PREFACE

The emergence of language looms large in any discussion of the evolutionary development of our species. Indeed, the phenomenon of human language often seems so awesome that it is difficult to approach the subject with scientific objectivity. Nevertheless, those who deal with pathologies of speech and language need a down-to-earth, pragmatic approach when they deal with deficit and loss, and compensation and recovery, with the nitty-gritty problems involved in evaluating the quality of everyday, face-to-face communication.

The pragmatic approach of the speech and language pathologist has much in common with the pragmatic approach of the evolutionary biologist. In our sign language studies of chimpanzees we face the same practical problems of observation, definition, and measurement that are the daily concern of those who study speech and language pathology, particularly in the development of young children. We feel that we have profited enormously from our reading in the literature and from our discussions with colleagues in this field. When William Perkins invited us to edit and contribute to an issue of *Seminars in Speech and Language* dealing with language from an evolutionary point of view, it was an offer that we could not refuse.

Inevitably, the result was limited by the format of this series; it would take at least one large volume to cover a representative sample of current topics. Even so, we hope that this issue of *SSL* offers an interesting sample and that each contribution contains enough material on its topic to be helpful to this audience, and to entice some of you into further study.

EVOLUTIONARY DEVELOPMENT

However wide the diversity of life forms is, all are subject to the same fundamental laws of nature. This is an essential premise of evolutionary biology. Rather than inventing different laws for different species—simpler laws for simpler species, more complex laws for more complex species—scientists attempt to discover more general and more powerful laws that act and inter-

act to yield the rich diversity of living forms. Evolutionary biologists assume that existing forms, diverse as they may seem to be at first, arose as variations of earlier forms. When traced through the fossil record, common traits, such as the five digits of the extremities and the sutures of the skull, reveal lines of descent from common ancestors.

In *The Origin of Species* Darwin described the archaeological record as

> a history of the world . .. [of which] . . . we possess the last volume alone, relating only to two or three countries. Of this volume, only here and there a short chapter has been preserved; and of each page, only here and there a few lines. (1859/1979, p. 316).

Much has been added to this record since Darwin's time, but the gaps are still vastly more extensive than the record. For any line of descent that we can trace, there are enough gaps remaining to support a theory of discontinuous leaps. Nevertheless, most evolutionary biologists remain convinced that nature does not move in jumps and that the inevitably fragmentary discoveries that make up the archaeological record trace the outlines of a continuous process.

As Lieberman shows in his contribution to this issue of *SSL,* the human voice box is dramatically different from the homologous breathing, eating, and noise-making structures of other mammals. Nevertheless, there is a fossil record, beginning with ancient prehuman beings millions of years ago, who had vocal tracts much like those of modern chimpanzees, and leading up to the human vocal tract so carefully studied by modern members of ASHA.

As Lieberman also shows, the current version has serious flaws. Our treasured voice box has developed so far in the direction of speech production that it interferes with the basic task of eating and drinking. We have become the only mammal that must stop breathing in order to swallow food and drink, which is often embarrassing and sometimes disastrous. This hazard to survival that has evolved along with our exquisite signaling device illustrates two important principles of evolutionary biology that Lieberman discusses and that we would like to stress here as well. First, a structure that costs so dearly in biological survival must be worth a great deal in terms of net survival value. This is the bottom line in biological economics. Second, as marvelous and varied as the products of evolution may seem, they are rigorously constrained. Later forms can only be variations of earlier forms. Complete breaks with the past are impossible, desirable as that might be, even from the harsh viewpoint of elementary survival.

CHILD DEVELOPMENT

The range of variation that is to be found among individuals of any given species is a fundamental fact of biology. Variations in traits that reflect variations in the gene pool are the fundamental source of evolutionary change. Descriptions of "the cat" or "the chimpanzee" or "the child" that fail to include the range of individual variation are necessarily distorted. In a similar way, any evaluation of pathology depends on an appreciation of the individual variability to be found both within the normal population and among those who suffer from each type of pathology. Descriptions of normal and pathological types that fail to include the range of individual variation are necessarily distorted.

We are usually concerned with variations among mature individuals, but development from birth to maturity presents us with the most dramatic examples of variation within a species. Children can hardly be described as miniature human beings. Each phase of their continuous development to maturity must be studied and described on its own terms with its own range of variability.

In the once-popular Chomskian movement, linguistic competence (as opposed to performance) was seen as a fundamental human trait without any significant variability, and without any significant developmental history.

> We are presenting an 'instantaneous model' of language acquisition which is surely false in detail, but can very well be accepted as a reasonable first approximation. . . . Given an instantaneous model that is empirically well-supported, as a first approximation, there are many questions that can immediately be raised. (Chomsky, 1967, pp. 441–442).

While the immediate followers of Chomsky could not deny some significant development of linguistic competence in early childhood, they insisted that the process of development was extremely rapid, if not quite instantaneous.

> Superficial acquaintance with young children reveals one of the problems that a theory of language acquisition must face. At 18 months or so, children begin to form simple two- and three-word sentences. By the age of four, they are able to produce sentences of almost every conceivable syntactic type. In approximately 30 months, therefore, language is acquired, at least that part of it having to do with syntax—an achievement that any theory of linguistic development must consider. (McNeill, 1968, p. 407).

As has so often been the case in the history of science, the discontinuity represented a gap in the record rather than a discontinuity of nature. The early theories were founded on a lack of information. They accepted absence of evidence as evidence of absence. Fortunately, a great volume of fresh research has given us a much fuller and richer picture of child development, including linguistic development. In her contribution, Kuhl describes a sample of the new findings, with particular emphasis on prelinguistic development. She and her associates have been studying early developments in the use of voice and gesture that reveal further significant continuities between linguistic development and the rest of early child development.

COMPARATIVE LINGUISTICS

Early anthropologists looked for examples of evolution within the human species. They soon found differences between the exotic peoples of the global empires and their European masters and read evidence of progress from primitive to advanced human beings. Darkness of skin and habits of dress or undress were clear evidence of primitiveness; peculiarities of language were another. Some of the exotic languages had too few consonants, suggesting a primitive lack of precision; others had too many consonants, revealing primitive roughness. Some of the exotic languages had too great a ratio of nouns to verbs, indicating a primitive lack of abstraction; others had too great a ratio of verbs to nouns, indicating a primitive concern with the motoric. It was only in the 20th century and after much argument that anthropologists arrived at the modern view that human beings may vary widely over the globe, but all represent a common humanity. In the same way modern linguists look for the common underlying principles that relate the widely different languages of the world.

But what about languages that are so different that they do not even use speech? What about the sign languages of the deaf? Only in recent times, and again after lengthy disputes, language has come to represent something much broader than the production and reception of a speech code. We no longer deny the common humanity of those who live in the many vigorous communities of human beings that carry on all of their face-to-face communication in one of the sign languages. Moreover, the parallels between sign and speech offer us a special way of looking at the fundamental nature of language and communication, at the basic functions that are independent of the speech code. William Stokoe's pioneering studies of the linguistics of sign and *A Dictionary of American Sign Language on Linguistic Principles* (Stokoe, Casterline, and Croneberg, 1965) mark the beginning of this field as a modern scientific discipline. The journal that he founded in 1972, *Sign Language Studies,* was the first scientific journal devoted to sign languages and is still the most important in this field. Stokoe's contribution here takes up some of the parallels between sign and speech, particularly those related to the acquisition of sign and speech by young children.

COMPARATIVE PSYCHOBIOLOGY

The geological record tells a tale of flux and change. Those creatures who are most finely tuned to the environment of their ancestors perish when conditions change. The paths of specialization are paths to extinction. The ancestors of the giant panda lived in a time when highly nourishing bamboo shoots were plentiful. In that place, and in those times, it was highly adaptive to specialize in that one kind of food. Now that bamboo is scarce, the panda is rapidly approaching extinction. Human beings are remarkable for their lack of specialization. We live in the Arctic and at the Equator, in the mountains and by the sea, in deserts and marshlands, and we thrive on an astounding variety of foods.

There is no accurate way to count the number of different species that inhabit the Earth today, and no way to count the number that once flourished, but are now extinct. Yet, we can estimate the ratio of one to the other and it is clear that for every species that is with us now, there are many hundreds, most likely thousands, that died out before our time. Through all of this stupendous variation from species to species, certain traits—such as the oxygen basis of metabolism, the molecular basis of the genetic code, and the electrochemical basis of communication in the nervous system—appear and then persist through all times and under all of the conditions that we have seen so far. Evolutionary biologists refer to these traits as conservative traits because once they appear in the course of evolution, they are rarely if ever abandoned, presumably because of their universal survival value.

Conservative traits are significant because they teach us general principles. They are also the common traits that link humanity to the rest of the animal kingdom and enable human beings to learn more about themselves while studying other animals. Scientists are more interested in the general principles underlying biological phenomena because they are the most powerful determinants with the widest range of practical applications.

It seems unlikely that a phenomenon such as language could be based on an isolated, unitary biological trait. It is much more reasonable to suppose that language is the result of a complex of interacting traits that have far-reaching effects on all aspects of human intelligence. It is also reasonable to suppose that, like other significant biological phenomena, the general principles that govern human intelligence are related to the general principles that govern the intelligence of all animals. It is the search for these general biological principles of intelligence that lead to our sign language studies of cross-fostered chimpanzees.

Our sign language studies of cross-fostered chimpanzees were also based on the observation that the acquisition of language by human beings is a long and gradual developmental process. Toddlers do not master their native language in a few short years. Even at our great universities we find a significant number of intelligent young adult human beings who have not yet fully mastered their native language. We reasoned that the stage-by-stage development of human children would provide us with a scale against which to measure the development of the cross-fosterlings. This gave us a strong interest in the work of those who measure speech and language disorders in the development of human children and a strong hope that our research could contribute to this work. We also reasoned that linguistic developments would be intimately related to the rest of behavioral development. These are the aspects of this research that we have emphasized in our contributions to this issue of *SSL*.

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