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ESSAYS ON LINGUISTICS

（第五十辑）

北京大学中国语言学研究中心

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《语言学论丛》出版五十辑了，编委会和商务印书馆在一年前就开始酝酿在这一辑庆祝一下，纪念这本学术辑刊走过的57年，巧合的是，《语言学论丛》创办就在1957年。

回顾《语言学论丛》这五十辑，我们从同人论集，主要发表北京大学师生的研究，发展到今天有世界影响力的学术辑刊，登载遍及世界各国的语言学者的语言学论文；我们从只限于中文，发展到中英文均可；我们从传统的纸笔操作，发展到电子投稿和审稿系统；我们从不定期出版，发展到每年两辑定期出版。无论是从出版形式上，还是在内容的涵盖上，这些年我们一直在努力。

回顾《语言学论丛》这五十辑，我们有改变，也有坚守。我们坚守的是论作的质量，因此，无论作者是年轻还是年长，也无论来稿是长篇宏论还是短文小札，只要是好文章，《论丛》就会发表。幸赖于很多同道支持，我们能坚持到今天。

我们经常听到很多学者告诉我们，“我的第一篇论文就是在《论丛》发表的”。说实话，这是最令我们这些编者开心的一句话。或许正是由于这样的原因，很多学者愿意惠赐自己的得意之作。当我们发出筹划出版五十辑纪念专辑的消息后，很多学者给我们寄来自己的近作，容量也大大超出了一辑能承受的最高限度。经与商务印书馆协商，我们决定出两册纪念专辑，第五十辑和第五十一辑，寄寓我们良好的期盼，“继往”和“开来”。

《语言学论丛》编辑部

2014年10月18日

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语言及人类的祖先*

王士元

提要 虽然我们在受精的一刹那从双亲继承了基因，但却一辈子都从不同的源头习得语言，因此表现这两种演化史的方式也一定会有所不同。树图和波图都是简单有用的示意法，可以代表语言传递的两种主要方式：纵向与横向传递。然而，也许受到生物学的影响，许多语言研究的趋势都以纵向传递为主流，而轻忽了横向传递的探索。我将回顾近年来一些关于语言与人类祖先的文献，探讨与这个领域相关的研究议题。

关键词 基因与语言　演化　演化史　纵向传递　横向传递

There is an intimate symbiotic relationship between peoples and languages. Without our species, language would not have emerged. At the same time, once language is in place, cultural evolution proceeded at an ever accelerating pace, superseding biological evolution in changing the face of our planet. Even though people are called *Homo sapiens*, according to the classification scheme pioneered by Carl Linnaeus (1707-1778), I have serious doubts that our species deserves to be called 'wise'. *Homo loquens* is really a better name, since language is unique to us. It was first proposed by J. G. Herder (1744-1803) in his prize-winning essay on the origin of language. ①So the question whether peoples or languages came first really is a chicken-or-

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* This essay is largely based on my recent presentations at Nanjing Normal University (NNU, 2014.4.22), and at Academia Sinica (AS, 2014.6.4). The latter occasion was the 14th meeting of the International Symposium on Chinese Languages and Linguistics, which coincides with the 10th anniversary of the establishment of the Institute of Linguistics at Academia Sinica. I thank Professor GuWentao顾文涛 of NNU and Professor Tseng Chiuyu郑秋豫 of ILAS for their invitation and hospitality. I am particularly happy to contribute this essay to the 50th volume of *YuyanxueLuncong*, a very important voice for linguistic research.

egg question.

Study of the ancestry of peoples and languages requires knowledge from several disciplines, especially linguistics, genetics, anthropology, psychology, neuroscience, and others. My remarks here will dwell more on linguistics and genetics, how these two disciplines interact with each other with mutual benefit. Since my topic concerns ancestry I will look at things from an evolutionary perspective—both biological and cultural. The geneticist T. Dobzhansky has famously said: "*Nothing in biology makes sense except in the light of evolution*" (1973). This statement can be extended to include language, which is a joint product of both biological and cultural evolution.

1 Two fundamental stores of information

As Roman Jakobson noted②, genes and words are the basic building blocks of the two fundamental information systems on our planet, and that the two systems exhibit similar aspects:

> "The **genetic code**, the primary manifestation of life, and, ... **language** (the universal endowment of humanity) and its momentous leap from genetics to civilization, are the **two fundamental stores of information transmitted from ancestry to progeny**, the molecular heredity and the verbal legacy as a necessary prerequisite of cultural tradition." (Emphasis added.)

The biologist Niels Jerne was also impressed by similarities between how languages generate numerous highly diverse sentences and how immune systems generate numerous highly diverse antibody molecules. He devoted his Nobel lecture of 1984 to compare language with immune systems.③

People perpetuate by biological evolution, by the transmission of genes across generations; this is a very slow process. For a biological innovation to spread across a population, it would require many generations of genetic transmission. To use an analogy[4] made famous by the geneticist François Jacob, another Nobel laureate with a strong interest in language, biological evolution is like tinkering[5]. This apt analogy has been recently discussed by the anthropologist Daniel Lieberman as follows[6]:

> "Jacob's analogy of evolution by tinkering helps explain several key emergent properties of evolutionary change, including the tendency of organisms to function and to be highly integrated. ...When new organisms make new use of preexisting or modified modules, these tinkered novelties often tend to work because they are made of modules that already function appropriately and come with existing mechanisms for adjusting to one another. In other words, tinkering takes advantage of modularity and leads to integration..." p. 52.

There are indeed many modules which need to be biologically evolved in the human body before it is language ready; I called the integration of these modules a 'mosaic' [7]. As we will discuss shortly, these modules came about directly or indirectly as a result of our bipedal posture. Many of these modules serve abstract abilities, such as consciousness, attention, self awareness, etc.; cognitive neuroscience is centrally interested in these abilities, and may be able to shed light on them before long.

Of particular importance is the ability for ***symbolic*** behavior, the realization that some symbol X is a representation of some completely unrelated Y, be it an object, an event, or whatever. Presumably this behavior started with a loose set of vaguely defined combination of body movements (facial expressions and gestures) and vocalizations, which accompany the hominin's emotions or intentions. For example, a gesture to bite or to strike, together with an aggressive growl, may indicate 'attack', even though no attack is forthcoming. Gestures are more iconic than vocalizations, and must have played a central role in the evolution of symbols; see Arbib (2013). Gestures persist to this day in the use of language, (witness the strong tendency to gesture even on the telephone), though the central communicative role is now taken over by segmental phonology.

A crucial aspect of symbolization is that it maps a continuous world of infinitely varying shapes, colors, and sounds into a discrete and finite inventory of categorical symbols. The use of such discrete symbols enables the speaker to refer to objects and events far removed in time and space from the 'now' and 'here', extending from the actual to the impossible, thus opening up the mind to the rich world of imagination. Indeed, the ability to symbolize is so fundamental to our species that the anthropologist Terrence Deacon used the term 'symbolic' to name our species. ⑧

The realization of the power of symbolization may arrive instantaneously in a flash, as poetically recorded by the young Helen Keller when she suddenly was able to connect the finger movements her teacher was making (X) with the water that was flowing over her hand (Y). ⑨ More likely, however, the realization evolved over numerous generations in early hominins⑩, fading in and out till it finally came to focus and became fixed in the community. Parallel with increasing enhancements in the cognitive faculty based on symbolic behavior, including strengthening various types of memory for processing the ever increasing inventory of symbols, were the major structural changes in the hominin body that came with bipedal posture to be discussed later. The coming together of these various modules, some cognitive, some sensory, some motor, created a unique mosaic that made our ancestors language ready.

When Mendel reported on his experiments on peas in 1855 and 1856, he was largely ignored, in sharp contrast to the reception to Darwin's 1859 publication. However, their importance was recognized early in the 20th century, independently in several laboratories, and genetics has been making stunning advances ever since. These include the double helix discovered by Watson and Crick, reported in an ultra-short two-page article published in 1953. The language of life, their discovery revealed, is written in just four bases, A, C, G, and T, paired and strung out like a long twisted ladder. This new understanding led to an analysis of the entire human genome, which was announced jointly by Bill Clinton and Tony Blair in June 2000.

Just to know the strings of the four letters is not very helpful, of course; the goal is to understand what they mean. The situation is comparable in linguistics to having unearthed a huge collection of texts written in a language no one can read. To make the texts meaningful, we need dictionaries and grammars. It will take many decades to decipher the language of life, but much progress has been made over these six decades. The bases, it turns out, group in codons of three along the helix, each coding an amino acid. Sequences of amino acids code the several thousand genes, which in turn make the proteins in the human body.

Most interestingly, it turns out that the portion that actually codes for genes is only a very small percentage of the genome[11]. Much of the genome is devoted to regulatory mechanisms which determine how these genes interact and how and when they should be expressed. The study of these regulatory mechanisms is called *epigenetics*[12], a relatively new but extremely important field. In a very limited sense, they correspond to the dictionaries and grammars we will need to understand the book of life.

The genetic alphabet of 4 bases is comparable to the several dozen phonemes of language—a small number of discrete units, each meaningless in and of itself.

A fixed length of three bases form amino acids, while several phonemes join to form morphemes. Both amino acids and morphemes show synonymy and homonymy. For example, the amino acid Alanine requires G in the first slot, C in the second slot, while the third slot can be filled by any of the 4 bases—therefore GCx is a synonym set of 4 (4 forms coding for one amino acid). This is similar to '*manual*, *handbook*' and '*student*, *pupil*' as synonyms in English. On the other hand, the codon AUG[13] is an instance of homonymy (one form coding for more than one meaning) since it codes for the amino acid Methionine, and serves as an initiation site for reading the sequence. This is similar to the English word '*bank*' having distinct and unrelated meanings in English.

At a higher level, genes are expressed by different alleles, such as *blue* and *brown* are different alleles for the gene which controls eye color. This corresponds roughly to a meaning being expressed by different words in different languages, such as *water* and *shui* for the H_2O. I expect more and deeper aspects of organizational similarity will be discovered between these two information systems as we explore them together, even though the genetic code and languages evolved in totally different contexts and are used respectively for distinct purposes.

Advances in genetics have important implications for linguistics on two exciting fronts. They will connect with neuroscience, another discipline that is growing explosively, and bring us knowledge on how genes build a brain that is language ready[14]. On a different front, genetics has been collaborating with linguistics and anthropology in exploring the evolution of peoples and languages, as exemplified by the pioneering work of L. L. Cavalli-sforza and others. I will review some of the results on this front in my remarks here.

2 Ancestry of peoples

The closest living relative to our species is the chimpanzee, who share most of our genes. Contrary to folk intuition, chimps are closer to us than they are to gorillas. As shown in the figure below taken from Lieberman 2013: 29, our lineages diverged some 6 million years ago. The chimpanzee lineage split around 2 million years ago into two species, the common chimp and the smaller bonobo, which have very different social structure and behaviors. Investigations of these chimpanzees have shed much light on our own evolution. ⑮

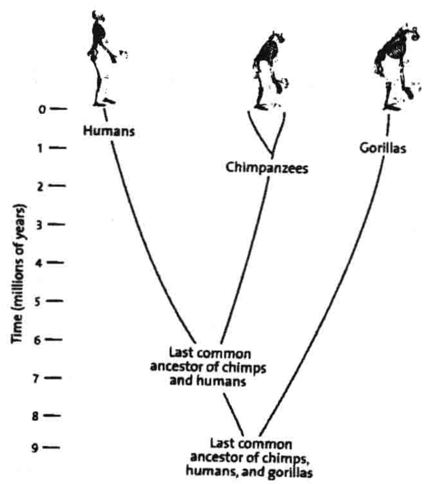

Fig. 1 A surprising phylogeny: chimps are more closely related to us than they are to gorillas

A most important innovation our lineage developed is bipedalism. This came around 4 million years in the genus *Australopithecus*, which is the precursor to our own genus of *Homo*. The structure of the foot of an *Australopithecus* and its implications for walking and running has been studied with renewed interest recently with the discovery of new fossils[16]. Bipedalism re-structured our body, introducing maladaptations[17], such as a weaker lumbar region due to curvature, and asphyxiation due to blockage in the throat. This latter danger was actually foreseen by Darwin, who noted in 1859: 191:

> "The strange fact that every particle of food and drink which we swallow has to pass over the orifice of the trachea with some risk of falling into the lungs, notwithstanding the beautiful contrivance by which the glottis is closed."

However, these drawbacks are more than offset by the advantages that came with bipedalism. Foremost among these is the use of the arms and hands, which led to the making of tools of greater and greater variety and functionality. Again Darwin remarked on the implications of bipedalism early in 1871:

> "Man alone has become a biped; ...which forms one of his most conspicuous characters. Man could not have attained his present dominant position in the world without the use of his hands, which are so admirably adapted to act in obedience to his will.... But the hands and arms could hardly have become perfect enough to have manufactured weapons, or to have hurled stones and spears with a true aim, as long as they were habitually used for locomotion and for supporting the whole weight of the body...If it be an advantage to man to stand firmly on his feet and to have his hands and arms free...then I can see no reason why it should not have been advantageous to the progenitors of man to have become more and more erect or bipedal. They would thus have been better able to defend themselves with stones or clubs, to attack their prey, or

otherwise to obtain food. The best built individuals would in the long run have succeeded best, and have survived in larger numbers."

The genus *Homo* is marked by the first making of stone tools some 2 million years ago. The stones that our ancestors shaped then to crack nuts and to cut meat are the distant precursors of modern airplanes and computers. Tool making indicates planning of sequences of events, and perhaps an elementary form of symbolic behavior. Planning and symbolizing co-evolved with cognition, thinking, and memory. Shortly after this important innovation, the hominin line began many waves of emigration from Africa into Asia, first in the form of *Homo erectus*, then later in the form of *Homo sapiens*.

In addition to free the arms and hands for creative use, another consequence of bipedalism is the descent of the larynx, which added an acoustic tube to the air pathway, perpendicular to the mouth. The enhanced space for forming speech sounds in the throat paved the way for developing segmental phonology, which greatly increased the efficiency and rate of information transmission. The figure below, taken from Stevens 1999: 286, illustrates how the mouth and the throat interact to produce the major vowels used in the languages of the world, where each is modeled as a straight tube.

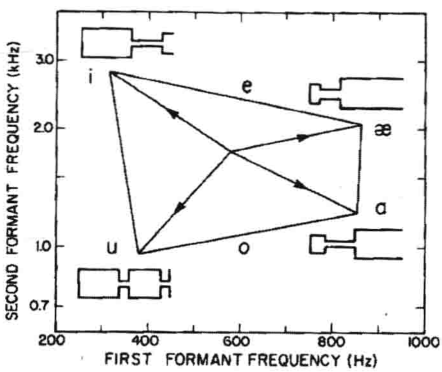

Fig. 2 The quadrilateral vowel space as modeled acoustically by a cascade of tubes