History lesson from the first farmers

The greatest technological revolution ever – farming replacing foraging – was initially a step back for human productivity, argues **Samuel Bowles**

THE great upheavals of our human past, the demise of slavery, for example, or the end of Communist rule in the Soviet Union, are the big game of historical explanation. A common strategy is to posit some external cause such as population growth, climate change, or a new technology, and then show its effect on institutions and culture. But because the dramatic changes in history are both rare and complex, attempting to account for them using standard scientific methods has proved difficult. Occasionally, though, history generously serves up a natural experiment.

The 17th-century Puritans who settled Providence Island off the coast of Nicaragua fled the political oppression of Britain to breathe the freer air of the New World. They were luckier than their fellow Puritans at Plymouth Bay, who subsisted as independent farmers, wresting meagre harvests of maize from the rocky soil of New England. The Providencian Puritans found themselves surrounded by land ideally suited for a crop of extraordinary value – sugar – which, unlike grains, could be profitably exploited using slave labour. An alienated worker can do little harm to sugar, while most other crops require tender loving care. The Puritans quickly became slave-masters, and subsequently abandoned their liberal ideals.

Unlike the usual tangle of confounding factors the past provides, history had designed a fine experiment. What had changed for the Providencians was the discovery of a new way of extracting a livelihood from nature: the change in their culture and institutions was a consequence of this change in technology.

The experiment is consistent with the widely held "better mousetrap theory" of history. An improved technology comes along – a more efficient toolkit, source of energy, or crop – and its subsequent adoption makes existing institutions inferior to alternative ways of organising society. As the technology is adopted, so is a new way of life. The tinkerer in his cellar becomes history's midwife.

Other natural experiments to be chalked up to the better mousetrap theory include the transformation of the social structures of the North American Plains Indians resulting from the introduction of the horse from the Spanish colonies to the south, or the way that the new water-driven mills in 19th-century New England led to a transformation of property rights in land and water.

But the one case that should be the poster child for the better mousetrap theory turns out not to be. The agricultural revolution 11 millennia ago did not occur because the first farmers were more productive than the foragers they displaced. Skeletal evidence shows that in many regions of the world, the first farmers were smaller and sicker than foragers, leading archaeologists to wonder if farming really did increase productivity. But the fact that the first farmers were often unhealthy could have resulted from living in close proximity to one another and their animals rather than from the use of an inferior technology.

To find out, I decided to estimate the caloric return for an hour of labour devoted respectively to foraging wild species and to cultivation of the cereals grown by the first farmers, using hand tools. I used

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SLAVERY IN THE SUGAR PLANTATION FROM THE SERIES 'HISTORY OF CUERNAVACA AND MORELOS: 1930-1', DIEGO RIVERA/PALACE OF CORTES/JAN MURSELL/MEXICOLORE/BRIDGEMAN ART LIBRARY © 2011 BANCO DE MÉXICO DIEGO RIVERA FRIDA KAHLO MUSEUMS TRUST, MEXICO, D.F./DACS

Sugar was a highly valued crop that could thrive even with the rough handling of forced labour

archaeological, ethnographic, climate and experimental data to estimate the energetic productivity of labour. For example, with native American maize farmers in Colorado I used a combination of agronomic and rainfall data; with Aché foragers in Paraguay I used data collected by anthropologists who had accompanied them, recording the caloric value of their hourly hunted and gathered foods; and I used data on yields obtained from harvesting wild grains in experiments in Anatolia using a Stone Age sickle. I took account of the likely losses of farmers' stored goods (to pests, rot, theft) and the substantial differences in the processing costs of foraging versus farming: grinding maize takes more time than growing it, for example.

The results surprised me: the 5 estimates of the hourly caloric return from exploiting wild species averaged 59 per cent greater than the 15 farming estimates. It gets even worse for the mousetrap theory if we take account of the time delay between planting and consuming and the greater risk taken by farmers who rely on a couple of crops, in contrast to foragers, whose diversified portfolio of nutrients came from dozens of wild species. Foraging is then 73 per cent more productive than farming.

Recent data are a poor basis for prehistoric estimates, of course, but they are the best we have and, even allowing for large margins of error, it is unlikely farming was initially more productive than foraging, and possibly it was much less. Many of the biases in the data such as the more productive seeds used by recent farmers, the inferior environments into which modern foragers have been displaced, and the fact that the protein-starved nature of many farmers' diets is not captured in my calorie calculations, mean that I may have actually underestimated the disadvantages of farming.

Farming was indeed revolutionary, ushering in new property rights and unprecedented inequalities both between families and between men and women, allowing mini population explosions and even altering the genetic evolution of the species. But initially, it did not do this by raising productivity. Instead, the social and demographic aspects of farming, rather than its productivity, may have been essential to its emergence and spread. Prominent among those aspects may have been the contribution of farming to a sedentary lifestyle and hence to population growth and the emergence of private property, and to the military prowess needed to defend it all.

The fault in the mousetrap theory is not the connection between novel technologies and cultural and institutional change, rather it is to posit technological advance as an external cause. Sometimes it is: the bow and arrow, the spinning jenny and the computer were all adopted because they allowed extraordinary gains in productivity. Nobody doubts their dramatic effects on social organisation and culture. Similarly, the fact that slaves did not make good factory workers may have contributed to slavery's demise, and more complex technologies may have baffled Moscow's central planners, leading to the economic slowdown that was the backdrop to collapse.

But history sometimes does not wait for the tinkerer. Instead, new technologies emerge in tandem with novel institutions and cultures, and sometimes even as their consequence. This surely is the case with the emergence of capitalism three centuries ago and the subsequent industrial revolution. Two centuries ago in Massachusetts, independent shoe-makers tapping away in their shops became shoe factory workers tapping away using the same tools. Shoe-making machinery came later, and its proliferation was facilitated by the existence of factories. Institutional change led to technological innovation.

"Explaining the agricultural revolution needs a different way of doing history"

The same may be said for the emergence of human modernity toward the end of the Pleistocene. In a 2009 *Science* paper, Adam Powell, Stephen Shennan and Mark Thomas make a good case that this did not occur because someone invented stone-grinding tools, say, or microlithic blades, but rather because social networks became sufficiently dense for novel ways of interacting with nature to spread and persist.

The driver of history – whether it be the better mousetrap, change in population, or environmental collapse – will remain an elusive prey. This may be because the target, a simple external cause of complex human social dynamics, does not exist. Explaining the agricultural revolution requires a different way of doing history, one without a driver, in which, under favourable climatic conditions, foragers became farmers via an interplay of culture, institutions and demographic change. n

Sources for "History Lesson from the First Farmers" *New Scientist,* 30 July, 2011

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…introduction of the horse from the Spanish colonies to the south(*2*)

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…a sedentary life style and hence to population growth(*7, 8*)

… and to military prowess (*9*)

…contributed to slavery's demise. (*10*)

…baffled the central planners in Moscow(*11*)

…capitalism three centuries ago and the subsequent industrial revolution(*12, 13*).

…shoe makers in Massachusetts.(*14-16*)

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