

## Human technological innovation arose in a variety of prehistoric human civilizations

**F**or the first few million years of human evolution, technologies changed slowly. Some three million years ago, our ancestors were making [chipped stone flakes and crude choppers](#). Two million years ago, [hand-axes](#). A million years ago, primitive humans sometimes used [fire](#), but with difficulty. Then, 500,000 years ago, technological change accelerated, as spearpoints, firemaking, axes, beads and bows appeared.

This technological revolution wasn't the work of one people. Innovations arose in different groups – [modern \*Homo sapiens\*](#), [primitive \*sapiens\*](#), possibly even [Neanderthals](#) – and then spread. Many key inventions were unique: one-offs. Instead of being invented by different people independently, they were discovered once, then shared. That implies a few clever people created many of history's big inventions.

And not all of them were modern humans.

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### The tip of the spear

[500,000 years ago in southern Africa](#), primitive *Homo sapiens* first bound stone blades to wooden spears, creating the spearpoint. Spearpoints were revolutionary as weaponry, and as the first “composite tools” – combining components.

The spearpoint spread, appearing 300,000 years ago in [East Africa](#) and the Mideast, then 250,000 years ago in Europe, wielded by Neanderthals. That pattern suggests the spearpoint was gradually passed on from one people to another, all the way from Africa to Europe.



Serengeti spearpoint. Credit: Nicholas Longrich

**Catching fire**

[400,000 years ago](#) hints of fire, including charcoal and burnt bones, became common in Europe, the Mideast and Africa. It happened roughly the same time everywhere – rather than randomly in disconnected places – suggesting invention, then rapid spread. Fire’s utility is obvious, and keeping a fire going is easy. Starting a fire is harder, however, and was probably the main barrier. If so, widespread use of fire likely marked the invention of the [fire-drill](#) – a stick spun against another piece of wood to create friction, a tool still used today by hunter-gatherers.

Curiously, the oldest evidence for regular fire use comes from Europe – then inhabited by Neanderthals. Did Neanderthals master fire first? Why not? Their brains [were as big as ours](#); they used them for something, and living through Europe’s ice-age winters, Neanderthals needed fire more than African *Homo sapiens*.

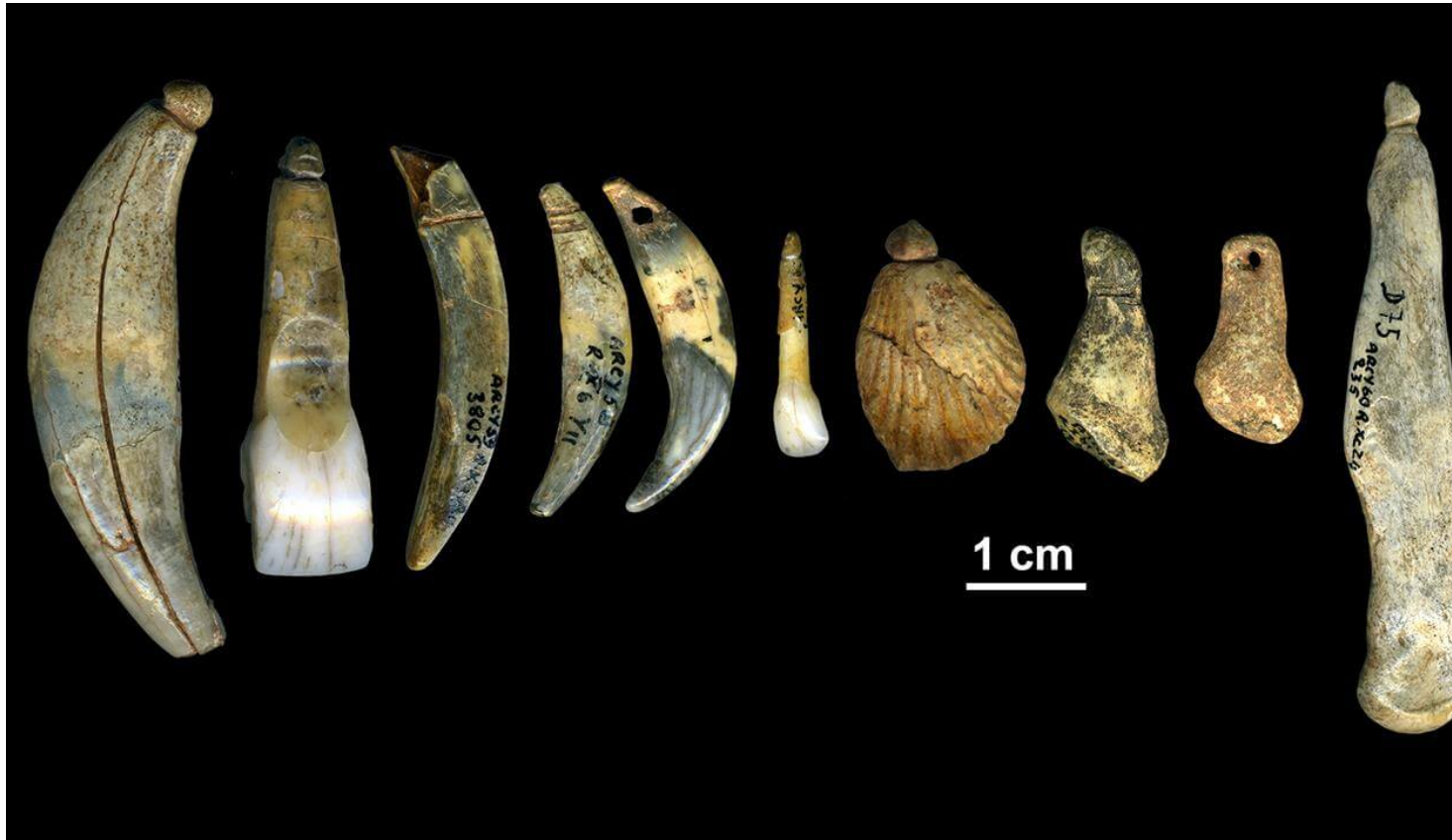
## The axe

[270,000 years ago](#) in central Africa, [hand-axes](#) began to disappear, replaced by a new technology, the [core-axe](#). Core-axes looked like small, fat hand-axes, but were radically different tools. Microscopic scratches show core-axes were [bound to wooden handles](#) – making a true, hafted axe. Axes quickly spread through Africa, then were carried by modern humans into the [Arabian peninsula](#), [Australia](#), and ultimately [Europe](#).

## Ornamentation

The oldest beads are [140,000 years old](#), and come from Morocco. They were made by piercing snail shells, then stringing them on a cord. At the time, [archaic Homo sapiens](#) inhabited North Africa, so their makers weren’t modern humans.

Beads then appeared in Europe, 115,000-120,000 years ago, worn by [Neanderthals](#), and were finally adopted by modern humans [in southern Africa](#) 70,000 years ago.



Neanderthal beads. Credit: Dr. Marian Vanheren

## Bow and arrow

The oldest arrowheads appeared in southern Africa over [70,000 years ago](#), likely made by the ancestors of the Bushmen, who've lived there for [200,000 years](#). Bows then spread to modern humans in [East Africa](#), to south Asia [48,000 years ago](#), on to Europe [40,000 years ago](#), and finally to Alaska and the Americas, [12,000 years ago](#).

Neanderthals never adopted bows, but the timing of the bow's spread means it was likely [used by \*Homo sapiens\* against them](#).

## Trading technology

It's not impossible that people invented similar technologies in different parts of the world at roughly the same time, and in some cases, this must have happened. But the simplest explanation for the archaeological data we have is that instead of reinventing technologies, many advances were made just once, then spread widely. After all, assuming fewer innovations requires fewer assumptions.

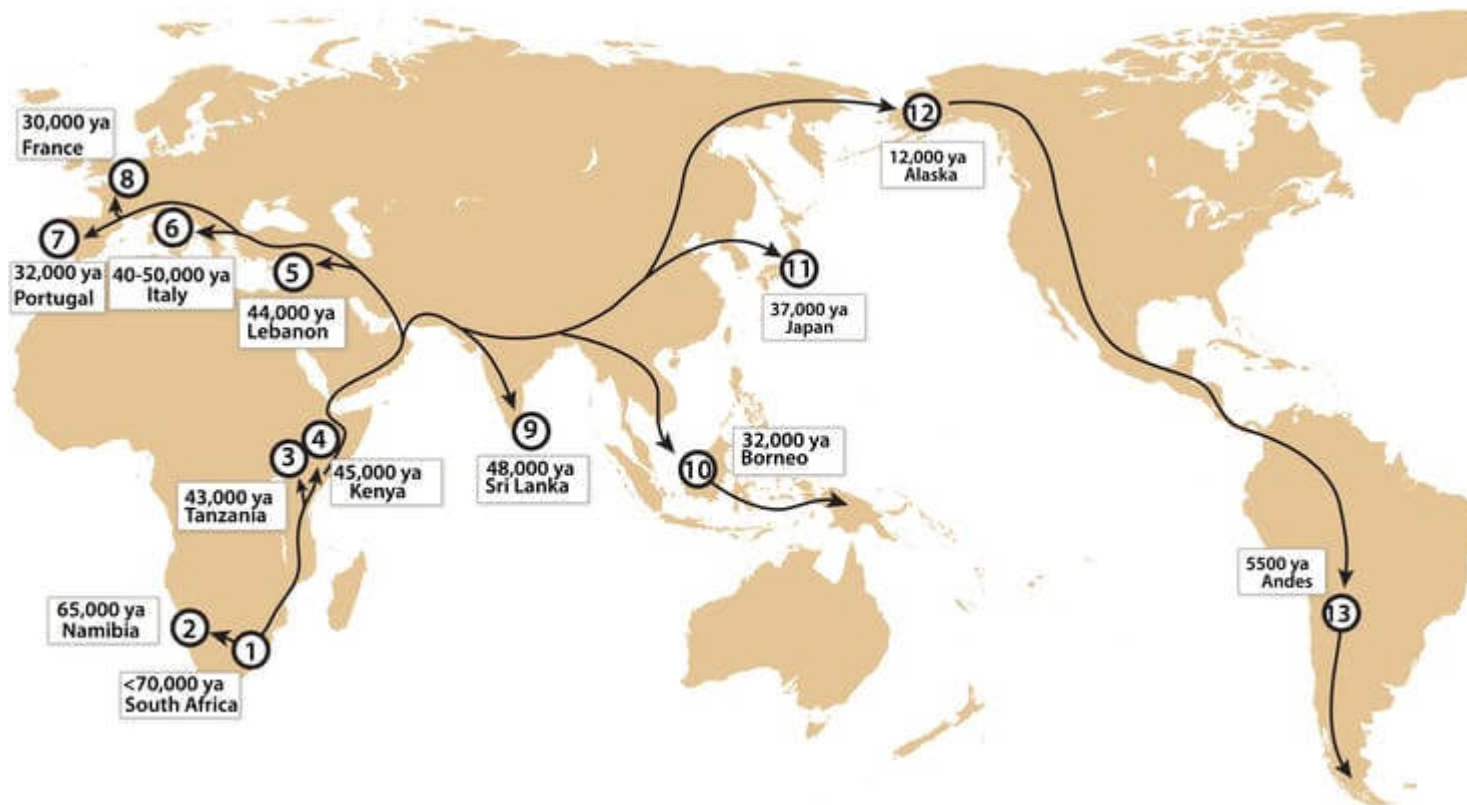
But how did technology spread? It's unlikely individual prehistoric people travelled long distances through lands [held by hostile tribes](#) (although there were obviously major migrations over generations), so African

humans probably didn't meet Neanderthals in Europe, or vice versa. Instead, technology and ideas diffused – transferred from one band and tribe to the next, and the next, in a vast chain linking modern *Homo sapiens* in southern Africa to archaic humans in North and East Africa, and Neanderthals in Europe.

Conflict could have driven exchange, with people stealing or capturing tools and weapons. Native Americans, for example, got horses by [capturing them from the Spanish](#). But it's likely that people often just traded technologies, simply because it was safer and easier. Even today, modern hunter-gatherers, who lack money, still trade – Hadzabe hunters exchange honey for iron arrowheads made by neighbouring tribes, for example.

Archaeology shows such trade is ancient. Ostrich eggshell beads from South Africa, up to 30,000 years old, have been found over [300 kilometres](#) from where they were made. [200,000—300,000](#) years ago, archaic *Homo sapiens* in East Africa used tools from obsidian sourced from 50-150 kilometres away, further than modern hunter-gatherers typically travel.

Last, we shouldn't overlook human generosity – some exchanges may simply have been [gifts](#). Human history and prehistory were doubtless [full of conflict](#), but then as now, tribes may have had peaceful interactions – treaties, [marriages](#), friendships – and may simply have gifted technology to their neighbours.



Map of bow and arrow diffusion out of Africa. Credit: Wikipedia and Nicholas Longrich



## Stone Age geniuses

The pattern seen here – single origin, then spread of innovations – has another remarkable implication. Progress may have been highly dependent on single individuals, rather than being the inevitable outcome of larger cultural forces.

Consider the bow. It's so useful that its invention seems both obvious and inevitable. But if it really was obvious, we'd see bows invented repeatedly in different parts of the world. But Native Americans didn't invent the bow – neither did Australian Aborigines, nor people in Europe and Asia.

Instead, it seems one clever Bushman invented the bow, and then everyone else adopted it. That hunter's invention would change the course of human history for thousands of years to come, determining the fates of peoples and empires.

The prehistoric pattern resembles what we've seen in historic times. Some innovations were developed repeatedly – [farming](#), civilisation, calendars, pyramids, mathematics, [writing](#), and [beer](#) were invented independently around the world, for example. Certain inventions may be obvious enough to emerge in a predictable fashion in response to people's needs.

But many key innovations – the [wheel](#), gunpowder, the printing press, stirrups, the compass – seem to have been invented just once, before becoming widespread.

And likewise a handful of individuals – Steve Jobs, Thomas Edison, Nikola Tesla, the [Wright Brothers](#), James Watt, Archimedes – played outsized roles in driving our technological evolution, which implies highly creative individuals had a huge impact.

That suggests the odds of hitting on a major technological innovation are low. Perhaps it wasn't inevitable that fire, spearpoints, axes, beads or bows would be discovered when they were.

Then, as now, one person could literally change the course of history, with nothing more than an idea.

**Nick Longrich is an evolutionary biologist and paleontologist from Kodiak, Alaska. He is interested in how the world evolved to be the way it is. Nick studies mass extinction, adaptive radiation, dinosaurs, pterosaurs, and mosasaurs, among other things. Find Nick on Twitter [@NickLongrich](#)**

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