not every word they know appears in that slot in the utterances they have observed. In this way a category roughly equivalent to the category of nouns in adult language can be acquired. Over time, as the child grows and learns, the fully abstract grammatical word-classes of noun, verb, adjective and so on will emerge

When we look at all the empirical studies that have been done over the last 30 years to investigate children's acquisition of grammar, particularly syntax, we see that there is quite a lot of evidence suggesting that children do in fact learn language in an item-based way, as Tomasello's theory proposes. For instance, in experiments, young children who are able to use certain syntactic structures with verbs they already know – such as the subject-plus-verb structure, or subject-verb-object, and so on – often cannot extend this knowledge to made-up verbs which they are taught during the experiment. This strongly suggests their knowledge of these constructions is indeed item-based early on: we adults, of course, have no problem instantly extending all the verb-based constructions we know to any new verb we might learn. Moreover, as we have seen in Advances Box 37.2, there can be differences among children's acquisition of language depending on their input – that is, the usage they observe – exactly as we might expect if a usage-based account were broadly correct.

The innate cognitive skills that are called upon in Tomasello's theory – such as the **theory of mind** that enables intention reading, or the analogical thinking and distributional analysis that make the learning of grammar possible – are not specific to language. Rather, they are domain-general, and we know that human beings have these skills based on psychological research into other aspects of human thought. This allows Tomasello to explain language acquisition without positing an innate ability that is specifically for learning language.

37.4. Modern methods: large-scale data analysis

Investigating how children learn English is a painstaking and laborious process for the linguist or psychologist. First, access to children of appropriate age and language background must be arranged. Then recordings must be made, which must then be transcribed. Transcription even of adult speech is a difficult process; with child speech, many of the problems are exacerbated because, especially in the earlier stages, children's speech may be wholly or partially unclear. Then the data must be analysed, which (depending on the extent of the transcriptions) may take months or years.

Because of these difficulties, a lot of the basic work on child language acquisition was based on rather few children. The very earliest studies were 'diary studies', typically involving a linguist making regular notes on their own child's language learning. Later studies were based on wider samples, but the numbers were still usually low. For instance, Roger Brown's classic study (Brown 1973), which – as we saw above – laid much of the foundation of our knowledge of how English grammar is learnt, was based on the analysis of just three children.

However, just as modern computer technology has revolutionized the study of English in general, in the form of corpus linguistics, so too has it revolutionized the study of child language. This revolution has largely been made possible by the **CHILDES** initiative, pioneered by Brian MacWhinney (2000). CHILDES (*Child Language Data Exchange System*) is a large database of transcripts of children's speech. These transcripts have been contributed by many different researchers over a period of many years. All were created,

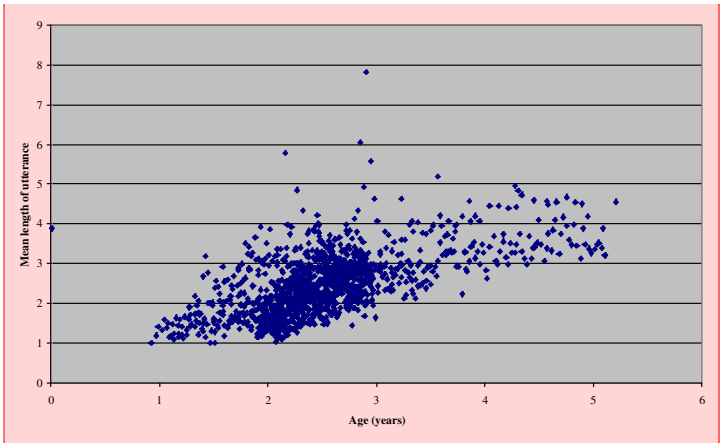
originally, by the painstaking methods described above. However, by adding their transcripts to the CHILDES database, researchers make it possible for others to use their data. By bringing together data contributed by different researchers, CHILDES makes it possible to investigate child language on a truly massive scale.

The advantage of computer-based investigation is that we can reliably analyse massive amounts of data at high speed. Another important contribution of the CHILDES project has been the creation of a piece of corpus-analysis software, CLAN, which is specifically designed for the analyses that child language researchers most often wish to carry out. It has also been designed to work with the file format of the CHILDES database. In the remainder of this chapter, we will outline a very simple example of the kind of study that can be done using the massive amounts of data in CHILDES and the CLAN program for swift, large-scale analysis of the language of young children.

We took three of the largest datasets from the CHILDES database: the *Manchester* transcripts from Theakston et al.'s (2001) study, the data from Brown (1973), and the *Providence* transcripts from the study of Demuth et al. (2006). Between them, these contain 1,381 transcripts, based on recordings of 21 different children (some learning British English and some American English). Using the CLAN program, we extracted two measures of a child's level of language production. The first, the 'mean length of utterance' or MLU, was introduced by Brown (1973) and measures the average number of morphemes in a child's utterances in a text. As such it is a good measure of grammatical complexity (as more complex sentences are usually longer). The second measure is a statistic called D, introduced by Malvern and Richards (1997). D indicates how diverse the child's vocabulary is, and thus tells us how advanced their lexical development is. I compiled the results from CLAN into a table like Table 37.2, with one row for each transcript.

Mean length of utterance	Vocabulary diversity score	Age in years
2.097	69.63	2.26
2.143	83.73	2.30
2.334	84.04	2.34
…	…	…

Table 37.2 Example of data extracted for three of the texts.



Comment [AH1]: For this graph and the two following, please use the versions of the images that appeared in the typeset 1st edition.

Figure 37.1 Mean length of utterance and age of child in 1,381 CHILDES transcripts

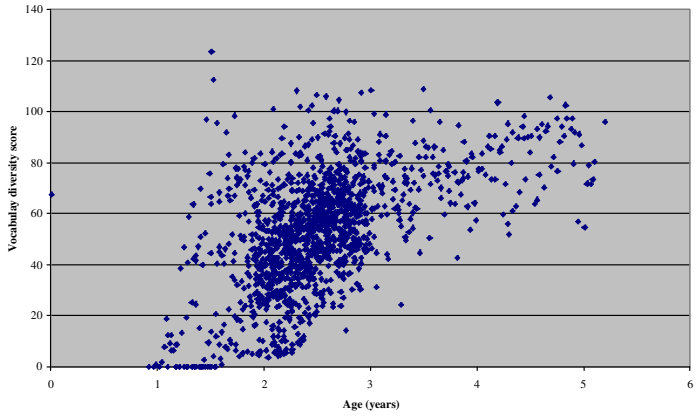


Figure 37.2. Vocabulary diversity and age of child in 1,381 CHILDES transcripts

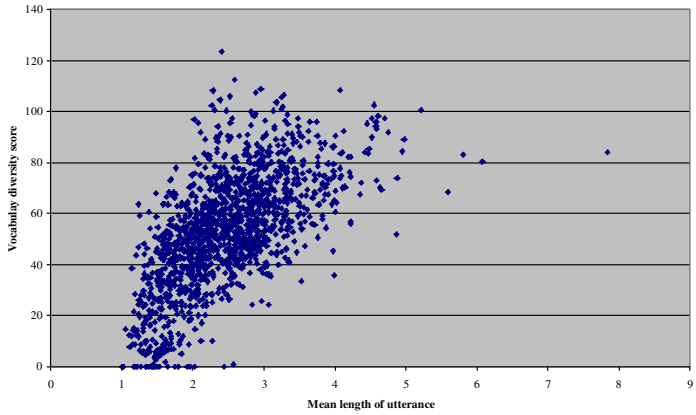


Figure 37.3. Mean length of utterance and vocabulary diversity of child in 1,381 CHILDES transcripts

We were then able to generate the graph in Figure 37.1, comparing MLU to age. The points form an upward line, as we would expect, but the important thing to note here is how much variation there is in MLU among transcripts of children at the same or similar ages. Remember that there are only 21 different children in the data. What these results suggest is that the MLU of any given child can vary a lot from occasion to occasion! Figure 37.2 is a similar graph comparing vocabulary diversity to age. We can see a similar general upward trend, but with even greater variability, especially at earlier ages. Finally, Figure 37.3 compares MLU and vocabulary diversity. We can see from the way these two measures correlate that these two types of linguistic progress mostly go hand-in-hand – as, perhaps, we would expect. However, again there is much variation, and as the two statistics increase, the variability rises.

This analysis is not particularly ‘original’ in terms of what was measured, or in terms of the

findings. But it is 'original' in the sense that we worked out these figures for the first time when writing this chapter. It took a few hours, and if you wanted to do something similar yourself, all you would need is an everyday computer, an Internet connection, and some time to practise.[2] The CLAN tool, and the entire CHILDES database itself, are freely available for download on the Web.[3] Despite its simplicity, however, this analysis clearly demonstrates what a great change the CHILDES initiative has wrought to the range of possibilities now open to the child language researcher.

Recommended readings

There is a range of excellent introductions to the field of language acquisition. These include Brooks and Kempe (2012), Rowland (2014), and Clark (2016). A more advanced-level account is given by Ambridge and Lieven (2011), a book especially notable for its detail in describing and discussing primary research, and comparing in depth the different theories that this chapter introduced. Recent collections of key research papers include Tomasello and Bates (2001) and Lust and Foley (2004). The two sides of the (occasionally heated) debate over Chomsky's theory are well-represented by Pinker (1994) and Sampson (2005). For more on the view of language acquisition which emphasizes input from the caregiver, see Snow and Ferguson (1977). Finally, the *Journal of Child Language* is one of the major avenues for the publication of new research in this area.

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Comment [AH2]:

GREEN HIGHLIGHT: reference added in the new version.

RED HIGHLIGHT: reference that was used in the old version, but has been removed from the new version (and should therefore prob be removed from the book's bibliography)

Note also: I have corrected some formatting shortcomings in one or two of the refs that are neither green nor red – but these may already have been fixed at proof stage in the actual book as printed.

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[1] These two examples are from Braine (1976).

[2] CLAN is controlled by typing commands in a special format. The commands used for this analysis were as follows:

mlu +t*CHI *FILENAME*

vocd +t*CHI +r6 +s"*-%%" *FILENAME*

where *FILENAME* stands for the name of the computer file containing the transcript being analysed. If you do wish to try this yourself, we recommend starting with just one transcript, then moving on to a group of a dozen or so files.

[3] The web address of the CHILDES project is http://childes.psy.cmu.edu/ .