LANGUAGE, LITERACY AND COGNITION

Language is another important study of cognitive psychology. Language can be discussed as the means by which thoughts are communicated. Language is our primary means of communicating thought. Moreover, it is universal: Every human society has a language, and every human being of normal intelligence acquires his or her native language and uses it effortlessly. The naturalness of language sometimes lulls us into thinking that language use requires no special explanation. Some people can read, and others cannot; some people can do arithmetic, and others cannot; some play chess, and others cannot. But virtually everyone can master and use an enormously complex linguistic system. In contrast, even the most sophisticated computers have severe problems in interpreting speech, understanding written text, or speaking in a productive way. Yet most normal children perform these linguistic tasks effortlessly. Why this should be is so among the fundamental puzzles of human Psychology.

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

- Human language development represents a unique kind abstraction, which is basic to cognition. Although other forms of life (bees, birds, dolphins, prairie dogs, and so on) have elaborate means of communicating and apes seem to use a form of language abstraction, the degree of 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 operated as a window.
- The processing of words, speech, and semantic[1] seems to engage specific cerebral areas and this provide a meaningful link between Neuro-anatomical structures and language. In addition, the study of the pathology of the brain has frequently shown manifest changes in language functions, as in the case of aphasia[2].

For these reasons, language has been extensively studied by cognitive psychologists, *psycholinguists*[3] and neuropsychologists.

At present many experts agree that what truly sets us apart from other species of animals is our use of language – our ability to use extremely rich sets of symbols, plus rules for combining them, to communicate information. While the members of all species fo communicate with one another in some manner, and while some may use certain features of language the human ability to use language far exceeds that of any other organism on earth.

[1] The study of meaning
[2] Loss of ability to understand or express speech, caused by brain damage
[3] Specialists who study the relationship between psychology and language

Language: Its basic nature

Language uses symbols for communicating information. In order for a set of symbols to be viewed as a language, however, several additional criteria must be met. First, information must be transmitted by the symbols: the words and sentences must carry a *MEANING*. Second, although the number of separate sounds of words in a language may be limited, it must be possible to combine these elements into an essentially infinite number of sentences. Third, the meanings of these combinations must be independent of the settings in which they are used. In other words, sentences must be able to convey information about other places and other times. Only if all three of these criteria are met can the term *LANGUAGE* be applied to a system of communication.

- **1. Theories of Language Development**

The major theoretical perspectives in language development include learning theory and early cognitive-development theory (Jean Piaget). Briefly learning theorists believe that language acquired through classical conditioning, operant conditioning, and/or modelling. B. F. Skinner is a proponent of this perspective. Cognitive developmental theorists believe that language has to do with the child's capacity for symbolic thought, which develops toward the end of the sensorimotor period. This perspective holds that language continues to develop according to the child's cognitive level. For example, the acquisition of comparison terms like *more than* or *less than* occurs about the same time that cognition develops from preoperational to concrete operational thought.

Some contrasting Views:

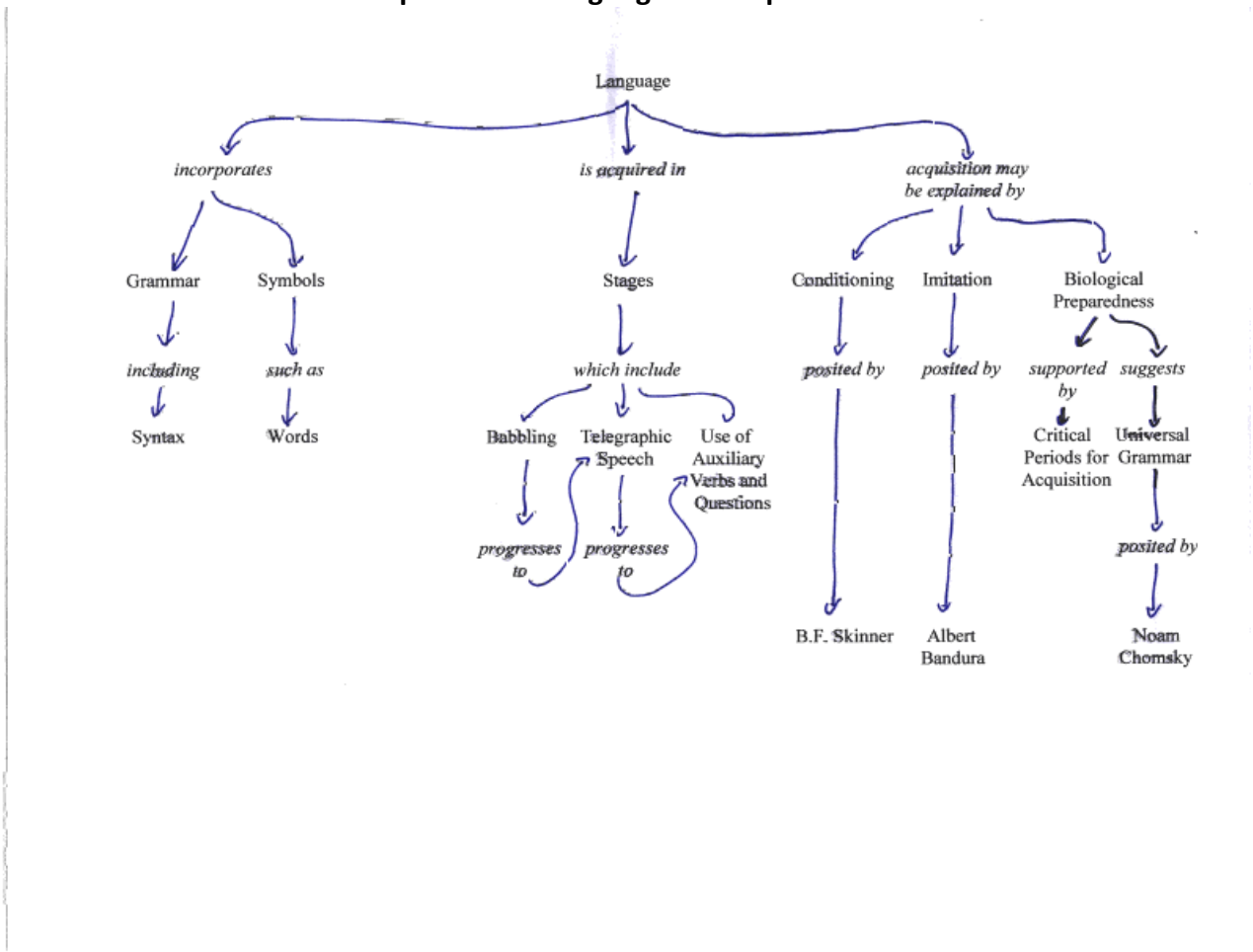
The *SOCIAL LEARNING VIEW* suggests one mechanism for the rapid acquisition of language. This view proposes that speech is acquired through a combination of operant conditioning and imitation. Presumably, children are praised or otherwise rewarded by their parents for making sounds approximating those of their native language. Moreover, parents often model sounds, words, or sentences for them. Together, it is contended, these basic forms of leaning contribute to the rapid acquisition of language.

A sharply different view has been proposed by the noted linguist Noam Chomsky (1968). According to Chomsky, language acquisition is at least partly innate. Human beings, he contends, have a *LANGUAGE ACQUISITION DEVICE* – a built-in neural system that provides them with an intuitive grasp of grammar. In other words, humans are prepared to acquire language and do so rapidly for this reason.

Finally, a *COGNITIVE THEORY* offered by Slobin (1979) recognises the importance of both innate mechanisms and learning. This theory suggests that children possess certain information-processing abilities or strategies that they use in acquiring language. These are termed *OPERATING PRINCIPLES* and seem to be present, or to develop, very easily in life. One such operating principle seems to be "pay attention to the ends of words" – children pay more attention to the ends than to the beginnings or middles of words. This makes sense, because in many languages suffixes carry important meaning. Another principle is "Pay attention to the order of words." And indeed, word order differs greatly from one language to another, this, too, is an important principle.

Which one of these theories is correct? At present, all are supported by some evidence, but none seems sufficient by itself to account for all aspects of language development. Given this mixed pattern of evidence, it is probably safest to conclude that language development is the result of a complex process involving several aspects of learning, many cognitive processes, and perhaps various genetically determined mechanisms as well.

- **2. Basic Components of language Development**



Language use has two aspects: production and comprehension. In the production of language we start with a thought, somehow translate it into a sentence, and end up with sounds that express the sentence. In the comprehension of language, we start by hearing sounds, attach meaning to the sounds in the form of sentences. Language use seems to involve moving through various levels and at the highest level are sentence units, including sentences and phrases. The next level is that of words and parts of words that carry meaning (the prefix 'none' and suffix 'er'). The lowest level contains speech sounds. The adjacent levels are closely related: the phrases of a sentence are built from words and prefixes and suffixes, which in turn are constructed from speech sounds. Language therefore is a multilevel system for relating thoughts to speech by means of word and sentence units (Chomsky, 1965).

There are striking differences in the number of units at each level. All languages have only a limited number of speech sounds; English has about 40 of them. But rules for combining these sounds make it possible to produce and understand thousands of words (a vocabulary of 70,000 words is not unusual for an adult). Similarly, rules for combining words make it possible to produce and understand millions of sentences (if not an infinite number of them).

This property of language is called 'productivity': rules allow us to combine units at one level into a vastly greater number of units at the next level. So, two of the basic properties language are that it is structured at multiple levels and that it is productive. Every human language has these two properties.

- **Phonological Development: The spoken word**

At some point between three and six months, babies begin babbling. At first babbling contains rich mixture of sounds virtually every sound used in human speech. Indeed, research suggests that babies only a few months old can distinguish sounds from many different languages (Werker & Desjardins, 1995). By nine ot ten months, however, the range of babbling narrows and consists mainly of sounds used in language of the child's native culture. From this point to the production of the first spoken word is a relatively short step, and most children accomplish it by their first birthday?

Between the ages of one and two, children's vocabularies increase rapidly; for instance, by the time they are eighteen months old, many toddlers have a vocabulary of fifty words or more. What are these words? Generally, they include the names of familiar objects important in the children's own loves – for instance, foods (juice, cookie), animals (dog, cat), toys (ball, block), body parts, clothing and people (mom, daady). Children make the most of these words, often using them as holophrases – single-word utterances that communicate with meaning especially when combined with pointing and other gestures. Such use of gestures may be due tom at least in part, to the fact that at this stage children's pronunciation leaves much to be desired; many of their words take a simple form, consisting of a consonant and a vowel. So the child might say "mih" instead of "milk." Toddlers often have difficulty with clusters of two or more consonants (for e.g., referring to stairs as "tairs" and to blanket as "blanky").

Verbs – words describing actions; when do children acquire these? Until recent years it was widely assumed that acquisition of such words follows the acquisition of nouns – words referring to specific objects (Gentner, 1982). However, some evidence suggests that in some cultures this order may be reversed. For instance Tardif (1996) found that Chinese children 22 months old actually used more verbs than nouns and verbs may vary somewhat from culture to culture, and further research is needed to determine precisely why this is so.

- **Semantic Development: the Acquisition of Meaning**

In the early stages of language development, children do not use words in the same way as adults. Word meaning change as children develop. The meanings of adult words usually consist of relatively abstract concepts. For example, the main meaning of the word "father" is a "man in relation to a child" which could be a biological relation to the child or adoptive father. When adults say that a man is a child's father, they mean that the man fits the given definition of the word. They are often amused when 2 years old wanders into a room full of adults and proceeds to call each of them men present "daddy" (Cole & Cole, 1993). This happens because the child's word "daddy" in this example does not have the same meaning as the adult word "father". We know that children in early childhood are not capable of abstract thinking so when they say "daddy" there is no abstract concept of "father" behind the word. The way the child uses the word "daddy" in the described example is called _____. This means a broad application of the word to a wider collection of terms than appropriate (p-77).

Vygotsky called the overextended word meaning “complex” as opposed to the adult “concept”. The elements within the complexes can connect to each other by any factual bonds actually existing between the objects. Children do not overextend the meanings of the word randomly but by a real similarity of the objects. The function of complex word meaning is to establish and reinforce the bonds and relationships between objects, connecting them under the same name. It is the starting point for further abstraction.

In contrst to overextension, the term _____ applies to a too-narrow application of the word and a too-narrow and one-dimensional meaning of it. For example, children may think that the word “cat” applies to their cat only therefore the word “cat” would mean for them “their cat”. One example for one-dimensional word meanings of preschool children is their inability to understand figurative expressions.

As children grow, their vocabulary increases and between primary and high school the amount of words double. The word meanings change and become more abstract. At primary school, the meanings move closer to the generally accepted meanings of the words but they are still closely connected to the concrete description of the real objects. For example, the 6-year-old child defines a pen as “it is when I write a letter to Ann. I take a paper and write.” So the elements, which child collects under the name “pen”, bond to each other by the essential characteristic: its function (to write on paper).

At the end of primary school, children are able to give more abstract definitions of the words such as “a pen is something you can write with.” Children no longer need to refer to the concrete situation. In adolescence, they are able to learn the meanings of new words through verbal definition.

- **Understanding Language Acquisition**

It is wonderful that virtually all children in all cultures accomplish so much in a mere four to five years. We will discuss *what* is acquired and then *how* it is acquired – specifically, the roles played by learning and innate factors.

Language acquisition research is important for our understanding of man in general and of the intellectual development of the child in particular; it addresses major questions about the nature of man, questions that have generated a great deal of lively and often acrimonious debate over the centuries amongst philosophers and psychologists.

<u>What is acquired?</u>

Development occurs at all three levels of language. It starts at the level of phonemes, proceeds to the level of words and other morphemes, and then moves on to the level of sentence units, or syntax. In what follows, we adopt a chronological perspective, tracing the child’s development in both understanding and producing language.

Children come into the world able to discriminate among different sounds that correspond to different Phonemes in any language.

<u>Innate factors</u>

As noted earlier some of our knowledge about language is inborn, or innate. There are, however, some controversial questions about the extent and nature of this innate knowledge. One question concerns its richness. If our innate knowledge is very rich or detailed, the process of language acquisition should be similar for learning differ among cultures. Is this the case? A second question about innate factors involves critical periods. Innate behaviour will be acquired more readily if the organism is exposed to the right cues during a critical time period. Are there such critical periods in language acquisition? A third question concerns the possible uniqueness of our innate knowledge about language. Is the ability to learn a language system unique to the human species?

The Richness of innate knowledge

All children, regardless of their culture and language seem to go through the same sequence of language development. At age 1 year, the child speaks a few isolated words; at about age 2, the child speaks two and three words sentences; at age 3, sentences become more grammatical; and at age 4, the child's speech sounds much like that of an adult.

Grammatical Development

Development of grammar starts straight after birth with the first signs of its comprehension when children become sensitive to the natural rhythm and intonation of their native language. Development of grammar production starts when children begin to use more than one word in a sentence which happens approximately between 1.5 and 2.5 years of age. The first sentence that children produce consists of two words which are put together but are not grammatically connected. This two-word style is _____ which puts the accent on high-content words and leaves out less important parts. It is more concerned with the meaning of the speech than the grammar. Nevertheless, some aspects of grammar, such as the word-order rules in English language, are already applied.

Three word sentences appear between two and three years of age. English speaking children use the fixed order of words: subject-verb-object. Children of other language backgrounds where the word-order rules does not exist, do not use the fixed order of the words because it is not present in the speech of adults. Many children at this stage can use more than three words in a sentence.

At approximately the same time as children begin to move from two-word sentences they start to use **grammatical morphemes**. This is a period of grammatical explosion, when children intuitively learn at a very rapid pace how to use very complicated grammatical forms. What are grammatical morphemes> consider this: a two year old girl says, "You cannot pick up a big kitty **'cos** a big kitty might bite." The parts which are bold in the sentences do not mean anything by themselves but they help create the meaning of the sentence. The article "a" indicates that the girl is talking about big cats in general, not just about a particular one. The word "because" shows the casual relationship between the two parts of the sentence. These elements are called grammatical morphemes (Cole & Cole, 1993). Other examples of morphemes are the endings of the words "-ed" "-ing" and "-s" and prepositions "on" "in" and "at". The sequence of grammatical morpheme acquisition is the same for all children within the same language. The use of grammatical morphemes shows that children differentiate nouns and verbs. For example, they never apply rules or the use of article (a, the) before verbs such as "a jumped".

An amazing peculiarity of children's speech at this stage is _____. This refers to the application of regular rules, which children learn, to words that are exceptions. For example, children may say "He drived" and even "He droved" instead of "He drove". This indicates that children intuitively learn the rules and apply them creatively. Between ages of 3 to 6, children acquire complex grammatical constructions such as mastering of the verb "to, be", negatives, and questions and so on.

- **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**.

Linguists are interested in developing a descriptive framework of language. Their approach is, in one respect, similar to that of a cognitive psychologist interested in developing a model of memory. From our discussion of memory, you may recall that a model of memory involved the content of memory, the structure of memory, and the processes that operate within memory (for example, coding operations, retrieval operations, and transformational operations). Similarly, some linguists are concerned with the development of a model of language – its content, structure, and process. However, unlike memory research, linguistic research postulates a hierarchy that ranges from fundamental components to compound components to very complex components – that is, sound units and meaning units in order of growing complexity. Each level is somewhat dependent on a lower level but may interact with any other level.

The development of a writing system that reflects speech and conveys thought is one of the most significant of humanity's hierarchical creations. In the English language, there are only ten symbols for digits and twenty-six letters, some of which are so redundant or infrequently used that they contribute little to the overall structure of the written language. From these few letters and digits, about forty thousand words in our working vocabulary are constructed, and from these words billions and billions of sentences are created. Well, there may not be as many sentences as there are particles in the universe, but given our insatiable need to communicate with others, we are producing a huge number of original sentences every minute and promise to approach that number someday. When we consider the richness of the human experience generated by so few symbols (from literature such as the Song of Solomon to *Mein Kampf*), the hierarchical coding properties of language is staggering.

An understanding of language cannot be divorced from an understanding of its structure. In this respect language is like any other tool humans might invent. The way in which a wrench is structured, for instance, largely determines the purposes for which it can be used, just as the functions a wrench is to serve largely govern its structure. In much the same way linguistic function and structure are intimately linked. Linguistics have consequently spent much time dissecting human languages into their component parts and trying to specify the rules for

combining these parts into meaningful utterances. They have found that the structure of language can be analysed at three basic levels:

1. In terms of the sounds that make up the language (**Phonology**). Out of the great number of vocal sounds a human being can make, each language uses certain ones as its fundamental building blocks. Linguists divide these sounds into categories called Phonemes.

Phonemes are the _____ of language. A Phoneme is a class of slightly varying sounds that speakers of a language perceive as linguistically similar. Consider the sounds of the t/s in the word *total*. If you hold your palm several inches in front of your mouth while you say this word out loud, you will discover that the two t/s are not identical. The first is aspirated (it concludes with a short puff of breath).

The basic unit of spoken language is the _____. Phonemes, single speech sounds that are represented by a single symbol, are created by an intricate coordination of lungs, vocal cavaties, larynx, lips, tongue, and teeth. When all works well, the sound produced is available for rapid perception and understanding by someone familiar with the language being spoken. English uses about forty-five different phonemes, but not equally. Only nine are needed to make up more than half our words, with the most frequently used occurring more than one hundred times more often than the least used. Other languages get by with as few as fifteen phonemes, while some require as many as eighty-five.
Speech sounds that are produced by a coordinated effort of lungs, thorax, tongue, and so on and that include vibration of the vocal cords are classified as *voiced* – for example, a or z. Speech sounds that do not use vocal cords – such as the *s* in hiss – are called *unvoiced* sounds. Among other sounds – voiced or unvoiced – are *fricatives* (produced by restricting the air passage in the mouth), such as *sh, f, v,* and *plosives*, or *stops* (producing by interrupting the flow of air for brief period), such as *t* and *d*.

2. In terms of the rules by which these sounds are combined to form basic units of speech and these basic units of speech are combined to form complex words (morphology)

Morphemes are the _____ in a language. Phonemes are empty; they have no meaning. Morphemes may be words, parts of words, prefixes, suffixes, or combinations of these. For example, in the sentence "The old chemist loved joyful sounds," *the* and *old* are free morphemes, which stand alone, while *chemist*, *joyful,* and *sounds* are the combination of a free morpheme and a bound morpheme, *chemist* is composed of the morpheme *chem and ist; joyful* of *joy and ful;* and *loved,* of *love and d*. By combining morphemes, we can generate untold millions of words. In English we have more than one thousand words formed by morpheme combinations, but even with such a vast number the composition of morphemes is tightly governed by linguistic constraints. One of the linguistic constraints of English is that no more than three consonants may start a syllable; usually it is less than two. Another constraint is that certain letters – for example, *q* and *d* or *j* and *z* – never appear together. These and other constraints on morphological formation, plus the built-in redundancy of our language, act to minimise the number of errors in transmission and decoding.

3. In terms of the rules by which words are combined into grammatical phrases and sentences. The next level in the linguistic hierarchy is that of syntax, or the rules that govern the combination of morphemes in phrases and sentences.

Semantic deals with the _____, and **syntax** deals with the _____. In recent years the principles underlying syntax have been extended to include how information can be transformed from one another. This extension began with the proposal, made by Noam Chomsky, of a universal theory of grammar aimed at describing the abstract nature of languages, not just their surface characteristics. The result was not only a theory that changed our conceptualisation of linguistics but also one that had a profound effect on psychology, especially psycholinguistics.

The number of different sentences humans can generate is restricted only by time and imagination, both of which are in long supply. In an attempt to understand the structure of language, linguists – those people who study the nature of language – have concentrated their efforts on two aspects: **productivity** and **regularity**. *Productivity* refers to the infinite number of sentences, phrases, or utterances that are possible in a language (billions and billions of sentences). *Regularity* refers to the systematic nature of the sentences, phrases, or utterances ("The boy hit the ball'' rather than "ball boy The hit the").

Language productivity seems apparent, but the regularity of language is a much more tricky affair. The set of rules that govern the regularity of language is called grammar, and transformational grammar deals with the changes in the linguistic forms that may retain the same message. For example,

- The cat was chased by the dog.
- The dog chased the cat.

Both sentences are correct, convey essentially the same meaning, have similar words, and yet differ somehow in their underlying structure. Apparently, the surface features of a language and the deep structure of a language needed to be separated, and the theories of Chomsky were designed along those lines.

Chomsky directed much criticism toward behaviourism and its basis, S-R (stimulus-response) learning (including the learning of language), arguing that the development of language cannot be described simply in terms of operant learning principles and that psychological theory must be concerned with underlying processes rather than surface ones. Even though many psychologists dispute Chomsky's criticism, it is generally agreed that it has had far reaching implications for psychological theory and cognitive research.

- **4. Chomsky's Theory of Grammar**

Chomsky's Work

Noam Chomsky critiqued the behaviourist perspective on language, and proposed a **nativist theory** of language acquisition. Because children across the world produce speech so early in their development (12-18 months) and become fluent by about five years old, Chomsky believed that there must be some sort of innate, biologically based mechanism for language acquisition. Chomsky proposed a _____**(LAD)**, which is built-in advanced knowledge of rule structures in language.

The following points are frequently cited as embodying the most important aspects of Chomsky's thesis:

- Language has much underlying uniformity, and the underlying structure is often more closely related to the meaning of a sentence than are the surface characteristics.
- Language us not closed system but a generative one.
- Within the underlying structures are elements common to all languages, and these may reflect innate organising principles of cognition. These organising principles may directly influence the learning and generation of language.

Two important aspects of Chomsky's theory of grammar are the distinction between **deep** and **surface grammatical structure**, and the concept of **transformational rules**.

The **surface structure** of a sentence is the actual word order of the words in a sentence. Surface structure is "that part of the actual sentence that can be segmented and labelled by conventional parsing"

The **deep**, or **abstract structure** is "an underlying form that specifies the meaning of the sentence". For instance, the following sentences all have different surface structures but similar deep structures: 1) The boy picked up the book; 2) The boy picked the book up; and 3) The book was picked up by the boy. Furthermore, sometimes sentences with the same surface structure have different meanings. For instances, "they are eating apples" can mean that *some people are eating apples*, or that *those apples are for eating*.

Transformational rules/grammar, a revolutionary component of Chomsky's system, details the laws that govern this transformation of one form of linguistic message into another. Consider the sentences: "The jock pursued the sorority girl" and "The sorority girl was pursued by the jock." Both sentences express the same basic idea, which is contained in the deep structure, but the specific form, or surface structure, differs, and transformational rules relate the two.

In another example, the basic meaning of the simple sentence "The short hippopotamus saw the tall giraffe" may also be expressed as "The tall giraffe was seen by the short hippopotamus" or "It was the short hippopotamus who was the tall giraffe." Our awareness of the true sense of the sentence prevails, despite the semantic rearrangement, and some instances, alteration of words or morphemes. The integrity of meaning is maintained in deep structure. As another example, try telling a story about some event in your life, such as, going to a concert. After you have told the story, tell it again, but avoid using the same sentences in retelling. Then under the same constraints, tell it a third time. There seems to be no real end to the ability of varying the means of saying the same thing. The rules underlying this phenomenon are what modern grammarians call transformational grammar. This task, which even children can easily do, is difficult to explain in S-R terms. Speech and language are rarely passive, repetitive pattern of activity; rather, human language is a productive, generative system. Each sentence we utter is more or less a creative product, which is also more or less easily understood by the listener even though it is novel to both of you.

- **5. Language and Thought**

The Relationship between Language and Thought

Benjamin Whorf proposed the Whorfian hypothesis, also called the linguistic relativity hypothesis, which suggests that our perception of reality, the way that we can think about the world, is determined by the content of language. Basically, language affects the way we think and not the other way around. For instance, the Eskimo language has a wide variety of names for different types of snow, whereas the English language has only one. Therefore, according to the Whorfian hypothesis, Eskimos are better at discriminating between different types of snow than English speakers are. Though this is somewhat controversial notion, and there is evidence for both for it and against it.

- ***Innate Properties and Environmental Effects***

Among the most controversial aspects of Chomsky's theory is his assertion that the essential components of language are innate and universal rather than, as argued by B. F. Skinner, learned. Thus, reinforcement – a fundamental element of the Skinnerian (behavioural) view – may determine only the morphological aspects of language development. (For example, a child learns to say apple when her request for an apple is reinforced by the object.

Basic question of Chomsky's assertion: How does a child generate a perfectly grammatical sentence he or she has never heard? The innate propensity for language, based on deep structure, is offered as the explanation. Chomsky's position does not hold that a particular grammatical system is innate, but it does argue that we have an innate scheme for processing information and forming abstract structures of our language. This may be tied to the biological development of the child.

Several points from our exposition of structural linguistics are important to summarise. From the most general standpoint, we can conceptualise the human brain as a very complex information-processing and storage system. With regard to language, it appears that a great deal of information about language in the form of an abstraction of information (much as we have knowledge of algebra), but we also have specific semantic entities- that is words. Linguists, especially those subscribing to the ideas of generative grammar, have proposed a description of the abstract nature of language, the exact form of abstraction remains debatable.

Another viewpoint (not necessarily antagonistic to the first) is that language and biological maturation go hand in hand, each influencing the other. Both of these positions give us a detailed and expansive paradigm in which to frame a cognitive theory of language.

• 6. Multilingualism and Cognition

Here we will discuss on how language focuses on the cognitive analysis of language, and to search for underlying, abstract cognitive structures of language.

- "The War of the Ghosts": Bartlett (Bartlett's Schema theory)

Many investigators have concentrated their efforts on psychological processes involving meaningful prose that closely resembles that of real-life language experiences. The best known of the investigations of complex literary material was done by F. C. Bartlett of Cambridge University and reported in his remarkable book *Remembering: A Study in*

Experimental and Social Psychology (1932). In this book Bartlett describes several experiments in which brief stories, prose passages, pictures, and Native American picture writings were used to study the remembering (and forgetting) of meaningful material. The procedure was simple. Subjects were given a short story, or other material. They read it and then free-recalled what they could remember after a certain period. In other cases a story would be told to a person, who then retold it to another, who then retold it to another, and so on. By examining the contents of the reproduced version of the stories, it is possible to analyse both the nature of the material could be coded and the nature of the material forgotten.

The war of the Ghosts

One night two young men from Egulac went down to the river to hunt seals and while they were there it became foggy and calm. Then they heard war-cries, and they thought: "Maybe this is a war-party". They escaped to the shore, and hid behind a log. Now canoes came up, and they heard the noise of paddles, and saw one canoe coming up to them. There were five men in the canoe, and they said:

"What do you think? We wish to take you along. We are going up the river to make war on the people."

One of the young men said,"I have no arrows."

"Arrows are in the canoe," they said.

"I will not go along. I might be killed. My relatives do not know where I have gone. But you," he said, turning to the other, "may go with them."

So one of the young men went, but the other returned home.

And the warriors went on up the river to a town on the other side of Kalama. The people came down to the water and they began to fight, and many were killed. But presently the young man heard one of the warriors say, "Quick, let us go home: that Indian has been hit." Now he thought: "Oh, they are ghosts." He did not feel sick, but they said he had been shot.

So the canoes went back to Egulac and the young man went ashore to his house and made a fire. And he told everybody and said: "Behold I accompanied the ghosts, and we went to fight. Many of our fellows were killed, and many of those who attacked us were killed. They said I was hit, and I did not feel sick."

He told it all, and then he became quiet. When the sun rose he fell down. Something black came out of his mouth. His face became contorted. The people jumped up and cried.

He was dead.

After about 20hours, one subject produced a reproduction that in general is shorter, and the style is more informal. Additionally, there are numerous omissions and some transformations. Familiar words replace less familiar words. Eight days later the same subject recalled the story. This second reproduction was abbreviated and certain words were missing. Six months

later another recall measure was made. In this very short version, all unusual terms, all proper names, and references to supernatural powers were dropped. Finally, one subject was asked to recall the story after 2 years and 6 months. He had not seen the original version in that amount of time and, according to his own statement, had not thought of the story. In his version, only the barest rudiments of the story remain. Little elaboration of details can be found, and several themes appear that seem to be related to what the subject thought should happen, rather than what actually did happen in the story.

Bartlett (1932) analysed this type of information in terms of several categories. These include:

- *Omissions* – Specific information seems to drop out. Also, information that is illogical or does not fit into the subject's expectation is not readily recalled.

- *Rationalisation* – Occasionally some information is added that would help explain certain incongruous (out of place) passages.

- *Dominant Theme* – Some themes seem to become prominent, and other features are then related to the dominant theme.

- *Transformational of information* – Unfamiliar words are transformed to more familiar ones.

- *Transformation of sequence* – Some events are characterised as appearing earlier in the story, other later.

- *Subject attitude* – The attitude of a subject toward the material determines the degree of recollection.

In making analyses on these bases, Bartlett used the concept of *schema* to account for his results. (His account, written more than half a century ago, appears as fresh as the latest theory.) Schema, in his view, refers to an active organisation of past reactions or past experiences. Incoming stimuli all contribute to the build-up of an organised schema. In Bartlett's words:

There is not the slightest reason, however, to suppose that each set of incoming impulses, each new group of experiences persists as an isolated member of some passive patchwork. They have to be regarded as constituents of living, momentary settings belonging to the organism, or to whatever parts of the organism are concerned in making a response of a given kind, and not as a number of individual events somehow strung together and stored within the organism.

Clearly, Bartlett has anticipated the "abstraction of linguistic ideas" that was empirically tested forty years later by Bransford and Franks and Thorndyke, and Kintsch and that has been a recurrent theme in many of the theories of semantic memory. Some have criticised Bartlett's theory of remembering, and schema on the basis that it is too vague and complex to be empirically testable – and with some justifications.
The contribution of Bartlett is important for three reasons. First, the notion of abstract memory is introduced in his writings. These abstractions form part of the basis for new

learning and later for transformation of new information. Second, he demonstrated that research with real-life stories was possible and led to useful conclusions. Finally, his work provided an important frame of reference for his own students (Broadbent, Brown and Conrad) and other scholars (Miller, Neisser and Rumelhart).

In the time since the introduction of Bartlett's notion that stories are coded and remembered by means of schemata, contemporary researchers have proposed ideas that further add to our understanding of the functional properties of narrative memory. Modern theorists have attempted to quantify some of the basic notions of the abstraction of linguistic ideas. Among the best known of these researchers are Bransford and Frank.

- "Ants ate the Jelly": Bransford and Franks

It has been asserted that beneath the surface structure of our language is a deep structure that follows systematic rules of transformation. The result of this theory has been the proliferation of hypotheses about other hidden cognitive structures. Among the most intriguing of these are those developed by Bransford and Franks (1971, 1972). They developed a hypothesis concerning the nature of encoding sentences, they composed complex sentences that contained four simple declarative parts, one, two, or three of which could be removed to leave sentences composed, respectively, of three pospositions, two propositions, and one proposition. Some of the sentences follow:

4 –
The ants in the kitchen ate the sweet jelly that was on the table.

3 –
The ants ate the sweet jelly which was on the table.
The ants in the kitchen ate the jelly which was on the table.
The ants in the kitchen ate the sweet jelly

2 –
The ants in the kitchen ate the jelly.
The ants ate the sweet jelly.
The sweet jelly was on the table.
The ants ate the jelly which was on the table.

1 –
The ants were in the kitchen.
The jelly was on the table.
The jelly was sweet.
The ants ate the jelly.

The experiment consisted of two parts: acquisition of the sentences and a recognition task.
Acquisition: Ss heard 1-, 2-, and 3-fact sentences only

Test: Ss heard 1-, 2-, 3-, 4-fact sentences (most of which were never presented) and noncase sentences

Results: the more facts in the sentences, the more likely Ss would judge them as old and with higher confidence

Why were Ss consistently more likely to believe they heard the whole story -- which they had not -- than the simpler sentences -- which they had heard?

the mind's search for meaning -- when presented with a random series of statements, the mind tries to put them together in a way that tells a meaningful, coherent story rather than finding verbatim memory, B & F found memory for meaning or memory based on abstraction of meaning from memory and the semantic integration of related material because the 4-fact sentences most closely match the full meaning of the sentence stories in memory, Ss were most confident of having heard them before

Constructive Model: we integrate info from individual sentences in order to construct larger ideas; emphasizes the active nature of our cognitive processes

- **7. Knowledge and Comprehension**

We begin with the simple generalisation that the greater the knowledge of a reader, the better the comprehension of text. This generalisation seems to be valid for readers who have broad knowledge and read colloquial material as well as those who have specialised knowledge and read technical material. One way to account for this generalisation is that knowledge can be viewed as an organised collection of information. New information, as might be gathered through reading, can be assimilated more thoroughly when existing cognitive structures and information already exist. Conversely, insufficient knowledge limits comprehension because the reader must develop some structure of knowledge about the material as well as encode the information being read. Comprehension, within this framework, is perceived more as a confirmation of hypotheses about the way the world is thought to be than as a purely original assimilation of new facts. Much, but not all, comprehension is top-down processing. People with specialised knowledge, be it plumbing, ballet, astrophysics, or motorcar racing, comprehend technical information in their field better than non-specialists do. Following are several examples of **top-down** processing.

- ***"Soap Opera, "Thieves" and "Police"***

Text comprehension and understanding is influenced by situational information or instructions. In one experiment by Owens, Bower, and Black (1979), which illustrates the "soap opera" effect in story recall, subjects were to read a story about a water-skier and the driver of a boat. Half the subjects were introduced to the story by a passage that was designed to persuade the reader to identify with the water-skier, and half by a passage to identify the driver. The test story was the same for both groups. After the groups read the story, a series of questions was asked. These positively biased toward the water-skier tended to make errors in his behalf. For example, their reaction to the statement "(The skier)....reached for the handle (of the rope tow) but it escaped him" was to blame the failure on the boat driver for not coming close enough. On the other hand, those subjects positively biased toward the driver tended to believe that the skier was not fast enough to grab the handle. The tendency to ascribe guilt to the "other guy" and innocence to "our guy" demonstrates how understanding of textual material can be based on contextual biases.

In yet another study, by R. Anderson and Pichert (1978), subjects were asked to read a story about the home of a wealthy family from the stand-point of a prospective home buyer or a burglar. Many features about the house and its contents were described, such as fireplace, musty basement, leaky roof, silverware, coin collection, and television set. The rated importance of these items as well as what was remembered was predictably related to the reader's viewpoints. The would-be thieves seemed to concentrate on the valuable loot, whereas the home buyers focused on the condition of the house. These experiments suggest that understanding or encoding textual material is influenced by contextual information that activates a specific type of schema.

The power of an induced schema[4] on story recall was further illustrated in a study by MacLin and Solso (2000). A "police officer schema" was introduced by having college students complete a police officer entrance exam. A sample question follows:

A patrol officer responds at night to a telephone complaint that a prowler has been observed at a particular location. The patrol officer arrives at the location and notices someone who appears to fit the description of the prowler previously given by the complainant. In approaching this individual, it would be ***best*** *for the patrol officer to:*

- **A.** Avoid taking any precautionary measures since the officer has no means of knowing whether any offence has been committed.
- **B.** Consider this individual to be a potentially dangerous criminal.
- **C.** Consider that this individual is probably harmless and is only a "peeping tom."
- **D.** Fire a warning shot over the individual's head.

After working through 25 such questions, the students were then asked to read a story which contained of 66 "idea units", or separate notions, some of which were consistent with a police officer schema and some of which were not. As an example, the sentence "He reached for another cigarette, finding the pack empty" is neutral for a police schema and was generally neutral for the study – although, if you were a person who had schemas related to stopping smoking or you were a tobacco executive, the sentence may have had a particular trenchant (sharp) meaning. However, the sentence, "Jay called 911 on his cellular phone and reported a break-in in progress, and then let himself out of the truck, pocketing the keys, careful not to let the door slam" contains several salient ideas that are sure to seize the attention of a police officer or, in the case of the experiment, the attention of someone whose level of police consciousness had been elevated simply by having taken a police entrance examination. The results were overwhelmingly significant in that those students who took the police examination recalled two times as many police ideas units as did the non-examination group (schema recall was 15; non-schema recall was 7.88). However, overall, the recall for idea units was about equal for the two groups. By having a brief experience with a police test, a kind of schema seemed to be induced which had a profound effect on the way the story was encoded and recalled.

[4] A schema is a cognitive framework or concept that helps organize and interpret information. Schemas can be useful because they allow us to take shortcuts in interpreting the vast amount of information that is available in our environment. However, these mental frameworks also cause us to exclude pertinent information to instead focus only on things that confirm our pre-existing beliefs and ideas. Schemas can contribute to stereotypes and make it difficult to retain new information that does not conform to our established ideas about the world.

The power of induced schemas to influence perception and memory was also illustrated by Beal and Solso (1996) in an experiment in which participants were assigned to a nurse, architect, or police officer schema, or to a control condition. In this experiment subjects wrote an essay about the workdays and special skills of the schema assigned to them: A nurse might write that he or she would begin the day by taking the vital statistics on a patient, administering medication, consulting with doctors, and the like. Then the subjects were asked to look at a slide show of photos and paintings: this was followed by a memory task. Schema induction increased recall for schema-related questions.

Perhaps even more fascinating was the finding that some of the induced schemas, for example the police officer and nurse schemas, tended to overestimate the number of schema-consistent components in the pictures. Perception and memory for schema-related material seem to be the focus of attention, and in some cases, the observer estimates the magnitude of the related material.

- ***"Bumper Stickers and the Cops": Kintsch and van Dijk***

The model of comprehension espoused by Kintsch and van Dijk is important from the bottom-up and top-down perspective. On the level of reading text material, the model is based on the propositions, or abstractions of information, drawn from the text base, while on the level of reader intention, the model posits a goal schema that directs the reader's comprehension of text material.

The model allows researchers interested in the structure of stories to make precise predictions about the memorability of specific types of information. The technique developed by the authors of the experiment is consistent with modern scientific methodology in psychology as contrasted with the subjective method used earlier in the important work of Bartlett.

For purposes of our discussion, we concentrate in the way student subjects go about storing in memory information acquired from an article called "Bumper Stickers and the Cops." In an experiment done by Kintsch and van Dijk (1978), subjects were asked to read a nontechnical report that was about 1,300 words long. Following the reading of the report, one-third of the subjects were immediately asked to recall and write a summary of it. Another one-third of the subjects were tested after 1month, and the final one-third after 3months. The procedure is similar to the one conducted by Bartlett.

All of the recall accounts and summaries were organized into statements that could be identified as:

- Reproductions (statements that accurately reflects the comprehension of the text).
- Reconstructions (statements that are plausible inferences from the main theme aided by the subjects' knowledge, such as "Deepa went to Kerala by train," might be expanded to include "She went into the station to buy a ticket").
- Metastatements (subjects' comments, opinions, and attitudes on the text).

These components were computer analyzed with specific predictions made by the model. Several important conclusions were made by the authors about text comprehension and

memory. Data gathered over three different time periods indicated that subjects lost more and more of the specific details of the report over time but retained the gist of the story with about the same degree of fidelity throughout 3-month period – a finding consistent with protocol analysis of Bartlett. Additionally, it seems that the analysis of written material, such as books, stories, and technical reports, is organized in a way that is susceptible to careful empirical study of propositions, which may tell us more about the way text material is organized and how the human mind records and stories in memory written material over time.

There are several comprehensive theories of language. One by Kintsch is particularly significant because it incorporates many bits of wisdom from previous studies and, at the same time, contains a model of the mind.

- ***A model of Comprehension: Kintsch***

In this section we explain the principle components of one influential and extensive model by Kintsch and his co-workers at the University of Colorado.

This model of comprehension is more than a system that deals with the way textual information is understood. It is a theory that cuts across many topics in cognitive psychology, including memory and comprehension of the written and spoken language. Comprehension is dependent on two disparate sources that are similar top-down and bottom-up processing, discussed in some detail throughout this book. At the highest level is the goal schema, which decides what material is relevant. At the opposite extreme of model is the text.

The model is based on this proposition, a term first introduced in our discussion of semantic memory. A proposition is an abstraction, and, as such, it is difficult to define concretely. We can, however, identify some characteristics of propositions: they are abstractions based on observations (such as reading text material or listening to a speaker); they are retained in memory and follow the laws governing memory processes; and, in Kintsch's system, they consist of a predicate and one or more arguments. Predicates correspond to verb, adjectives, adverbs, or connectives in the words a person reads or hears. This is called *surface structure*, a term used by several linguists, including Chomsky. Arguments correspond to nouns, noun phrases, or clauses. The model is illustrated with the following little story:

> The Swazi tribe was at war with neighbouring tribe because of a dispute over some cattle. Among the warriors were two unmarried men, Kakra and his younger brother Gum. Kakra was killed in battle.

The first sentence is divided into five groups, in which only three of the factors are in working memory. The predicate "was at war with" is considered the most important part of this sentence insofar as comprehension of the story is concerned. The other parts are clustered around it. A significant feature of the model is that the initial processing of text is assumed to take place in STM, which we know has limited capacity. Because of this constraint, only a portion of the proposition is held in memory. With the reading of the second sentence, some of the propositions from the first sentence are still vital in STM. The reader tries to connect the old and new propositions but finds no match between them. Failing to find a match between the propositions in STM, the reader searches LTM for possible match. This search of

LTM is called *reinstatement search* and is one reason that text material may be hard to read. Text material that flows may be easy to read because the reader is able to retain much of recent material in STM without having access to LTM. In the example, the lack of a match between propositions in the first and second sentence requires the reader to construct a new network for the ideas and to attempt to relate the two sentences. One inference the reader makes is that the two men were members of the Swazi tribe, a reasonable conclusions even though that fact is not stated directly. With the reading of more sentences, the semantic network begins to get more complicated and interrelated. The reading of the sentence "Among the warriors were two unmarried men, Kakra and his younger brother Gum" retains in memory the names of the men, which can easily be related to the information in the last sentence, "Kakra was killed in the battle."

- **8. Language, Us and Other Species**

Jill G. De Villiers and Peter A. De Villiers (1978).

MAN VERSUS ANIMAL

Throughout history, man has tried to establish which aspects of his behaviour and thought make him unique amongst the world's creatures. Language has been the aspect most frequently chosen. Writers point to the importance of language in man's socialisation and adaptation to his environment. Man can pass on his accumulated knowledge of the world and his culture to his offspring by means of oral and written words, making first-hand experience unnecessary. Linguistic symbols also provide us with a powerful and flexible tool for thought. Indeed, the child's understanding and use of language often provides us with the best, and sometimes the only, window on the development of his thought and reasoning.

Nevertheless, the degree to which human language is qualitatively different from, as opposed to just more complex than, other animal communication systems continues to dominate much of the theoretical debate in the study of language. For example, honey bees perform an intricate dance that serves to indicate to the other bees the direction and distance from the hive of a source of nectar. What particular properties distinguish this communication from human language? The most passionate disagreement and the greatest media attention have been aroused by recent efforts to teach chimpanzees a form of language.

NATURE VERSUS NURTURE

Another recurring question is, what does the child bring into the world with him by way of inherited knowledge or behaviour, and what is the product of experience? Psychologists often dismiss this problem as insoluble or poorly formulated, pointing out that clearly both nature (genetics) and nurture (experience) are important in the acquisition of knowledge, but they interact in such complex ways that it is impossible to tease them apart. Nevertheless, the issue, often cleverly disguised, recurs constantly in psychology and continues to arouse heated discussion.

One for, it takes in the study of language acquisition concerns the possible innate basis of the child's linguistic knowledge. Does the child come to the language learning task with any innate concept of what sentences are (McNeil, 1970) or with a bias towards acquiring a particular kind of linguistic system? Another version of the nature versus nurture controversy considers

the influence of biological maturation on the course of language acquisition. It is known from neurophysiological studies that the brain of the child takes some years to mature completely. While there appear to be certain basic environmental conditions, such as minimal levels of nutrition and sensory stimulation that must be fulfilled for brain development to take place, under a normal range of environments the biological maturation of the child is influenced by little experience. The physical development of the child's brain, as opposed to the quality of his experience with language, may be a major determinant of several aspects of his language development, including the ages at which he begins to babble speech sounds, begins to combine words, and masters certain complex sentence forms.

A particularly influential argument for biological determination posits a critical period for language learning based on the maturity of the child's brain. On this view a first language must be acquired during the years in which the brain is developing. Language acquisition is not possible before the brain of the child has reached a certain level of development, and is difficult, if not impossible, once that development is complete.

ACTIVE VERSUS PASSIVE LEARNING

Is the child an active participant in the learning process, trying to make sense of world about him, or his behaviour shaped by the environment? In the study if child language this issue is illustrated by an opposition between two accounts of acquisition. One account stresses the way children develop their own grammar or phonological rule system and views the child as an active contributor who adopts strategies, forms hypotheses, and searches for evidence to confirm or deny them. An extreme version of this approach suggests that language is not *learned* by the child, it is *created*. The other approach points to the structured environment of the child, the simplified language he hears from his parents, and their responses to his attempts at speech, and emphasises their role in his learning of the language. Questions of the child's contribution to the learning process and the effects of his linguistic and non-linguistic environment will be addressed throughout the book.

NORMAL VERSUS ABNORMAL BEHAVIOUR

Over the years one of the major tasks of psychology has been to provide an adequate account of abnormal behaviour and thought, an account that distinguishes it from normal behaviour, explains its origins, and suggests possible treatments or prevention. Deviant pr delayed language development accompanies many childhood disorders, amongst them sensory deficits, psychotic syndromes, and general mental retardation. In some cases the language disability may reflect the basic problem of the child better than other symptoms do. Study of normal language acquisition provides a standard with which to compare the specific language difficulties of the disordered child, frequently bringing great insight into the nature of the disorder as well as suggesting guidelines for treatment programs.

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