**Language and the Brain**

**The Domain of Study**

This domain of study examines the relationship between linguistic theories and actual language use by children and adults. Findings are presented from research on a variety of topics, including the course of language development, language production and understanding, and the nature of language breakdown due to brain injury. These topics provide examples of what is currently known about language and the mind, and they offer insights into the central issues in this area of linguistic research.

Language is a significant part of what makes us human, along with other cognitive skills such as mathematical and spatial reasoning, musical and drawing ability, the capacity to form social relationships, and the like. As with these other cognitive skills, linguistic behavior is open to investigation using the familiar tools of observation and experimentation.

It is wrong, however, to exaggerate the similarity between language and other cognitive skills, because language stands apart in several ways. For one thing, the use of language is universal—all normally developing children learn to speak at least one language, and many learn more than one. By contrast, not everyone becomes proficient at complex mathematical reasoning, few people learn to paint well, and many people cannot carry a tune. Because everyone is capable of learning to speak and understand language, it may seem to be simple. But just the opposite is true—language is one of the most complex of all human cognitive abilities.

**The Language Instinct**

Even outside the laboratory, one can make many interesting observations that one can make about the course of language development. Many of the most complex aspects of language are mastered by three- and four-year-old children. It is astonishing for most parents to watch the process unfold. What many parents don't realize is that all children follow roughly the same path in language development. And all children reach essentially many of the same conclusions about language, despite differences in experience. All preschool children, for example, have mastered several complex aspects of the syntax and semantics of the language they are learning. This suggests that certain aspects of syntax and semantics are not taught to children. Further underscoring this conclusion is the finding, from experimental studies with children, that knowledge about some aspects of syntax and semantics sometimes develops in the absence of corresponding evidence from the environment.

To explain this remarkable collection of facts about language development, linguists have attempted to formulate a theory of linguistic principles that apply to all natural languages (as opposed to artificial languages, such as programming languages). These principles, known as linguistic universals, offer insight into the acquisition scenario set out before us: why language is universal, why it is mastered so rapidly, why there are often only loose or incomplete connections between linguistic knowledge and experience. These features of development follow from a single premise--that linguistic universals are part of a human 'instinct' to learn language, i.e., part of a biological blueprint for language development.

There is another way in which knowledge of language and real-world experience are kept apart in the minds of children; they do not always base their understanding of language on what they have come to know from experience. For example, children do not combine the words of the sentence 'Mice chase cats' in a way that conforms with their experience; if they did, they would understand it to mean that cats chase mice, not the reverse. In other words, children are able to tell when sentences are false, as well as when they are true. This means that children use their knowledge of language structure in comprehending sentences, even if it means ignoring their wishes and the beliefs they have formed about the world around them.

**Modularity**

Research on adult language understanding is also concerned with the architecture of the mind and with the possibility that linguistic knowledge and belief-systems reside in separate 'modules'. To investigate the issue of modularity, studies of adult language understanding ask when different sources of information are used in processing sentences that have more than one possible interpretation. It is in the nature of language that many sentences are ambiguous. Yet, ordinarily, by the time a person reaches the end of an ambiguous sentence, only a single interpretation remains, the one that is consistent with the conversational context. In the absence of any context, e.g. in a laboratory setting, the interpretation that survives is often the one that best conforms with a person's general knowledge of the world.

Adopting a modular conception of the mind, some researchers contend that the preference for one interpretation over its competitors is initially decided on linguistic grounds (syntactic and semantic structure); real-world knowledge comes into play only later, on this view. The availability of different sources of information is difficult to determine, however, because the resolution of ambiguity takes place as a sentence is being read or heard, rather than after all the words have been taken in. In order to establish the time-course of various linguistic and nonlinguistic operations involved in language understanding, sentence processing is often measured in real time, by recording the movements of the eyes in reading, for example. The jury is still out on the question of the modularity of mind in language processing, but there are some suggestive research findings, and few researchers in the area would deny the contribution of linguistic knowledge in the process.

Another source of evidence bearing on the modularity hypothesis comes from studies of language breakdown. Language loss, or aphasia, is not an all-or-nothing affair; when a particular area of the brain is affected, the result is a complex pattern of retention and loss, often involving both language production and comprehension. The complex of symptoms can be strikingly similar for different people with the same affected area of the brain. Research in aphasia asks: Which aspects of linguistic knowledge are lost and which are spared? The fact that language loss is not always associated with a corresponding loss of pragmatic knowledge supports the modularity hypothesis, bringing the findings of research on aphasia in line with those from the study of child and adult language understanding.