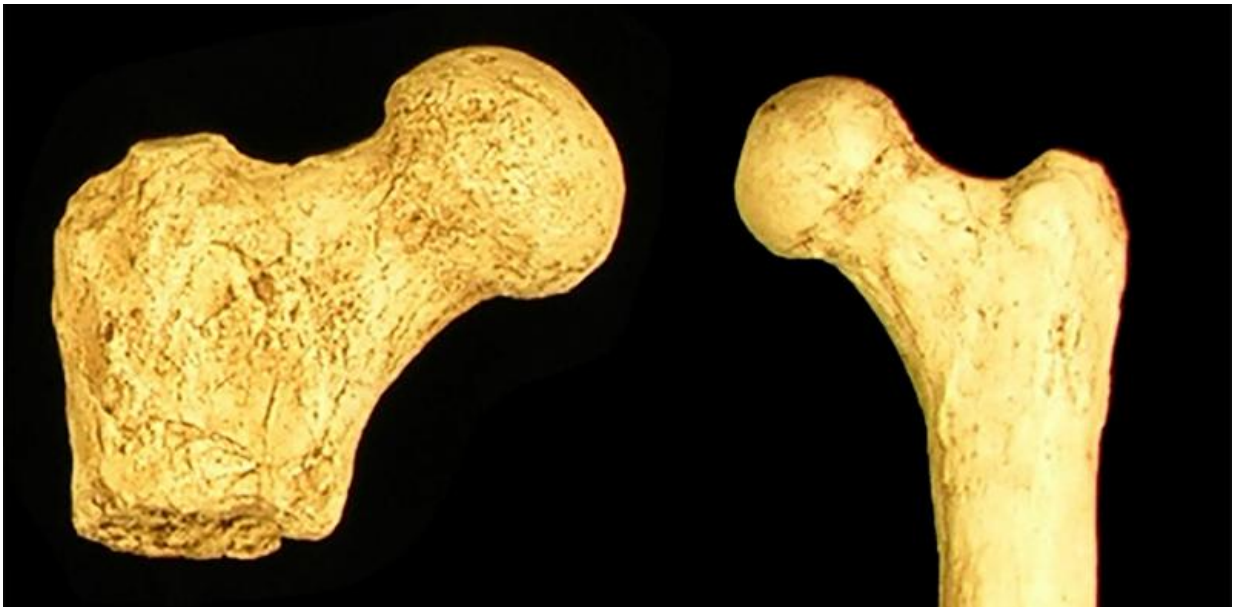


Not much size difference between male and female Australopithecines

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Two femora, on the left is a large, presumably male specimen and on the right is Lucy. The difference between these two gives the impression of a large size differences between the sexes. However, inclusion of the many intermediately sizes specimens from this species indicates that the size variation is similar to moderately dimorphic humans. Credit: Philip Reno, Penn State

Lucy and other members of the early hominid species *Australopithecus afarensis* probably were similar to humans in the size difference between males and females, according to researchers from Penn State and Kent State University.

"Previous convention in the field was that there were high levels of dimorphism in the *Australopithecus afarensis* population," said Philip Reno, assistant professor of anthropology, Penn State. "Males were thought to be much larger than females." Sexual dimorphism refers to differences between males and females of a species. These can show up, for example, in body [size](#) and weight or in the size of the canine teeth. For *Australopithecines*, canines of males and females are about the same size, but it was assumed their body sizes differed. Other primates have varying degrees of [sexual dimorphism](#). Gorillas are highly dimorphic, with males weighing as much as 200 pounds more than females. Chimpanzees are only moderately sexually dimorphic with males weighing about 18 pounds more than females on average. Humans are moderately sexually dimorphic. Previously, researchers assumed that *A. afarensis* was similar to or even more dimorphic than gorillas in sexual size differences.

Lucy is probably the most famous example of *A. afarensis*, a supposed female who measures 3.5 feet in height. Also often used as an example of this species is A.L. 128/129, another small specimen assumed to be female. However, *A. afarensis* existed long before brains in the human line became large enough to require the alteration in the pelvic structure that both allows for large-headed baby births and easy identification of female specimens. "There is no reason why Lucy, if female, would have the wide notched pelvic bone of a human female," said Reno. "We can't really sex *Australopithecines*."

While Lucy may not be female, she is the earliest discovered and most well preserved example of *A. afarensis* and so has been used as a model for the study of other specimens. Recently, another reasonably intact *A. afarensis*, Kadanuumuu, was uncovered and he stood 5 to 5.5 feet tall. Reno and C. Owen Lovejoy, distinguished professor of human evolutionary studies, Kent State, developed the Template Method to compare different skeletons and determine the range and dimorphism of

A. afarensis. They report their results in today's (Apr. 28) issue of *PeerJ*.

The pair used both Lucy and Kadanuumuu as templates for the method, which compares similar parts of the skeleton from partial remains to the nearly complete remains of the template. For example, the researchers compared the size of 41 specimens from different parts of the skeleton to that of Lucy. By determining the ratio of these specimens to Lucy, they could then calculate the relative size of partial bones from incomplete skeletons and better determine the size variation in the species.

Another method of determining sexual dimorphism is the Geometric Mean Method, which uses 11 characteristics to estimate size. Unfortunately, in this method, because Lucy is so complete a skeleton, she supplies seven or eight of the metrics; A.L. 128/129 supplies an additional three. So two very small individuals supply ten of the eleven metrics.

"In essence, Lucy is counted multiple times in the Geometric Mean Method, which gives her a skewed impact on the size of individuals," said Reno. "In our method, Lucy is weighted only once. The range shows intermediate moderate levels of sexual dimorphism, *A. afarensis* is within the human dimorphic range."

Another problem in comparing various *A. afarensis* skeletons is that except for those found in A.L. 333—a geologically contemporaneous group—individuals could be 10 thousand to 100 thousand years apart in age. During that time, the overall size of the species could have changed. Neither method can accommodate this potential time warp, but the researchers acknowledge that the time range is another variable that must be considered. Because Lucy was the first discovered specimen, it was easy to assume that she was a typical size specimen, but it now appears that Lucy is at the lower edge of *A. afarensis* size and that

Kadanuumuu may be an outlier at the upper edge of the range with many intermediate sized specimens between the two, according to Reno.

Provided by Pennsylvania State University

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