

Small prey compelled prehistoric humans to produce appropriate hunting weapons and improve their cognitive abilities

September 7 2023

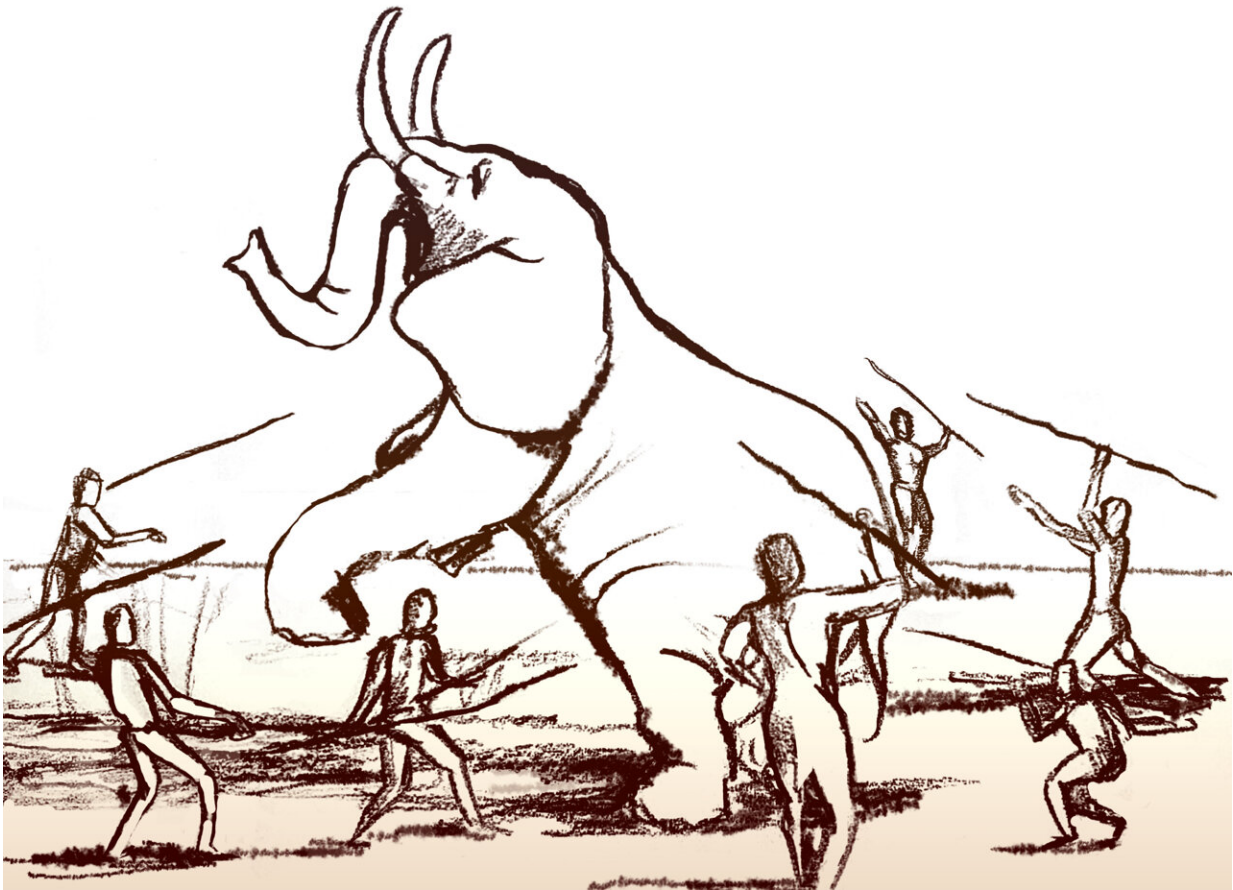


Illustration of elephant hunting using spears. Credit: Tel Aviv University

A new study from the Department of Archaeology at Tel Aviv University found that the extinction of large prey, upon which human nutrition had been based, compelled prehistoric humans to develop improved weapons for hunting small prey, thereby driving evolutionary adaptations. The study reviews the evolution of hunting weapons from wooden-tipped and stone-tipped spears, all the way to the sophisticated bow and arrow of a later era, correlating it with changes in prey size and human culture and physiology.

The researchers explain, "This study was designed to examine a broader unifying hypothesis, which we proposed in a previous paper published in 2021. The hypothesis explains the cultural and physiological evolution of prehistoric humans—including increased cognitive abilities—as an adaptational response to the need to hunt progressively smaller and quicker [prey](#)."

"So far such a unified hypothesis was lacking in professional literature, with the prevailing hypothesis maintaining that the changes in [hunting](#) weapons were a reflection of an essentially unexplained cognitive improvement."

The study was led by Dr. Miki Ben-Dor and Prof. Ran Barkai from the Department of Archaeology at Tel Aviv University. The paper was published in [Quaternary](#).




Dr. Ben-Dor says "In the present study we analyzed findings from nine prehistoric sites—in South Africa, East Africa, Spain, and France, inhabited during the transition from the Lower to the Middle Stone Age (Paleolithic), about 300,000 years ago, when Neanderthals and Homo Sapiens first emerged. In early archaeological sites of this kind, we find mostly [animal bones](#) and [stone tools](#) used to hunt and process prey. The bones reflect the relative quantities of different species hunted by humans, such as elephants, [fallow deer](#), etc."

"In this study we looked for a correlation between the advent of stone-tipped spears, and the progressive decline in prey size. Specifically, we examined the emergence of a sophisticated stone-knapping method known as the Levallois technique, which is especially indicative of cognitive development: unlike earlier knapping methods, here the craftsman first prepares a core of good-quality stone, then cuts a pointed item off with one stroke—a process that requires him/her to imagine the final outcome in advance."

"We found that in all cases, at all sites, stone tips made with the Levallois technology appeared simultaneously with a relative decrease in the quantity of bones of large prey. "

Dr. Ben-Dor adds that "studies of contemporary hunter-gatherers indicate that a wooden spear is quite sufficient for hunting large prey like an elephant: the hunters first limit the animal's mobility—for example by driving it into a swamp or digging a trapping pit and concealing it with branches—then thrust the spear into the prey and wait for it to bleed. On the other hand, a middle-sized animal like a deer is much more difficult to trap, and if hit by a wooden spear it will probably run away."

"A more substantial wound induced by a stone-tipped spear is likely to slow it down and reduce the distance it can run before ultimately collapsing—increasing the hunter's chances of retrieving the fallen prey. This insight further elucidates our findings from hundreds of thousands of years ago, when stone-tipped spears were developed in response to the increasing scarcity of large prey."

Period	LP/ESA	MP/MSA	UP/LSA
Weapon			

Changes in the hunting tools and the dominant animals in the sites from the Paleolithic period. Credit: Tel Aviv University

Reviewing the evolution of prehistoric hunting, the researchers explain that "humans began to make stone tools about 3 million years ago, and started to hunt about 2 million years ago, with hunting weapons evolving constantly throughout [prehistoric times](#). Homo Erectus, the ancestor of all later types of humans, used a wooden spear, probably thrusting it into large prey from up close."

"Homo Sapiens and Neanderthals, emerging about 300,000 years ago, upgraded their spears by adding stone tips, which they produced with the more sophisticated Levallois technique. These stone-tipped spears were apparently used for both thrusting and hurling. About 50,000 years ago

more complex hunting systems like the bow and arrow and spear thrower, were used regularly by Homo Sapiens."

"At the end of the Upper Paleolithic, about 25,000 years ago, new hunting aids emerged, such as dogs, traps, and fishing hooks. Facts about this continual evolution of hunting weapons, necessarily accompanied by improvement of human cognition and skills, have been known for a long time; and yet, a unifying hypothesis for explaining these facts or attributing them to some change in the environment, was not proposed. In our research we have tried to address this challenge."

Prof. Barkai says, "For the past ten years we have been searching for a unified explanation for focal phenomena in the cultural and biological evolution of [prehistoric humans](#). Our excavations at the Qesem Cave site led us to conclude that elephants, a major component of the human diet in our region for a million years, disappeared about 300,000 years ago, as a result of overhunting and climate change. With the huge elephants gone, humans had to find ways for obtaining the same amount of calories from a larger number of smaller animals."

"Ultimately, we hypothesized that prey size had played a major part in human evolution: at the beginning the largest animals were hunted, and when these were gone humans went on to the next in size, and so on. Finally, when hunting was no longer energetically viable, humans began to domesticate animals and plants. That's how the agricultural revolution began."

In 2021 Prof. Barkai and Dr. Ben-Dor published a unified hypothesis, which explains the physiological and cultural evolution of Paleolithic humans, including the improvement of cognitive capabilities, as adaptations to mitigate declined energetic returns due to a progressive decline in prey size. The present study's findings corroborate this hypothesis, following another study which they published last year

together with zoologists Jacob Dambitser and Prof. Shai Meiri of TAU.

Surveying data from archaeological sites dating from 1,500,000 to 20,000 years ago, the 2022 study found that the dominant species of prey at the beginning of the period was a 12-ton elephant, and at the end it was a 25kg gazelle. In addition, the data indicate that the average weight of animals hunted by humans a million years ago was 3 tons, going down to 50kg 20,000 years ago. In other words, prey size decreased continually through time.

Prof. Barkai says, "In the present study specifically, and in our broader unifying hypothesis in general, we propose for the first time an explanation for one of the most intriguing questions in prehistoric archaeology: Why did tools change? The usual explanation is that tools changed due to improvements in the [cognitive abilities](#) of humans. For instance, when humans were suddenly able to imagine the outcomes of a sophisticated process, they developed the Levallois technique."

"But one may well ask: Why did humans become smarter all of a sudden? What was the advantage of having a large brain that consumes so much energy? We demonstrate that these biological and cognitive changes correlate directly with the size of prey. To hunt small elusive animals humans had to become smarter, faster, more focused, more observant, and more collaborative. They had to develop new weapons for hunting from afar and learn how to track their prey."

"And they had to choose their prey carefully, with preference for high fat content, to ensure a sufficient energetic return—because hunting a large number of agile gazelles requires a much higher investment of energy than hunting one giant elephant. This, we propose, is the evolutionary pressure that generated the improvement in human ability and tools—to ensure an adequate energy return on investment (EROI)."

More information: Miki Ben-Dor et al, The Evolution of Paleolithic Hunting Weapons: A Response to Declining Prey Size, *Quaternary* (2023). [DOI: 10.3390/quat6030046](https://doi.org/10.3390/quat6030046)

Provided by Tel-Aviv University

Citation: Small prey compelled prehistoric humans to produce appropriate hunting weapons and improve their cognitive abilities (2023, September 7) retrieved 29 April 2024 from <https://phys.org/news/2023-09-small-prey-compelled-prehistoric-humans.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.