UNIT 1 LANGUAGE ACQUISITION

Structure

1.0 INTRODUCTION

People talk or use language incessantly. Language, to cognitive psychologists, is a system of communication in which thoughts are transmitted by means of sounds (as in speech and music) or symbols (as in written words and gestures). As you read this text, you are engaging in one of the mind's most enchanting processes – the way one mind influences another through language. In this process, some cell assemblies in your brain are permanently changed, new thoughts are made, and, in a very real sense, you are changed.

Cognitive psychology concerns both language and thought and has been popular only since the 1950s. Before that, many psychologists believed that the scientific method could not be applied towards the study of a process as private as thinking. From ancient Greek times, only philosophers and metaphysicians studied the nature of language and thought. The metaphysician René Descartes, for example, famously argued, "I think, therefore I am."

Today, thanks to increasingly sophisticated tools for studying brain activity, cognitive psychology is a thriving science. Cognitive psychologists explore such questions as how language affects thought, whether it is possible to create a "thinking" machine, and why humans are motivated to create art.

1.1 OBJECTIVES

After reading this unit, you will be able to:

- Define and elucidate the concept of language;
- Describe language and cognition;
- Explain theories of language acquisition and their limitations; and
- Explain biology of language acquisition.

1.2 LANGUAGE AND COGNITION

The study of human language is important to cognitive psychologists for the following reasons:

- Human language development represents a unique kind of abstraction, which is basic to cognition. Although other forms of life (bees, birds, dolphins, dogs and so on) have elaborate means of communicating and apes seem to use a form of language abstraction, the degree of abstraction is much greater among humans.
- Language processing is an important component of information processing and storage.
- Human thinking and problem solving can be conceptualised as processes involving language. Many, if not most, forms of thinking and problem solving are internal, that is, done in the absence of external stimuli. Abstraction of puzzles, for example, into verbal symbols provides a way to think about a solution.
- Language is the main means of human communication, the way in which most information is exchanged.
- Language influences perception, a fundamental aspect of cognition. Some argue that how we perceive the world is affected by the language we use to describe it. On the other hand, language development is at least largely based on our perception of language. So the perceptual-language process is one of interdependency; both significantly influence the other. Language from this point of view operates as a window.

The processing of words, speech, and semantics seem to engage specific cerebral areas and thus provide a meaningful link between neuro anatomical structures and language. In addition, the study of pathology of the brain has frequently shown manifest change in language functions, as in the case of aphasia.

1.3 LINGUISTICS

The study of linguistics is the formal description of the structure of language, including a description of speech sounds, meanings, and grammar. Language as

studied by linguists tends to be competency based (dealing with some ideal potential of the speaker-listener), while psychologists generally view language in terms of performance, or how humans use language. The discipline that incorporates both approaches to the study of language is called psycholinguistics.

1.3.1 The Structure of Language

Language is a system of symbols and rules that is used for meaningful communication. A system of communication has to meet *certain criteria* in order to be considered a language:

A language uses symbols, which are sounds, gestures, or written characters that represent objects, actions, events, and ideas. Symbols enable people to refer to objects that are in another place or events that occurred at a different time.

A language is meaningful and therefore can be understood by other users of that language.

A language is generative, which means that the symbols of a language can be combined to produce an infinite number of messages.

A language has rules that govern how symbols can be arranged. These rules allow people to understand messages in that language even if they have never encountered those messages before.

1.3.2 The Building Blocks of Language

Language is organised hierarchically, from phonemes to morphemes to phrases and sentences that communicate meaning

Phonemes are the smallest distinguishable units in a language. In the English language, many consonants, such as *t, p,* and *m,* correspond to single phonemes, while other consonants, such as *c* and *g,* can correspond to more than one phoneme. Vowels typically correspond to more bonhomie. For example, *o* corresponds to different phonemes depending on whether it is pronounced as in *bone* or *woman*. Some phonemes correspond to combinations of consonants, such as *ch, sh,* and *th*.

Morphemes are the smallest meaningful units in a language. In the English language, only a few single letters, such as *I* and *a*, are morphemes. Morphemes are usually whole words or meaningful parts of words, such as prefixes, suffixes, and word stems.

Example: The word "disliked" has three morphemes: "dis," "lik," and "ed."

Syntax is a system of rules that governs how words can be meaningfully arranged to form phrases and sentences.

Example: One rule of syntax is that an article such as "the" must come before a noun, not after: "Read the book," not "Read book the."

1.4 LANGUAGE ACQUISITION

Language acquisition is one of the central topics in cognitive science. Every theory of cognition has tried to explain it; probably no other topic has aroused such controversy. Possessing a language is the quintessentially human trait: all

normal humans speak, no nonhuman animal does. Language is the main vehicle by which we know about other people's thoughts, and the two must be intimately related. Every time we speak we are revealing something about language, so the facts of language structure are easy to come by; these data hint at a system of extraordinary complexity. Nonetheless, learning a first language is something every child does successfully, in a matter of a few years and without the need for formal lessons. With language so close to the core of what it means to be human, it is not surprising that children's acquisition of language has received so much attention. Anyone with strong views about the human mind would like to show that children's first few steps are steps in the right direction.

In the past, debates about the acquisition of language centered on the same theme as debates about the acquisition of any ability – the nature versus nurture theme. However, current thinking about the language acquisition has incorporated the understanding that acquiring language really involves a natural endowment modified by environment (Bates and Goodman, 1999; Dehaene-Lambertz, Hertz-Painter & Dubois, 2006; Lightfoot, 2003; Maratos, 2003). For example, the social environment, in which infants use their social capacities to interact with others, provides one source of information for language acquisition (Snow, 1999; Tomasello, 1999). Thus the approach to studying language acquisition now revolves around discovering what abilities are innate and how the child's environment tempers these abilities. This process is aptly termed innately guided learning (see Elman & associates, 1996; Jusczyk, 1997).

Before examining the various theories of language acquisition, let's take a look at a series of stages that seem to be universal in language acquisition.

1.4.1 Stages of Language Acquisition

Around the world, people seem to acquire their primary language in pretty much the same sequence and in just about the same way. Research on speech perception finds the same overall pattern of progression. They develop from more general to more specific abilities. That is, as infants we are initially able to distinguish among all possible phonetic contrasts. But over time we lose the ability to distinguish nonnative contrasts in favor of those used in our native language environment (see Jusczyk, 1997). Infants have remarkably acute language-learning abilities. They show these abilities even from an early age (Marcus et al., 1999; Pinker, 1997, 1999).

Within the first few years of life, we humans seem to progress through the following stages in producing language:

Cooing, which comprises of vowel sounds mostly. Cooing is the infant's oral expression that explores the production of vowel sounds. The cooing of infants around the world, including deaf infants, is indistinguishable across babies and languages. Infants are actually better than adults at being able to discriminate sounds that carry no meaning for them (Werker, 1989). They can make phonetic distinctions that adults have lost. During the cooing stage, hearing infants also can discriminate among all phones, not just phonemes characteristic of their own language.

Babbling, which comprises consonant as well as vowel sounds; to most people's ears, the babbling of infants growing up among speakers from different language

groups sounds very similar (Oller & Eilers, 1998). At the babbling stage, deaf infants no longer vocalise. The sounds produced by hearing infants change. Babbling is the infant's preferential production largely of those distinct phonemes-both vowels and consonants— that are characteristic of the infant's own language (Locke, 1994).

One-word utterances; these utterances are limited in both the vowels and the consonants they utilise (Ingram, 1999). Eventually, the infant utters his or her first word. It is followed shortly by one or two more. Soon after, yet a few more follow. The infant uses these one word utterances — termed holophrases — to convey intentions, desires, and demands. Usually the words are nouns describing familiar objects that the child observes (example; car, book, ball, baby, toy, nose) or wants (e.g. mama, dada, milk, cookie). By 18 months of age, children typically have vocabulary of 3 to 100 words (Seigler, 1986). The young child's vocabulary cannot yet encompass all that the child wishes to describe. As a result, the child commits overextension error. An *overextension error* is erroneously extending the meaning of words in the existing lexicon to cover things and ideas for which a new word is lacking. For example, the general term for any four legged animal may be 'doggie'.

Two-word utterances and telegraphic speech. Gradually, between 1.5 to 2.5 years of age, children start combining single words to produce two-word utterances. Thus begin an understanding of syntax. These early syntactical communications seem more like telegrams than conversation. The articles, prepositions, and other functional morphemes are usually left out. Hence, linguists refer to these early utterances with rudimentary syntax as *telegraphic speech*. e.g. "want juice", doggie bite", "mommy sit". These simple pairings of words convey a wealth of information about a child's intentions and needs.

Basic adult sentence structure (present by about age 4 years), with continuing vocabulary acquisition. Vocabulary expands rapidly. It more than triples from 300 words at about 2 years of age to about 1000 words at 3 years of age. Almost incredible, by age of 4, children acquire the foundations of adult syntax and language structure. By age of 5 years, most children also can understand and produce quite complex and uncommon sentence constructions. By age of 10 years, children's language is fundamentally the same as that of adults.

Normal children can differ by a year or more in their rate of language development, though the stages they pass through are generally the same regardless of how stretched out or compressed.

1.4.2 Language Acquisition and Cognitive Science

Language acquisition is not only inherently interesting; studying it is one way to look for concrete answers to questions that permeate cognitive science. The scientific study of language acquisition began around the same time as the birth of cognitive science, in the late 1950's. The historical catalyst was Noam Chomsky's review of Skinner's Verbal Behaviour (Chomsky, 1959). At that time, Anglo-American natural science, social science, and philosophy had come to a virtual consensus about the answers to the questions listed above. The mind consisted of sensorimotor abilities plus a few simple laws of learning governing gradual changes in an organism's behavioural repertoire. Therefore language

must be learned, it cannot be a module, and thinking must be a form of verbal behaviour, since verbal behaviour is the prime manifestation of "thought" that can be observed externally.

Chomsky argued that language acquisition falsified these beliefs in a single stroke: children learn languages that are governed by highly subtle and abstract principles, and they do so without explicit instruction or any other environmental clues to the nature of such principles. Hence language acquisition depends on an innate, species-specific module that is distinct from general intelligence. Much of the debate in language acquisition has attempted to test this once-revolutionary, and still controversial, collection of ideas. The implications extend to the rest of human cognition.

1.4.3 Language and Thought

Is language simply grafted on top of cognition as a way of sticking communicable labels onto thoughts (Fodor, 1975; Piaget, 1926)? Or does learning a language somehow mean learning to think in that language? A famous hypothesis, outlined by Benjamin Whorf (1956), asserts that the categories and relations that we use to understand the world come from our particular language, so that speakers of different languages conceptualise the world in different ways.

Language acquisition, then, would be learning to think, not just learning to talk. This is an intriguing hypothesis, but virtually all modern cognitive scientists believe it is false (see Pinker, 1994a). Babies can think before they can talk.

Cognitive psychology has shown that people think not just in words but in images and abstract logical propositions. Language acquisition has a unique contribution to make to this issue. As we shall see, it is virtually impossible to show how children could learn a language unless you assume they have a considerable amount of nonlinguistic cognitive machinery in place before they start.

1.5 THEORIES OF LANGUAGE ACQUISITION

How do we explain children's course of language acquisition — most importantly, their inevitable and early mastery? Several kinds of mechanisms are at work. As we will see in the next section, the brain changes after birth, and these maturational changes may govern the onset, rate, and adult decline of language acquisition capacity. General changes in the child's information processing abilities (attention, memory, short-term buffers for acoustic input and articulator output) could leave their mark as well. Language acquisition is so complex that one needs a precise framework for understanding what it involves.

Over the last fifty years, several theories have been put forward to explain the process by which children learn to understand and speak a language. They can be summarised as follows: (Refer to table below)

Table 1.1: Theory and the central idea associated with author

Theory	Central Idea	Individual most often associated with theory
Behaviourist	Children imitate adults. Their correct utterances are reinforced when they get what they want or are praised	Skinner
Innateness	A child's brain contains special language learning mechanisms at birth	Chomsky
Cognitive	Language is just one aspect of a child's overall intellectual development.	Piaget
Interaction	This theory emphasises the interaction between children and their care givers.	Bruner

We shall consider each of these in turn. Before we do, it is important to recognise that they should not be seen simply as conflicting theories, replacing each other in a sequence. Although Behaviourism is now seen as offering only a very limited explanation, each theory has added to our overall understanding, placing emphasis on different aspects of the process.

1.5.1 Behaviouristic Theory

The behaviourist psychologists developed their theories while carrying out a series of experiments on animals. They observed that rats or birds, for example, could be taught to perform various tasks by encouraging habit-forming. Researchers rewarded desirable behaviour. This was known as positive reinforcement. Undesirable behaviour was punished or simply not rewarded — negative reinforcement. The behaviourist B. F. Skinner then proposed this theory as an explanation for language acquisition in humans. In *Verbal Behaviour* (1957), he stated: "The basic processes and relations which give verbal behaviour its special characteristics are now fairly well understood. Much of the experimental work responsible for this advance has been carried out on other species, but the results have proved to be surprisingly free of species restrictions. Recent work has shown that the methods can be extended to human behaviour without serious modifications." (cited in Lowe and Graham, 1998, p.68)

Skinner suggested that a child imitates the language of its parents or carers. Successful attempts are rewarded because an adult who recognises a word spoken by a child will praise the child and/or give it what it is asking for. The linguistic input was key — a model for imitation to be either negatively or positively reinforced. Successful utterances are therefore reinforced while unsuccessful ones are forgotten. No essential difference between the way a rat learns to negotiate a maze and a child learns to speak.

1.5.2 Limitations of Behaviourism Theory

While there must be some truth in Skinner's explanation, there are many objections to it.

Language is based on a set of structures or rules, which could not be worked out simply by imitating individual utterances. The mistakes made by children reveal

that they are not simply imitating but actively working out and applying rules. For example, a child who says “drinked” instead of “drank” is not copying an adult but rather over-applying a rule.

The vast majority of children go through the same stages of language acquisition. Apart from certain extreme cases, the sequence seems to be largely unaffected by the treatment the child receives or the type of society in which s/he grows up.

Children are often unable to repeat what an adult says, especially if the adult utterance contains a structure the child has not yet started to use.

Few children receive much explicit grammatical correction. Parents are more interested in politeness and truthfulness. According to Brown, Cazden & Bellugi (1969): “It seems to be truth value rather than well-formed syntax that chiefly governs explicit verbal reinforcement by parents — which renders mildly paradoxical the fact that the usual product of such a training schedule is an adult whose speech is highly grammatical but not notably truthful.” (cited in Lowe and Graham, 1998)

There is evidence for a critical period for language acquisition. Children who have not acquired language by the age of about seven will never entirely catch up. The most famous example is that of Genie, discovered in 1970 at the age of 13. She had been severely neglected, brought up in isolation and deprived of normal human contact. Of course, she was disturbed and underdeveloped in many ways. During subsequent attempts at rehabilitation, her caretakers tried to teach her to speak. Despite some success, mainly in learning vocabulary, she never became a fluent speaker, failing to acquire the grammatical competence of the average five-year-old.

1.5.3 Innateness Theory

Noam Chomsky published a criticism of the behaviourist theory in 1957. In addition to some of the arguments listed above, he focused particularly on the impoverished language input children receive. This theory is connected with the writings of Chomsky, although the theory has been around for hundreds of years. Children are born with an innate capacity for learning human language. Humans are destined to speak. Children discover the grammar of their language based on their own inborn grammar. Certain aspects of language structure seem to be preordained by the cognitive structure of the human mind. This accounts for certain very basic universal features of language structure: every language has nouns/verbs, consonants and vowels. It is assumed that children are pre-programmed, hard-wired, to acquire such things.

Yet no one has been able to explain how quickly and perfectly all children acquire their native language. Every language is extremely complex, full of subtle distinctions that speakers are not even aware of. Nevertheless, children master their native language in 5 or 6 years regardless of their other talents and general intellectual ability. Acquisition must certainly be more than mere imitation; it also doesn’t seem to depend on levels of general intelligence, since even a severely retarded child will acquire a native language without special training. Some innate feature of the mind must be responsible for the universally rapid and natural acquisition of language by any young child exposed to speech.

Chomsky concluded that children must have an inborn faculty for language acquisition. According to this theory, the process is biologically determined - the human species has evolved a brain whose neural circuits contain linguistic information at birth. The child's natural predisposition to learn language is triggered by hearing speech and the child's brain is able to interpret what s/he hears according to the underlying principles or structures it already contains. This natural faculty has become known as the Language Acquisition Device (LAD).

Chomsky did not suggest that an English child is born knowing anything specific about English, of course. He stated that all human languages share common principles. (For example, they all have words for things and actions — nouns and verbs.) It is the child's task to establish how the specific language s/he hears expresses these underlying principles.

For example, the LAD already contains the concept of verb tense. By listening to such forms as "worked", "played" and "patted", the child will form the hypothesis that the past tense of verbs is formed by adding the sound /d/, /t/ or /id/ to the base form. This, in turn, will lead to the "virtuous errors" mentioned above. It hardly needs saying that the process is unconscious. Chomsky does not envisage the small child lying in its cot working out grammatical rules consciously!

Chomsky's ground-breaking theory remains at the centre of the debate about language acquisition. However, it has been modified, both by Chomsky himself and by others. Chomsky's original position was that the LAD contained specific knowledge about language. Dan Isaac Slobin has proposed that it may be more like a mechanism for working out the rules of language:

"It seems to me that the child is born not with a set of linguistic categories but with some sort of process mechanism — a set of procedures and inference rules, if you will - that he uses to process linguistic data. These mechanisms are such that, applying them to the input data, the child ends up with something which is a member of the class of human languages. The linguistic universals, then, are the *result* of an innate cognitive competence rather than the content of such a competence" (cited in Russell, 2001).

1.5.4 Evidence to Support Innateness Theory

Work in several areas of language study has provided support for the idea of an innate language faculty. Three types of evidence are offered here:

1) Slobin has pointed out that human anatomy is peculiarly adapted to the production of speech. Unlike our nearest relatives, the great apes, we have evolved a vocal tract which allows the precise articulation of a wide repertoire of vocal sounds.

2) Neuro-science has also identified specific areas of the brain with distinctly linguistic functions, notably Broca's area and Wernicke's area. Stroke victims provide valuable data: depending on the site of brain damage, they may suffer a range of language dysfunction, from problems with finding words to an inability to interpret syntax.

3) Experiments aimed at teaching chimpansees to communicate using plastic symbols or manual gestures have proved controversial. It seems likely that

our ape cousins, while able to learn individual "words", have little or no grammatical competence. Pinker (1994) offers a good account of this research.

The formation of creole varieties of English appears to be the result of the LAD at work. The linguist Derek Bickerton has studied the formation of Dutch-based creoles in Surinam. Escaped slaves, living together but originally from different language groups, were forced to communicate in their very limited Dutch.

The result was the restricted form of language known as a pidgin. The adult speakers were past the critical age at which they could learn a new language fluently — they had learned Dutch as a foreign language and under unfavourable conditions. Remarkably, the children of these slaves turned the pidgin into a full language, known by linguists as a creole. They were presumably unaware of the process but the outcome was a language variety which follows its own consistent rules and has a full expressive range. Creoles based on English are also found, in the Caribbean and elsewhere.

Studies of the sign languages used by the deaf have shown that, far from being crude gestures replacing spoken words, these are complex, fully grammatical languages in their own right. A sign language may exist in several dialects. Children learning to sign as a first language pass through similar stages to hearing children learning spoken language. Deprived of speech, the urge to communicate is realised through a manual system which fulfils the same function. There is even a signing creole, again developed by children, in Nicaragua (Pinker, 1994).

1.5.5 Limitations of Chomsky's Theory

Chomsky's work on language was theoretical. He was interested in grammar and much of his work consists of complex explanations of grammatical rules. He did not study real children. The theory relies on children being exposed to language but takes no account of the interaction between children and their caretakers. Nor does it recognise the reasons why a child might want to speak, the functions of language.

In 1977, Bard and Sachs published a study of a child known as Jim, the hearing son of deaf parents. Jim's parents wanted their son to learn speech rather than the sign language they used between themselves. He watched a lot of television and listened to the radio, therefore receiving frequent language input. However, his progress was limited until a speech therapist was enlisted to work with him. Simply being exposed to language was not enough. Without the associated interaction, it meant little to him.

Subsequent theories have placed greater emphasis on the ways in which real children develop language to fulfil their needs and interact with their environment, including other people.

1.5.6 Cognitive Theory

The Swiss psychologist Jean Piaget (1896-1980) placed acquisition of language within the context of a child's cognitive development. He argued that a child has to understand a concept before s/he can acquire the particular language form which expresses that concept. Cognitive theory views language acquisition within the context of the child's broader intellectual development. Since the cognitive

theory of language acquisition is based on Piaget's theory of cognitive development, a brief description and understanding of this theory is must.

Piaget suggested that children go through four separate stages in a fixed order that is universal in all children. Piaget declared that these stages differ not only in the quantity of information acquired at each, but also in the quality of knowledge and understanding at that stage. He suggested that movement from one stage to the next occurred when the child reached an appropriate level of maturation and was exposed to relevant types of experiences. Without experience, children were assumed incapable of reaching their highest cognitive ability. Piaget's four stages are known as the sensorimotor, preoperational, concrete operational, and formal operational stages.

The *sensory motor* stage in a child is from birth to approximately two years. During this stage, a child has relatively little competence in representing the environment using images, language, or symbols. An infant has no awareness of objects or people that are not immediately present at a given moment. Piaget called this a lack of object permanence. Object permanence is the awareness that objects and people continue to exist even if they are out of sight. In infants, when a person hides, the infant has no knowledge that they are just out of sight. According to Piaget, this person or object that has disappeared is gone forever to the infant.

The *preoperational* stage is from the age of two to seven years. The most important development at this time is language. Children develop an internal representation of the world that allows them to describe people, events, and feelings. Children at this time use symbols, they can pretend when driving their toy car across the couch that the couch is actually a bridge. Although the thinking of the child is more advanced than when it was in the sensory motor stage, it is still qualitatively inferior to that of an adult. Children in the preoperational stage are characterised by what Piaget called egocentric thoughts. The world at this stage is viewed entirely from the child's own perspective. Thus a child's explanation to an adult can be uninformative.

Three-year-olds will generally hide their face when they are in trouble—even though they are in plain view, three-year-olds believe that their inability to see others also results in others' inability to see them. A child in the preoperational stage also lacks the principle of conservation. This is the knowledge that quantity is unrelated to the arrangement and physical appearance of objects. Children who have not passed this stage do not know that the amount, volume or length of an object does not change length when the shape of the configuration is changed. If you put two identical pieces of clay in front of a child, one rolled up in the shape of a ball, the other rolled into a snake, a child at this stage may say the snake piece is bigger because it is rolled out. Piaget declared that this is not mastered until the next stage of development.

The *concrete operational* stage lasts from the age of seven to twelve years of age. The beginning of this stage is marked by the mastery of the principal of conservation. Children develop the ability to think in a more logical manner and they begin to overcome some of the egocentric characteristics of the preoperational period. One of the major ideas learned in this stage is the idea of reversibility. This is the idea that some changes can be undone by reversing an earlier action.

An example is the ball of clay that is rolled out into a snake piece of clay. Children at this stage understand that you can regain the ball of clay formation by rolling the piece of clay the other way. Children can even conceptualise the stage in their heads without having to see the action performed. Children in the concrete operational stage have a better understanding of time and space. Children at this stage have limits to their abstract thinking, according to Piaget.

The *formal operational* stage begins in most people at age twelve and continues into adulthood. This stage produces a new kind of thinking that is abstract, formal, and logical. Thinking is no longer tied to events that can be observed. A child at this stage can think hypothetically and use logic to solve problems. It is thought that not all individuals reach this level of thinking. Most studies show only forty to sixty percent of American college students and adults fully achieve it.

Piaget's suggestion, that cognitive performance cannot be attained unless cognitive readiness is brought about by maturation and environmental stimuli, has been instrumental in determining the structure of educational curricula.

Cognitive theory of language acquisition suggests that a child first becomes aware of a concept, such as relative size, and only afterward do they acquire the words and patterns to convey that concept. Simple ideas are expressed earlier than more complex ones even if they are grammatically more complicated— Conditional mood is one of the last. Conceptual development might affect language development: if a child has not yet mastered a difficult semantic distinction, he or she may be unable to master the syntax of the construction dedicated to expressing it.

The complexity of a grammatical form has a demonstrable role in development: simpler rules and forms appear in speech before more complex ones, all other things being equal. For example, the plural marker -s in English (e.g. cats), which requires knowing only whether the number of referents is singular or plural, is used consistently before the present tense marker -s (he walks), which requires knowing whether the subject is singular or plural and whether it is a first, second, or third person and whether the event is in the present tense (Brown, 1973).

There is a consistent order of mastery of the most common function morphemes in a language. Here's an example from English: first— -ing, then *in* and *on*, then the plural -s, last are the forms of the verb *to be*. Seems to be conditioned by logical complexity: plural is simple, while forms of the verb *to be* require sensitivity to both number and tense.

A good example of this is seriation. There will be a point in a child's intellectual development when s/he can compare objects with respect to size. This means that if you gave the child a number of sticks, s/he could arrange them in order of size. Piaget suggested that a child who had not yet reached this stage would not be able to learn and use comparative adjectives like "bigger" or "smaller".

Object permanence is another phenomenon often cited in relation to the cognitive theory. During the first year of life, children seem unaware of the existence of objects they cannot see. An object which moves out of sight ceases to exist. By the time they reach the age of 18 months, children have realised that objects have an existence independently of their perception. The cognitive theory draws attention to the large increase in children's vocabulary at around this age, suggesting a link between object permanence and the learning of labels for objects.

Clearly there is some link between cognitive development and language acquisition; Piaget's theory helps explain the order in which certain aspects of language are acquired.

1.5.7 Limitations of Cognitive Theories

This theory does not explain why language emerges in the first place. Apes also develop cognitively in much the same way as young children in the first few years of life, but language acquisition doesn't follow naturally from their development. Bees develop the cognitive ability to respond to many shades of colour, but bees never develop any communication signals based on shades of color.

During the first year to 18 months, connections of the type explained above are possible to trace but, as a child continues to develop, so it becomes harder to find clear links between language and intellect. Some studies have focused on children who have learned to speak fluently despite abnormal mental development. Syntax in particular does not appear to rely on general intellectual growth.

1.5.8 Input or Integrationist Theories

In contrast to the work of Chomsky, more recent theorists have stressed the importance of the language input children receive from their care-givers. Language exists for the purpose of communication and can only be learned in the context of interaction with people who want to communicate with the person. Interactionists such as Jerome Bruner (1966,68) suggest that the language behaviour of adults when talking to children (known as child-directed speech or CDS) is specially adapted to support the acquisition process. This support is often described to as scaffolding for the child's language learning. Bruner also coined the term Language Acquisition Support System or LASS in response to Chomsky's LAD. It has been noted that the turn-taking structure of conversation is developed through games and non-verbal communication long before actual words are uttered.

Children do not hear sentences in isolation, but in a context. Many models of language acquisition assume that the input to the child consists of a sentence and a representation of the meaning of that sentence, inferred from context and from the child's knowledge of the meanings of the words

1.5.9 Limitations of Input Theories

These theories serve as a useful corrective to Chomsky's early position and it seems likely that a child will learn more quickly with frequent interaction. However, it has already been noted that children in all cultures pass through the same stages in acquiring language. We have also seen that there are cultures in which adults do not adopt special ways of talking to children, so child directed speech may be useful but may not be essential.

As stated earlier, the various theories should not be seen simply as alternatives. Rather, each of them offers a partial explanation of the process.

1.6 THE BIOLOGY OF LANGUAGE ACQUISITION

Human language is made possible by special adaptations of the human mind and body that occurred in the course of human evolution, and which are put to use by children in acquiring their mother tongue.

Most obviously, the shape of the human vocal tract seems to have been modified in evolution for the demands of speech. Our larynxes are low in our throats, and our vocal tracts have a sharp right angle bend that creates two independently-modifiable resonant cavities (the mouth and the pharynx or throat) that defines a large two-dimensional range of vowel sounds (Lieberman, 1984).

It is tempting to think that if language evolved by gradual Darwinian natural selection, we must be able to find some precursor of it in our closest relatives, the chimpanzees. In several famous and controversial demonstrations, chimpanzees have been taught some hand-signs based on American Sign Language, to manipulate colored switches or tokens, and to understand some spoken commands (Gardner & Gardner, 1969; Premack & Premack, 1983; Savage-Rumbaugh, 1991). Though artificial chimp signaling systems have some analogies to human language (e.g., use in communication, combinations of more basic signals), it seems unlikely that they are homologous. Chimpanzees require massive regimented teaching sequences contrived by humans to acquire quite rudimentary abilities, mostly limited to a small number of signs, strung together in repetitive, quasi-random sequences, used with the intent of requesting food or tickling (Terrace, Petitto, Sanders, & Bever, 1979; Seidenberg & Petitto, 1979, 1987; Seidenberg, 1986; Wallman, 1992; Pinker, 1994a). These contrasts sharply with human children, who pick up thousands of words spontaneously, combine them in structured sequences where every word has a determinate role, respect the word order of the adult language, and use sentences for a variety of purposes such as commenting on interesting objects.

This lack of homology does not, by the way, cast doubt on a gradualist Darwinian account of language evolution. Humans did not evolve directly from chimpanzees. Both derived from common ancestor, probably around 6-7 million years ago. This leaves about 300,000 generations in which language could have evolved gradually in the lineage leading to humans, after it split off from the lineage leading to chimpanzees. Presumably language evolved in the human lineage for two reasons: our ancestors developed technology and knowledge of the local environment in their lifetimes, and were involved in extensive reciprocal cooperation. This allowed them to benefit by sharing hard-won knowledge with their kin and exchanging it with their neighbors (Pinker & Bloom, 1990).

1.6.1 Maturational Changes in Brain

The maturation of language circuits during a child's early years may be a driving force underlying the course of language acquisition (Pinker, 1994; Bates, Thal, & Janowsky, 1992; Locke, 1992; Huttenlocher, 1990). Before birth, virtually all the neurons (nerve cells) are formed, and they migrate into their proper locations in the brain. But head size, brain weight, and thickness of the cerebral cortex (gray matter), where the synapses (junctions) subserving mental computation take place, continue to increase rapidly in the year after birth. Long-distance connections (white matter) are not complete until nine months, and they continue to grow their speed-inducing myelin insulation throughout childhood. Synapses continue to develop, peaking in number between nine months and two years (depending on the brain region), at which point the child has 50% more synapses than the adult. Metabolic activity in the brain reaches adult levels by nine to ten months, and soon exceeds it, peaking around the age of four. Synapses wither from the age of two through the rest of childhood and into adolescence, when

the brain's metabolic rate falls back to adult levels. Perhaps linguistic milestones like babbling, first words, and grammar require minimum levels of brain size, long-distance connections, or extra synapses, particularly in the language centers of the brain.

Similarly, one can conjecture that these changes are responsible for the decline in the ability to learn a language over the lifespan. The language learning circuitry of the brain is more plastic in childhood; children learn or recover language when the left hemisphere of the brain is damaged or even surgically removed (though not quite at normal levels), but comparable damage in an adult usually leads to permanent aphasia (Curtiss, 1989; Lenneberg, 1967).

Newport and Gleitman (1995) shows how sheer age seems to play an important role. Successful acquisition of language typically happens by 4 and is guaranteed for children up to the age of six, is steadily compromised from then until shortly after puberty, and is rare thereafter. Maturational changes in the brain, such as the decline in metabolic rate and number of neurons during the early school age years, and the bottoming out of the number of synapses and metabolic rate around puberty, are plausible causes. Thus, there may be a neurologically-determined "critical period" for successful language acquisition, analogous to the critical periods documented in visual development in mammals and in the acquisition of songs by some birds.

1.6.2 Dissociations Between Language and General Intelligence

Humans evolved brain circuitry, mostly in the left hemisphere surrounding the sylvian fissure, that appears to be designed for language, though how exactly their internal wiring gives rise to rules of language is unknown (Zurif, 2000). The brain mechanisms underlying language are not just those allowing us to be smart in general. Strokes often leave adults with catastrophic losses in language (Zurif,2000; Pinker, 1994a), though not necessarily impaired in other aspects of intelligence, such as those measured on the nonverbal parts of IQ tests.

There are also syndromes showing the opposite dissociation, where intact language coexists with severe retardation. These cases show that language development does not depend on fully functioning general intelligence. One example comes from children with Williams Syndrome, an inherited condition involving physical abnormalities, significant retardation (the average IQ is about 50), incompetence at simple everyday tasks (tying shoelaces, finding one's way, adding two numbers, and retrieving items from a cupboard), social warmth and gregariousness, and fluent, articulate language abilities (Bellugi, et al., 1990).

1.6.3 Neural Networks

Some cognitive neuroscientists have created neural networks, or computer models, that can acquire some aspects of language. These neural networks are not preprogrammed with any rules. Instead, they are exposed to many examples of a language. Using these examples, the neural networks have been able to learn the language's statistical structure and accurately make the past tense forms of verbs. The developers of these networks speculate that children may acquire language in a similar way, through exposure to multiple examples.

1.7 LET US SUM UP

The topic of language acquisition implicates the most profound questions about our understanding of the human mind, and its subject matter, the speech of children, is endlessly fascinating. But the attempt to understand it scientifically is guaranteed to bring on a certain degree of frustration. Languages are complex combinations of elegant principles and historical accidents. We cannot design new ones with independent properties; we are stuck with the confounded ones entrenched in communities. Children, too, were not designed for the benefit of psychologists: their cognitive, social, perceptual, and motor skills are all developing at the same time as their linguistic systems are maturing and their knowledge of a particular language is increasing, and none of their behaviour reflects one of these components acting in isolation.

Learning anything about language acquisition at all, is only because a diverse set of conceptual and methodological tools has been used to trap the elusive answers to these questions: neurobiology, ethology, linguistic theory, naturalistic and experimental child psychology, cognitive psychology, philosophy of induction, theoretical and applied computer science. Language acquisition, then, is one of the best examples of the indispensability of the multidisciplinary approach called cognitive science.

1.8 UNIT END QUESTIONS

1) Describe some of the processes involved in language?
2) Why study of language is important for cognitive psychologists?
3) There is a universal course of development every child follows in the learning of language. Describe.
4) How do we acquire the ability to use language?
5) Compare and contrast the behaviourism and innateness theories of language acquisition.
6) Nature and nurture both influence the course of language development. Explain with empirical evidence.
7) Illustrate cognitive theory of language acquisition in detail.
8) Give a sample of an utterance one might reasonably expect to hear from an 18 month old child.
9) Give a detailed biological account of language acquisition.
10) Make a worksheet showing the initial stages of language acquisition in a child with elaborate examples and reference studies.

1.9 SUGGESTED READINGS AND REFERENCES

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