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# Humans: Why They Triumphed

*How did one ape 45,000 years ago happen to turn into a planet dominator? The answer lies in an epochal collision of creativity.*

By **MATT RIDLEY**

Human evolution presents a puzzle. Nothing seems to explain the sudden takeoff of the last 45,000 years—the conversion of just another rare predatory ape into a planet dominator with rapidly progressing technologies. Once "progress" started to produce new tools, different ways of life and burgeoning populations, it accelerated all over the world, culminating in agriculture, cities, literacy and all the rest. Yet all the ingredients of human success—tool making, big brains, culture, fire, even language—seem to have been in place half a million years before and nothing happened. Tools were made to the same monotonous design for hundreds of thousands of years and the ecological impact of people was minimal. Then suddenly—bang!—culture exploded, starting in Africa. Why then, why there?

The answer lies in a new idea, borrowed from economics, known as collective intelligence: the notion that what determines the inventiveness and rate of cultural change of a population is the amount of interaction between individuals. Even as it explains very old patterns in prehistory, this idea holds out hope that the human race will prosper mightily in the years ahead—because ideas are having sex with each other as never before.

The more scientists discover, the bigger the evolution puzzle has become. Tool-making itself has now been pushed back at least two million years, and modern tool kits emerged very gradually over

300,000 years in Africa. Meanwhile, Neanderthals are now known to have had brains that were bigger than ours and to have inherited the same genetic mutations that facilitate speech as us. Yet, despite surviving until 30,000 years ago, they hardly invented any new tools, let alone farms, cities and toothpaste. The Neanderthals prove that it is quite possible to be intelligent and imaginative human beings (they buried their dead) yet not experience cultural and economic progress.

Scientists have so far been looking for the answer to this riddle in the wrong place: inside human heads. Most have been expecting to find a sort of neural or genetic breakthrough that sparked a "big bang of human consciousness," an auspicious mutation so that people could speak, think or plan better, setting the human race on the path to continuous and exponential innovation.

But the sophistication of the modern world lies not in individual intelligence or imagination. It is a collective enterprise. Nobody—literally nobody—knows how to make the pencil on my desk (as the economist Leonard Read once pointed out), let alone the computer on which I am writing. The knowledge of how to design, mine, fell, extract, synthesize, combine, manufacture and market these things is fragmented among thousands, sometimes millions of heads. Once human progress started, it was no longer limited by the size of human brains. Intelligence became collective and cumulative.

In the modern world, innovation is a collective enterprise that relies on exchange. As Brian Arthur argues in his book "The Nature of Technology," nearly all technologies are combinations of other technologies and new ideas come from swapping things and thoughts. (My favorite example is the camera pill—invented after a conversation between a gastroenterologist and a guided missile designer.) We tend to forget that trade and urbanization are the grand stimuli to invention, far more important than governments, money or individual genius. It is no coincidence that trade-obsessed cities—

Tyre, Athens, Alexandria, Baghdad, Pisa, Amsterdam, London, Hong Kong, New York, Tokyo, San Francisco—are the places where invention and discovery happened. Think of them as well-endowed collective brains.

Trade also gave way to centralized institutions. Around 5,200 years ago, Uruk, in southern Mesopotamia, was probably the first city the world had ever seen, housing more than 50,000 people within its six miles of wall. Uruk, its agriculture made prosperous by sophisticated irrigation canals, was home to the first class of middlemen, trade intermediaries.

As with traders ever since, increasingly it came to look like tribute as Uruk merchants' dwellings were plonked amid the rural settlements of the trading partners in the hills. A cooperative trade network seems to have turned into something more like colonialism. Tax and even slavery began to rear their ugly heads. Thus was set the pattern that would endure for the next 6,000 years—merchants make wealth; chiefs nationalize it.

Agriculture was invented where people were already living in dense trading societies. The oldest farming settlements of all in what is now Syria and Jordan are situated at oases where trade routes crossed, as proved by finds of obsidian (volcanic glass) tools from Cappadocia. When farmers first colonized Greek islands 9,000 years ago they relied on imported tools and exported produce from the very start. Trade came before—and stimulated—farming.

Go even further back and you find the same thing. The explosion of new technologies for hunting and gathering in western Asia around 45,000 years ago, often called the Upper Paleolithic Revolution, occurred in an area with an especially dense population of hunter-gatherers—with a bigger collective brain. Long before the ancestors of modern people first set foot outside Africa, there was cultural progress within Africa itself, but it had a strangely intermittent,

ephemeral quality: There would be flowerings of new tool kits and new ways of life, which then faded again.

Recently at Pinnacle Point in South Africa, Curtis Marean of Arizona State University found evidence of seafood-eating people who made sophisticated "bladelet" stone tools, with small blades less than 10 millimeters wide, and who used ochre pigments to decorate themselves (implying symbolic behavior) as long as 164,000 years ago. They disappeared, but a similar complex culture re-emerged around 80,000 years ago at Blombos cave nearby. Adam Powell of University College, London, and his colleagues have recently modeled human populations and concluded that these flowerings are caused by transiently dense populations: "Variation in regional subpopulation density and/or migratory activity results in spatial structuring of cultural skill accumulation."

The notion that exchange stimulated innovation by bringing together different ideas has a close parallel in biological evolution. The Darwinian process by which creatures change depends crucially on sexual reproduction, which brings together mutations from different lineages. Without sex, the best mutations defeat the second best, which then get lost to posterity. With sex, they come together and join the same team. So sex makes evolution a collective and cumulative process in which any individual can draw on the gene pool of the whole species. And when it comes to gene pools, the species with gene lakes generally do better than the ones with gene ponds—hence the vulnerability of island species to competition with continental ones.

It is precisely the same in cultural evolution. Trade is to culture as sex is to biology. Exchange makes cultural change collective and cumulative. It becomes possible to draw upon inventions made throughout society, not just in your neighborhood. The rate of cultural and economic progress depends on the rate at which ideas are having sex.

Dense populations don't produce innovation in other species. They only do so in human beings, because only human beings indulge in regular exchange of different items among unrelated, unmated individuals and even among strangers. So here is the answer to the puzzle of human takeoff. It was caused by the invention of a collective brain itself made possible by the invention of exchange.

Once human beings started swapping things and thoughts, they stumbled upon divisions of labor, in which specialization led to mutually beneficial collective knowledge. Specialization is the means by which exchange encourages innovation: In getting better at making your product or delivering your service, you come up with new tools. The story of the human race has been a gradual spread of specialization and exchange ever since: Prosperity consists of getting more and more narrow in what you make and more and more diverse in what you buy. Self-sufficiency—subsistence—is poverty.

This theory neatly explains why some parts of the world lagged behind in their rate of cultural evolution after the Upper Paleolithic takeoff. Australia, though it was colonized by modern people 20,000 years earlier than most of Europe, saw comparatively slow change in technology and never experienced the transition to farming. This might have been because its dry and erratic climate never allowed hunter-gatherers to reach high enough densities of interaction to indulge in more than a little specialization.

Where population falls or is fragmented, cultural evolution may actually regress. A telling example comes from Tasmania, where people who had been making bone tools, clothing and fishing equipment for 25,000 years gradually gave these up after being isolated by rising sea levels 10,000 years ago. Joe Henrich of the University of British Columbia argues that the population of 4,000 Tasmanians on the island constituted too small a collective brain to sustain, let alone improve, the existing technology.

Tierra del Fuego, in a similar climatic and demographic position, experienced no such technological regress because its people remained in trading contact with the mainland of South America across a much narrower strait throughout the prehistoric period. In effect, they had access to a continental collective brain.

Further proof that exchange and collective intelligence are the key to human progress comes from Neanderthal remains. Almost all Neanderthal tools are found close to their likely site of origin: they did not trade. In the southern Caucasus, argues Daniel Adler of the University of Connecticut, it is the "development and maintenance of larger social networks, rather than technological innovations or increased hunting prowess, that distinguish modern humans from Neanderthals."

The oldest evidence for human trade comes from roughly 80,000 to 120,000 years ago, when shell beads in Algeria and obsidian tools in Ethiopia began to move more than 100 miles from the sea and from a particular volcano respectively. (In recent centuries stone tools moved such distances in Australia by trade rather than by migration.) This first stirring of trade was the most momentous innovation of the human species, because it led to the invention of invention. Why it happened in Africa remains a puzzle, but Steve Kuhn and Mary Stiner of the University of Arizona have argued that for some reason only Africans had invented a sexual division of labor between male hunters and female gatherers—the most basic of all trades.

There's a cheery modern lesson in this theory about ancient events. Given that progress is inexorable, cumulative and collective if human beings exchange and specialize, then globalization and the Internet are bound to ensure furious economic progress in the coming century—despite the usual setbacks from recessions, wars, spendthrift governments and natural disasters.

The process of cumulative innovation that has doubled life span, cut child mortality by three-quarters and multiplied per capita income ninefold—world-wide—in little more than a century is driven by ideas having sex. And things like the search engine, the mobile phone and container shipping just made ideas a whole lot more promiscuous still.

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