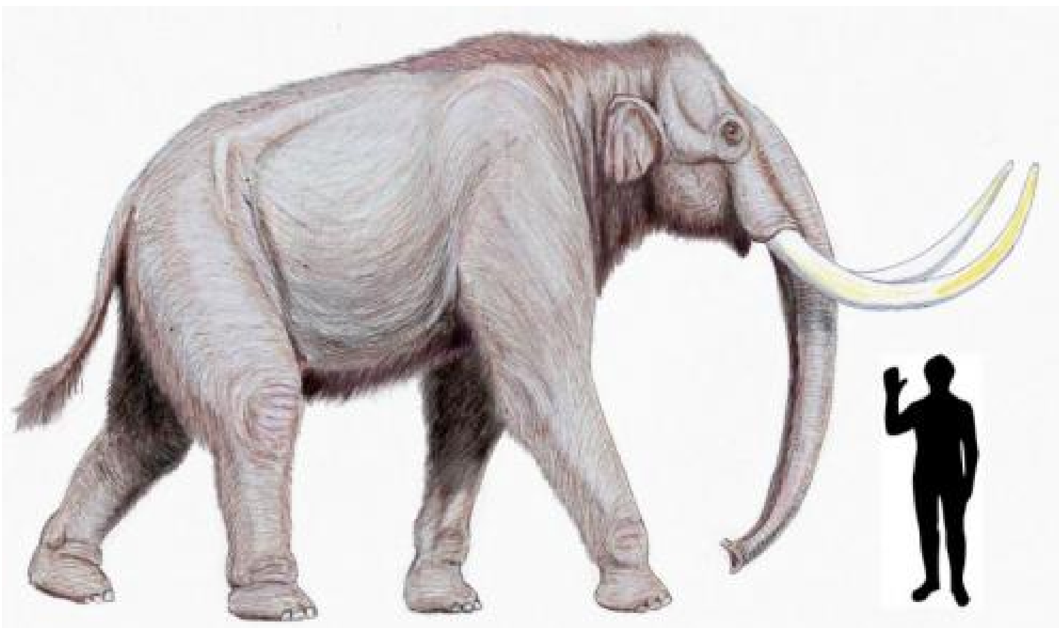
New algorithm for estimating body mass of extinct quadrupedal mammals

August 19 2015, by Bob Yirka



Restoration of a steppe mammoth. Credit: Kurzon/Wikipedia, CC BY-SA 3.0

A pair of researchers, one with the University of Manchester, the other with the University of Salford, both in the U.K., has developed a new computer algorithm for estimating the body mass of extinct quadrupedal mammals. In their paper published in *Royal Society Open Science*, Charlotte Brassey and James Gardiner describe how they came up with the new algorithm and the ways that they believe it can be used to improve estimates of body mass of extinct creatures.

Ever since humans discovered that there were creatures roaming the earth that had gone extinct, efforts have been made to try to imagine what they must have looked like. Skeletons have been reassembled and then estimates on body shape and mass were made based on how modern animals are put together—but such efforts have been deemed too open to interpretation, which likely meant that researchers were simply guessing. In an attempt to improve the accuracy, other researchers developed 3D computer models and simulations, but have had to acknowledge that there was still a lot of guesswork involved.

Now, in an attempt to remove some of that guesswork, Brassey and Gardiner have developed a computer algorithm that takes advantage of the best aspects of both prior methods. Their algorithm allows for the creation of what they call "alpha-shapes" where objects meant to mimic actual body parts, are "shrink-wrapped" around a reconstructed virtual skeleton created from the actual bones of a real specimen. The algorithm also allows for fine-tuning the shrink wrapping process from very fine, to quite coarse—on an individual specimen. Once the rendering is done, the algorithm calculates the original body mass of the creature by using an average of the body mass of 14 modern animals.

Brassey and Gardiner have tested their algorithm on the remains of a found wooly mammoth and a giant sloth—the first was calculated to be 3.6 metric tons, the second 3.7. They note that the reconstruction of the skeleton has a big impact on the final result, which means that in order to get an accurate body mass estimate, researchers must first put the skeleton together in the way that nature intended.

More information: An advanced shape-fitting algorithm applied to quadrupedal mammals: improving volumetric mass estimates, Published 19 August 2015.DOI: 10.1098/rsos.150302

Abstract

Body mass is a fundamental physical property of an individual and has enormous bearing upon ecology and physiology. Generating reliable estimates for body mass is therefore a necessary step in many palaeontological studies. Whilst early reconstructions of mass in extinct species relied upon isolated skeletal elements, volumetric techniques are increasingly applied to fossils when skeletal completeness allows. We apply a new 'alpha shapes' (α-shapes) algorithm to volumetric mass estimation in quadrupedal mammals. α-shapes are defined by: (i) the underlying skeletal structure to which they are fitted; and (ii) the value α, determining the refinement of fit. For a given skeleton, a range of α-shapes may be fitted around the individual, spanning from very coarse to very fine. We fit α-shapes to three-dimensional models of extant mammals and calculate volumes, which are regressed against mass to generate predictive equations. Our optimal model is characterized by a high correlation coefficient and mean square error (r^2=0.975, m.s.e.=0.025). When applied to the woolly mammoth (Mammuthus primigenius) and giant ground sloth (Megatherium americanum), we reconstruct masses of 3635 and 3706 kg, respectively. We consider α-shapes an improvement upon previous techniques as resulting volumes are less sensitive to uncertainties in skeletal reconstructions, and do not require manual separation of body segments from skeletons.

Citation: New algorithm for estimating body mass of extinct quadrupedal mammals (2015, August 19) retrieved 2 May 2024 from https://phys.org/news/2015-08-algorithm-body-mass-extinct-quadrupedal.html