preadaptations to speech

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"Possible Preadaptations to Speech. A Preliminary Comparative Approach"
Marc Verhaegen & Stephen Munro 2004
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Abstract

Human language is a unique phenomenon and its evolutionary origins are uncertain. In this paper we attempt to explore some of the preadaptations that might have contributed to the origin of human speech.
The comparative approach we use is based on the assumption that all features of a species are functional, and that all features can be compared with those of other animals and correlated with certain lifestyles. Using this method we attempt to reconstruct the different evolutionary pathways of humans and chimpanzees after they split from a common ancestor.
Previous results from comparative studies suggest human ancestors may not have evolved on the open African savannas as was once believed, but more probably were coastal omnivores feeding on plant matter and easy to catch invertebrates such as shellfish from beaches and shallow waters. Fossil and archaeological data suggest this coastal phase occurred at the beginning of the Pleistocene, when Homo ergaster−erectus dispersed between East−Africa, North−Africa, South−Asia and Indonesia.
This paper presents comparative data suggesting the various human speech skills may have had their origins at different times and may originally have had different functions. Possible preadaptations to speech include, for instance, musical skills present in a variety of primate species (sound production); airway closure and breath−hold diving for collecting seafood (voluntary breath control); and suction feeding adaptations for the consumption of fruit juice or certain seafoods (fine control of oropharyngeal movements). The different evolutionary pathways of chimpanzees and humans might explain why chimpanzees lack language skills and why human language is a relatively recent phenomenon.

Concluding Remarks

The combination of comparative and fossil data suggests that by about 1.8 million years ago human ancestors may have become more reliant on wading and diving than on climbing.

A waterside mammal might be expected to have greater control of the lips, tongue and throat muscles for seafood consumption, as well as voluntary control of the airway and breathing musculature for swimming and diving. This oral cavity and airway control might have been preadaptative to the evolution of human speech, particularly in combination with the already well−developed rhythmical, melodic and duetting abilities of our primate ancestors.

A wading−and−diving lifestyle might have also required a different method of communication. Traditional primate communication systems such as smell and certain types of body language (such as posture, for example, though not facial expression) may have been less effective in a semi−aquatic milieu when compared to a purely terrestrial or arboreal one (Morgan 1997). Derek Ellis (personal communication) notes "how well sound travels over water, compared to being muffled in forests, and even compared to grassland. Foraging beach and lagoon apes could separate quite widely and still remain in contact by vocalising."

It is possible that the modifications to our ancestors' food and airway entrances coincided with an early stage in the disproportionate expansion of the human neocortex, in particular Area 4 (precentral) and Area 44 (Broca), which control the fine movements of the mouth and throat muscles − whether for singing, swallowing or diving. Humans, as opposed to chimpanzees and other primates, have disproportionally large neocortical areas when compared to the brain stem (e.g. Deacon 1997). Of these, the temporal and insular areas (including the Areas 4, 44 and Wernicke), where sounds are produced, processed and interpreted, seem to have undergone the greatest enlargement (Semendeferi & Damasio 2000). Perhaps in this part of the brain, the pre−existing functions of song production, food consumption and airway control were integrated into a system that could produce voluntary and articulated sounds, i.e. the beginnings of speech. The integration of this voluntary sound production system with the symbolic powers that may have already existed in primates (Savage−Rumbaugh 1986), might have been made possible due to the extra brain tissue (association or integration cortex) that developed during human evolution.

Our paper can be found in the AAT files
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