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"What are the Uniquely Human Components of the Language Faculty?"
by Marc D. Hauser and W. Tecumseh Fitch

Hauser and Fitch use the comparative approach to understand the evolution and characteristics of human language. Their article focuses on speech production and speech perception, using studies that involve both human and non-human ancestors. In order to determine which language faculties are uniquely human, Hauser and Fitch argue that the comparative approach must be employed since subsystems of language exist in other animal brains as well. These animal studies are necessary to determine which mechanisms are used only by humans and which mechanisms are shared.

"An adequate understanding of the evolution of acoustic communication systems requires mature theories of both production and perception" (161). The source-filter theory of animal vocal production states that production consists of two components: the source (the larynx) produces an acoustic signal, and the filter forms a basis for speech perception. These components are found in nearly all vertebrates and they are independent of each other in humans. The larynx in mammals contains vocal cords that can vibrate and vary pitch. Relative size of the larynx varies as well, so that a larger larynx can produce lower-pitched sounds.

Although the human larynx does not differ much from other mammals with regards to speech production, the vocal tract, and in particular, the location of the larynx, is different from other mammals. The human larynx is located lower in the throat and this disables simultaneous swallowing and breathing. However, this does allow humans to produce a wider range of formant patterns as we can create several vocal tract shapes. When the larynx descended in humans is still debatable because the tongue and larynx do not fossilize. Nevertheless, "speech in early hominids might have been accompanied by a temporary laryngeal retraction (as seen in other mammals during vocalization)" (164). Recent research has also shown that the male red deer has a descended larynx (exceeding the laryngeal descent of humans), which would indicate that speech is not dependent on the descent of the larynx.

Hauser and Fitch next discuss formants in animal communication and their importance in evolutionary history. One important type of information that may be conveyed via formants is body size. The formant frequencies are determined by the length of the vocal tract, which is determined by the size of the skull, which is determined by body size. "Because body size is highly relevant to social behaviour and reproductive success in most terrestrial vertebrates, it seems likely that an initial function of formant perception was to help judge the body size of a vocalizer" (166). Data such as this supports the idea that formants used in communication were present hundreds of millions of years ago in the common ancestor of birds and mammals.

In the last section about speech production, the authors return to the descent of the larynx in humans (a trait that was previously thought to be uniquely human) and address the question of why the larynx is permanently descended in two deer species as well. One hypothesis is a "size exaggeration" of the vocalizer. Since formant perception is related to body size, the deer can deceive other animals (intimidating rivals and attracting females.)

The descended larynx in humans and deer is an example of convergent evolution since the common ancestor did not have a descended larynx and the descent most likely did not occur for the same reasons in the two species. "However, since the size exaggeration hypothesis is based on physical and physiological principles that are common to all mammals it also provides a plausible alternative explanation for the initial descent of the larynx in our own species" (168).

The descended larynx in humans could have evolved for purposes of size exaggeration long before the evolution of language for communication. A second descent in the human male larynx at puberty provides evidence for this, as it probably serves the same function as the descended larynx in male deer.

The second half of the article focuses on speech perception and the question of which components evolved solely in humans and which evolved in all mammals. Categorical perception was once thought to be uniquely human, but studies using other animals have proved this wrong. "This suggests that the mechanism underlying categorical perception in humans is shared with other animals, and may have evolved as least as far back as the divergence point with birds" (171).

Further research on the importance of processing speech has been done with human and non-human primates, focusing on phonemic contrasts and formant perception. The results of Kuhl's study indicate that a "perceptual magnet effect" is uniquely human because there is no evidence that "rhesus monkeys distinguish prototypical from non-prototypical instances of a phonetic category" (172). On the other hand, a replication of Kuhl's study with starlings indicates that the magnet effect is not uniquely human and can be explained using general auditory mechanisms. Obviously, much more research needs to be done in this area as there are only two studies using animals.

Hauser and Fitch next describe experiments that attempt to explain which speech mechanisms are available to human infants and animals in a spontaneous, rather than a trained, setting during acquisition. The habituation/dishabituation procedure is used to determine if the subject can detect a difference in acoustic class by responding to the stimulus. French newborns and cotton-top tamarin monkeys were used in an experiment comparing spoken sentences of Dutch and Japanese. The newborns were unable to discriminate between the two languages with natural speech, but were able to with synthetic speech. The tamarins were able to discriminate between the two languages with both natural and synthetic speech. However, when the sentences were played backwards, neither could discriminate between the languages. The findings of this experiment indicate that "newborns may be more sensitive to prosodic differences (e.g. rhythm), while tamarins may be more sensitive to phonetic contrasts" (175).

Other experiments focus on the ability of humans to distinguish words and phrases from acoustic cues. Saffran hypothesized that human infants are able to extract regularities from a particular language and this aids in later language acquisition. Studies involving non-human animals also show that animals possess these same statistical computations. Yet the "results on statistical learning should be treated somewhat cautiously because of subtle differences in methods between species, the lack of information on where in the brain such statistics are being computed, and the degree to which such computations can operate over any kind of input" (177-8).

Hauser and Fitch conclude by stating that most of the mechanisms for speech production and comprehension are present in our closest living relatives and that these mechanisms evolved for communicative and cognitive functions. Comparative studies will help to determine which components of language are not uniquely human by process of elimination. "What is perhaps uniquely human, however, is our capacity to take the units that constitute spoken and signed language, and recombine them into an infinite variety of meaningful expression" (179).