

# State of the art: Language acquisition

**M**ANY would argue that using language is an ability unique to humans. It is a central component to all our lives and is especially important in allowing children to learn so much and so extensively about their world. Despite this, there still remains controversy about how children are able to acquire language so quickly, given the immaturity of their other cognitive abilities and the lack of formal tuition. In this review, I will discuss the main ideas about the way children master the grammar of their mother tongue.<sup>1</sup>

A long-standing focus of debate is whether information from the environment can assist language acquisition — most psychologists will have been exposed to this argument in one form or another. The debate has sometimes been portrayed as being between those who deny and those who support the role of the environment.

Current discussions centre on whether the environment does anything more than provide examples of speech that are then analysed by language-specific processors in the brain. There are also related discussions of whether cross-linguistic evidence supports the idea that these processes are applicable to all human language.

Most investigators now accept that innate dispositions play a vital part in human language acquisition. But there continues to be controversy about whether children's environment plays more than a minor part in the development of language.

Here, I will examine children's language-learning environment and the ways it might help acquisition, then I will look at Chomskian perspectives and finally evaluate connectionist ideas.

## The language-learning environment

Numerous studies have shown how child directed speech (CDS, sometimes called 'motherese' or baby talk) is simplified when compared to adult-to-adult speech. Simplified CDS is found in many language groups (ranging from Apache to Arabic; Ferguson, 1964), and even four-year-olds use simplified CDS with an infant (Shatz & Gelman, 1973).

DAVID MESSER *looks at the continuing controversies.*

It also seems that CDS is very well adapted to infant capacities, and infants prefer to listen to CDS than to other speech (Fernald, 1991).

The general findings are that CDS is slower, more repetitive, with shorter utterances and a restricted vocabulary, and is grammatically less complex (Dockrell & Messer, 1999). All these characteristics should make the speech easier to process and the grammar easier to acquire (see below).

*How you today?  
How are you feeling?  
What do you see there?  
You like that teddy.  
Yes, it's your favourite.*

An important question is whether any of these simplifications assist language development — and there is still no consensus about the answer.

A number of studies have tried to discover whether mothers who make more simplifications to their speech have children whose language is more advanced. However, the findings are mixed (see Messer, 1999). Some studies report positive correlations between CDS and later speech, but more fail to find such a relationship. Also, because these studies are not experiments and because of other methodological problems, it is difficult to be sure whether there is a causal relation between CDS and children's language acquisition.

There have been claims that, in some cultures, children do not receive CDS in the simplified form common in middle-class families of the West. If this is true, CDS cannot be necessary for language acquisition. Particularly notable are cross-cultural studies by Ochs & Schieffelin (1995) and a study of rural Afro-American families by Heath (1989).

Snow (1995) has countered that while some features of CDS may be absent in some cultures, it remains to be established whether there are cultures that totally fail to modify speech in ways that could help children to acquire language. Furthermore, in discussing cross-cultural findings, Ochs and Schieffelin (1995) have argued that CDS needs to be considered in relation to cultural beliefs about childrearing. They suggest that taking part in a community's everyday social activities provides the basis for shared understanding and language development.

Another controversial topic concerns whether social interaction provides specific information that helps children correct their own grammatical mistakes. A classic study by Brown and Hanlon (1970) examined adults' reactions to children's ungrammatical speech. They found overt correction of grammatical errors was very rare. If a child said 'he goed', adults were likely to accept this and not reply 'that's incorrect, you should say he went'.

The finding that children's mistakes go uncorrected has often been interpreted as indicating that children need to access innate sources of information to make language acquisition possible, because their mistakes would go unchallenged.

Studies in the 1980s confirmed Brown and Hanlon's observations, but also revealed more subtle reactions. In general, the findings indicate that, when children make a grammatical mistake, adults are more likely to produce an expansion. This usually involves the adult supplying a grammatically correct version of the child's utterance or a follow-up question (see Saxton, 1997).

*Child: He SHOOTED the fish*

*Adult: He SHOT the fish!*

*Child: I'm the scarecrow and I can BEAT UP you*

*Adult: I can BEAT YOU UP!*

*Child: Do you know how Big Foot was BORNED?*

*Adult: No, how was he BORN?*

(from Saxton, 1997; p.145)

The studies found that when a child's utterance is grammatically correct, then adults are more likely to continue the topic of conversation.

Interestingly, in non-Western cultures a wider range of reactions have been observed to children's grammatical errors, such as caregivers asking the child to imitate their own correct model utterances (Ochs & Schieffelin, 1995).

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It has been claimed that these reactions can enable children to identify grammatically incorrect utterances. But such claims have been rejected by others, who argue that the probabilistic nature of this feedback means that children would have to store a vast amount of information about their own utterances and adults' replies to identify whether a particular utterance is grammatically correct (Morgan & Travis, 1989; Pinker, 1989). These arguments have some force and do not seem to have been effectively countered.

A different perspective about these adult reactions has been provided by Saxton (1997). He argues that children learn from adult expansions because they are given an immediate 'contrast' between their own incorrect speech and the 'correct' adult utterance. In other words, the expansions provide mini-learning sessions for the child.

Supporting evidence comes from the finding that children are more likely to repeat an adult expansion than other utterances, indicating that they are processing the information (Farrar, 1992). Saxton's own experiments are also supportive. Consequently, this work suggests an extremely interesting mechanism for the way children might benefit from adults' reactions. However, there are still uncertainties about the

general significance of these specific processes.

Another body of research has examined whether non-verbal aspects of social interaction help children learn new words.

For a long time it has been recognised that adult speech is usually about an object that the young child is looking at, or which the adult or child is handling (Collis, 1977; Messer, 1978). A number of experimental investigations confirm that links between speech and visual attention help children to develop their vocabulary (e.g. Tomasello & Farrar, 1986; Tomasello & Kruger, 1992).

For example, if carers diligently name objects that are the visual focus of the child's interest, this will aid the later comprehension of the word. Thus, the social structure of children's environment seems to play a part in the acquisition of vocabulary (see Messer, 1997).

If language acquisition can be aided by the linking of speech with relevant non-linguistic information, what happens when certain forms of sensory input are not available? One might think that, if speech input or other sensory experiences are restricted, language development would be delayed. A debate between Chomsky and Piaget resulted in the former predicting that blind children would acquire language with

little difficulty, whereas Piaget maintained the opposite.

Research findings tend to support Chomsky, in that children who are blind (and have no other disabilities) acquire many features of language at about the same rate as sighted children. Similarly, children who are deaf and have deaf parents acquire sign language at a similar rate to hearing children's acquisition of spoken language. Other studies have reported that hearing children of deaf parents, who may hear as little as 10 hours of speech a week, do not seem to lag behind children with more extensive linguistic experience (see Dockrell & Messer, 1999).

It is important to make clear, however, that the lack of sensory input does affect some features of language use. But these are often subtle effects that can be partly attributed to the nature of the input. For instance, blind children tend to have few words referring to animals in their early vocabulary.

One interpretation of these findings is that being exposed to appropriate linguistic information is sufficient for language acquisition to take place. However, it may be a mistake to draw such a conclusion too quickly. For example, there are reports of children whose main source about a language is television. This is either because their parents are deaf or because the children have been watching cartoons from a different country. In these cases, the children make little or no progress with the language they hear (Sachs & Johnson, 1976; Snow, 1977).

Another example is that of twins, who are often delayed in their initial acquisition of language, although they usually catch up with their peers by school entry. One explanation of the delay is that twins may hear the same amount of speech as other children, but only half the speech they hear is linked to their own activities and interests. So it could be that the lack of an association between speech and context impedes language development.

Furthermore, it can be argued that language acquisition in children who are blind does not occur by processing a disembodied stream of speech, but by caregivers adapting their speech to objects a child is engaged by. In this way, adult speech is matched to children's attention and interests.

From this diverse set of findings, it is possible to discern two interrelated themes. One is that non-linguistic information and experiences can contribute to language

acquisition, by providing a context in which adults' speech can be understood and interpreted. Another theme is that the way speech is linked to other activities plays an important part in acquiring vocabulary.

But, what has been lacking from these two perspectives is a detailed account of the way that environmental processes enable children to master the complex grammatical rules that make up every human language.

For this reason, increasing interest is being paid to the possibility that children may start to use language in a more limited way than has been commonly supposed. This work suggests that children's early multi-word utterances reflect the most frequent arrangement of these words in the speech they hear, and that it takes some time before children master the full complexity of adult language.

Thus, Tomasello has proposed the idea of 'verb islands' where children learn the way particular verbs are used. But they do

not immediately apply grammatical principles associated with these verbs in a general manner, as might be predicted if they had acquired a grammatical rule (Tomasello, 1992; Akhtar & Tomasello, 1997).

Similar ideas are contained in the work of Lieven, Pine and their colleagues (e.g. Pine & Lieven, 1997). They suggest that children's early language is less flexible than might be supposed if they had acquired general grammatical rules. These ideas, as we will see in the next section, contrast with those who see language acquisition as a process of acquiring formal rules.

### Grammatical rules as an inherited capacity

Although linguistic models about the acquisition process have changed over the last 40 years, a common feature has been that children must have access to some inherited form of information which allows them to acquire the grammar of any human language.

Many of you will have come across proposals about a language acquisition device (LAD) that enables children to identify the grammatical rules in the speech they hear. These ideas have been superseded by 'government and binding theory' (from a book title by Chomsky) or 'principles and parameters theory' (PPT, which refers to the elements of the theory). The two terms usually refer to the same set of ideas.

Chomsky's theory assumes that some features of language are universal (e.g. it is thought that all languages contain nouns). It also assumes that other features involve grammatical differences between languages which involve parametric variation. For example, English sentences typically have a subject-verb-object order, whereas Japanese has a subject-object-verb order.

In the process of acquiring language, children are believed to identify the correct parameter (i.e. correct grammatical rules) from hearing relevant examples in adults' speech. At first, this was seen as similar to

setting a switch to one of several positions, much as you might switch a light on or off.

Thus, children acquiring English would have a parameter set for subject-verb-object order, whereas children acquiring Japanese would have a parameter set for subject-object-verb. In other words, children are supposed to match the language they hear with internal grammatical structures that they already possess. Discovering a match allows children to start to use the relevant grammatical rule.

This is the process termed 'parameter setting'. As there is a large number of dimensions on which languages vary, it is supposed that a number of related grammatical features of a language will be used once a parameter is set.

It is well established that children's early speech is not grammatically correct and that their language develops over time. To account for these phenomena, two lines of argument have been developed within the parameter setting approach.

In one case, it is supposed that all the principles and parameters are available from the very beginning, but peripheral problems (such as identifying parts of speech and memory limitations) prevent children from using this knowledge. When these peripheral problems are overcome, children's language advances (Clahsen, 1992). This is sometimes known as the continuity hypothesis.

An alternative hypothesis is that children do not initially have access to all their inherited linguistic knowledge, but this becomes available as children become older (Felix, 1992). This has been termed the maturation hypothesis.

There continue to be arguments about which of these models provides the best description of children's language development.

Research into PPT has often involved finding out when children are able to use a particular grammatical form. It is supposed that this establishes the age at which a parameter is set. However, sceptics argue that while such data provide descriptive information, they do not establish whether this was due to parameter setting.

More convincing support could come from cross-linguistic similarities in the grammatical forms that children learn. Following this line of reasoning, there have been proposals that the early telegraphic speech of English-speaking children might be similar to Italian. This is because the telegraphic speech of English children (e.g. 'want juice') and that of Italian adults

allow the absence of a subject (the equivalent of 'am going to the cinema' is grammatically acceptable in Italian). One explanation is that English-speaking children mistakenly set a parameter which involves leaving out the subject of an utterance.

Maratsos (1998), in reviewing this and similar research, has come to the conclusion that finding examples indicating that the same parameter is set in different languages has been remarkably difficult. For example, although both telegraphic speech of English children and Italian adult speech allows the absence of a subject, only Italian verbs have endings that identify the subject of the sentence.

There are other areas of difficulty for PPT. One is to explain the acquisition of sign languages, which seems to necessitate identifying linguistic structure in speech and in hand movements, and matching this input to a set of universal grammatical principles. Another is about the way bilingual children are able to acquire two or more languages, and whether the same parameter can be set in different positions for two languages at the same time.

PPT has been very influential. Advocates of the theory see it as providing a framework for understanding language acquisition and as indicating a direction for research. They argue that it gives a coherent theory about the acquisition of grammatical rules that is lacking in most other approaches. Furthermore, it makes sense that humans have a set of cognitive operations that allow them to acquire any human language.

In contrast, critics have serious concerns about the neurophysiological plausibility of PPT. They find it difficult to believe that the brain possesses a considerable amount of specific innate information that can all be set in operation merely by hearing the speech of others.

In response to these and other worries, there has been a new generation of explanations, with Chomsky's (1995) proposals about minimalism being very influential. Many previous theories have supposed that grammatical representations are independent of the lexicon (the vocabulary of a language), as this contains mainly semantic information. The newer explanations suggest that many aspects of grammar, such as whether a verb is transitive, are contained in the lexicon.

This is an important move away from the idea that grammatical rules exist as abstract representations unconnected to the lexicon. It also involves a move towards the 'minimal' use of general grammatical rules

This view also seems to mean a shift away from modular conceptions of linguistic functioning, where grammar is processed by separate brain mechanisms from other aspects of cognition (see also Maratsos, 1998; Bates & Goodman, 1997). The shift will have many implications for the way language acquisition is conceptualised; and, interestingly, it brings linguistic perspectives nearer to the connectionist approach.

### Connectionist networks

PPT involves the idea that there are special cognitive operations specific to language. A contrasting viewpoint involves connectionist networks, neural networks, and parallel distributed processes (the terms are often used interchangeably). This centres round the idea that language acquisition is just one of many cognitive advances that take place because of general learning mechanisms (see Plunkett *et al.*, 1997).

The connectionist approach uses computer programmes designed to mimic the information processing in the brain (but not necessarily the brain's structure). These systems often involve many interconnections between an input message and some form of output.

In studies of language acquisition, computers are usually given speech concerning a specific aspect of grammar. For instance, they might be given verbs in the present tense and have to learn to produce the past tense.

The computer is given speech that has been converted by some means to a numeric form. At first, it makes random connections between the 'input' (e.g. the present tense of a verb) and a range of outputs (e.g. various possible past tense forms).

After this 'guess', the computer is usually given information about whether its response was correct or incorrect. Typically, if the response is correct, the tendency to produce that response and related ones is strengthened. If the response is incorrect, the tendency is weakened (both these responses involve a process known as backpropagation).

Computers are 'trained' by being repeatedly provided with feedback about their responses to the input. Such training has enabled computers to learn various features of language, such as the past tense of verbs.

It is not so surprising that connectionist networks learn to produce regular past tense forms by adding '-ed' to a verb. What

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Language acquisition needs to be seen in relation to the more general process of socialisation

is more surprising is that networks can also learn to produce irregular forms (e.g. 'went') when given speech similar to that to and from children. The reason seems to be that irregular verbs are very common in speech; as a result there are more opportunities to learn these idiosyncratic forms. For instance, think how often we use the irregular verbs 'be' (was/were), 'can' (could) and 'go' (went).

It should be emphasised that few people claim the computer programmes exactly imitate children's language acquisition. Rather, the work is concerned with whether innate processes are needed and whether the frequency of grammatical forms in CDS enables the learning of both regular and irregular forms.

This and other research has challenged PPT in several ways (see Plunkett, 1995). Firstly, the learning mechanisms are not specialised for language; these are general learning processes that can be used to model linguistic and non-linguistic cognitive processes. Secondly, the computer does not contain any linguistic rules (all the learning is in terms of mathematical adjustments that govern the

choice of output); yet the computer behaves as if it were governed by rules. Thirdly, there is no specific innate knowledge of the rules of grammar supplied to the computer.

Thus, it would seem that non-specialised but sophisticated learning systems can acquire rules in a very different way to PPT.

More recent connectionist research has emphasised that language emerges as a product of basic, but innate, associative capacities to process information and that this is supported by how grammatical forms are distributed in a child's environment (Plunkett *et al.*, 1997). As a result, language acquisition can take place because of the combination of both these factors.

However, two serious issues need to be resolved before connectionist accounts can provide a convincing general account of language acquisition. The first is that most connectionist networks are given feedback about the correctness of every single response that they make. But, as has already been discussed, this does not occur with children.

An idea that goes some way to overcoming this objection supposes that children, as they listen to speech, make predictions about what will come next. In this way, they are given the correct version of language in relation to their predictions. However, as yet we have no evidence that children actually do this.

The other issue is that most connectionist modelling involves a single linguistic form (e.g. past tense), and speech given to the computer is usually selected by the researcher to contain only these forms. Children, on the other hand, seem to learn a number of linguistic forms at the same time (e.g. tense, plurals, word order, etc.). It remains to be established whether connectionist systems can be devised to deal with a much higher level of complexity in the input and output.

## Conclusions

There is a strong case that the way the environment is structured plays an important role in children's acquisition of vocabulary, both in terms of the speed of acquisition and the specific words that are acquired. There also are powerful arguments that language acquisition needs to be seen in relation to the more general process of socialisation. However, few would now argue that the special social environment adults create for children by itself makes language acquisition possible.

Recent proposals suggest there may be intermediate steps before children identify the full complexity of the rules of adult grammar. Investigators such as Tomasello believe that children's initial multi-word use may depend on a very limited understanding of how words are combined; and the full understanding of grammatical principles is a long, gradual process.

These ideas contrast with PPT, which claims that children quickly acquire general grammatical principles through a process of parameter setting. However, it is interesting that Chomsky's new proposals about 'minimalism' involve less emphasis on general grammatical principles and more on the lexicon.

Connectionism also has challenged orthodox ideas. This research has shown that rule-like behaviour may occur without rules being present in any part of the production system. It has alerted us to the way that the acquisition of regular and irregular forms may be a product of the distribution of these forms in the speech that children hear.

A characteristic of recent research is that more attention is being paid to how adults actually speak to children, and to the speech that is actually produced by children. This is providing the basis for new proposals about the way that adults' speech input provides a basis for children's speech output. All this gives us cause for optimism that genuine progress can be made in understanding how children's speech develops and the mechanisms that underlie this process.

For too long, research has been influenced by grand theories. Instead, we need to spend more time watching and listening to children.

## Note

<sup>1</sup> If we were to follow psycholinguistic terminology, this would be a discussion about morpho-syntax (that is, the way a language is organised in terms of word order and linguistic elements). However, in common usage, grammar refers to this aspect of language, and I use the word in this way.

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