

The acoustic role of supralaryngeal air sacs

Bart de Boer

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This paper investigates the acoustic effect of supralaryngeal air sacs on the range of sounds that a given vocal tract can generate. Humans do not have supralaryngeal air sacs, whereas apes (chimpanzees, orangutans and gorillas) do. It has also been found that the anatomy of the hyoid bone of Neanderthals (the Kebara hyoid) is consistent with the absence of air sacs, while that of Australopithecines (the Dikika baby) is consistent with their presence. As an important difference between humans and all other primates is that humans speak, it has been suggested that the loss of air sacs has something to do with the evolution of speech.

Here an articulatory model is used to compare the acoustic properties of a human-like vocal tract with and without a chimpanzee-like air sac. The articulatory model is based on the Mermelstein model, and the air sac is a simplified model of a side branch with the approximate size of a chimpanzee air sac. It is found that the air sac reduces the range of articulations, and decreases the average formant frequency. This would provide an explanation for the presence of air sacs in apes (size exaggeration) and their disappearance in humans (increased articulatory range).