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**Warfare, culture and human evolution**

# Blood and treasure

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**People are altruistic because they are militaristic, and cultured because they are common. At least that is the message of a couple of new studies**

Corbis

TWO of the oddest things about people are morality and culture. Neither is unique to humans, but *Homo sapiens* has both in an abundance missing from other species. Indeed, that abundance—of concern for the well-being of others, (even unrelated others), and of finely crafted material objects both useful and ornamental—is seen by many as the mark of man, as what distinguishes humanity from mere beasts.

How these human traits evolved is controversial. But two papers in this week's *Science* may throw light on the process. In one, Samuel Bowles of the Santa Fe Institute in New Mexico fleshes out his paradoxical theory that much of human virtue was forged in the crucible of war. Comrades in arms, he believes, become comrades in other things, too.

In the other paper, Mark Thomas and his colleagues at University College, London, suggest that cultural sophistication depends on more than just the evolution of intelligence. It also requires a dense population. If correct, this would explain some puzzling features of the archaeological record that have hitherto been put down to the arbitrary nature of what has survived to the present and what has not.

Dr Bowles's argument starts in an obscure cranny of evolutionary theory called group selection. This suggests that groups of collaborative individuals will often do better than groups of selfish ones, and thus prosper at their expense. It is therefore no surprise, according to group-selectionists, that individuals might be genetically predisposed to act in self-sacrificial ways.

This good-of-the-group argument was widely believed until the 1960s, when it was subject to rigorous scrutiny and found wanting. The new theory does not pitch groups against groups, or even individuals against individuals, but genes against genes. It does not disallow altruistic behaviour, but requires that this evolve in a way that promotes the interest of a particular gene—for example by helping close relatives who might also harbour the gene in question. The "selfish gene" analysis, so called after a book by Richard Dawkins, makes good-of-

the-group outcomes almost impossible to achieve.

## War and peace

A few researchers, of whom Dr Bowles is one, have been unwilling to give up on group selection completely. They note the word "almost" in the argument above and contend that humans, with their high intelligence and possession of language, and their tendency to live in small, tightly knit groups, might be exceptional. They also think people could be subject to a form of group selection that is genetically selfish.

Dr Bowles has focused the argument on war, since it is both highly collaborative and often genetically terminal for the losers. In his latest paper he puts some numbers on the idea. He looks at the data, plugs them into a mathematical model of his devising and finds a pleasing outcome.

To gather his data, Dr Bowles trawled through ethnographic and archaeological evidence about warfare between groups of hunter-gatherers. This is rarely war in the modern sense of planned campaigns. It is more a matter of raids, ambushes and fights between groups who have met accidentally. It is, nevertheless, quite lethal. Dr Bowles identified eight ethnographic and 15 archaeological studies that met his criteria of reliability and abundance of data. They suggest that 12-16% of mortality is the result of such low-level warfare. This is a figure much higher than, for example, the mortality caused in Europe by two world wars, and is certainly enough to drive evolution. But the question remained of whether it could drive group selection.

It was to test that idea that Dr Bowles devised his model. Although it pitches group against group, it is strictly based on the idea of selfish genes. It looks at the benefit to a notional gene that promotes self-sacrifice. The question is, does such a gene do well if individuals having it belong to a group that takes over the territory and resources of a similar, neighbouring group, but at the risk of some of those individuals losing their life in the process? What is the maximum self-sacrificial cost that can evolve in these circumstances?

In the absence of war, a gene imposing a self-sacrificial cost of as little as 3% in forgone reproduction would drop from 90% to 10% of the population in 150 generations. Dr Bowles's model, however, predicts that much higher levels of self-sacrifice—up to 13% in one case—could be sustained if warfare were brought into the equation. This, he contends, allows the evolution of collaborative, altruistic traits that would not otherwise be possible. Moreover, although warfare is an extreme example, other, less martial forms of self sacrifice may have similar group-strengthening virtues.

Dr Thomas and his colleagues also rely on a mathematical model. They are trying to explain the pattern of apparent false-starts to modern human culture. The species is now believed to have emerged 150,000-200,000 years ago in Africa and to have begun spreading to the rest of the world about 60,000 years ago. But signs of modern culture, such as shell beads for necklaces, the use of pigments and delicate, sophisticated tools like bone harpoons, do not appear until 90,000 years ago. They then disappear, before popping up again (and also sometimes disappearing), until they really get going around 35,000 years ago in Europe.

The team drew on an earlier insight that it requires a certain number of people to maintain skills and knowledge in a population. Below this level, random effects can be important. The probability of useful inventions being made is low and if only a few have the skills to fabricate the new inventions, they may die without having passed on their knowledge.

In their model, Dr Thomas and his colleagues divided a simulated world into regions with different densities of human groups. Individuals in these groups had certain "skills", each with an associated degree of complexity. Such skills could be passed on, more or less faithfully, thus yielding an average level of skills that could vary over time. The groups could also exchange skills.

The model suggested that once more than about 50 groups were in contact with one another, the complexity of skills that could be maintained did not increase as the number of groups increased. Rather, it was population density that turned out to be the key to cultural sophistication. The more people there were, the more exchange there was between groups and the richer the culture of each group became.

Dr Thomas therefore suggests that the reason there is so little sign of culture until 90,000 years ago is that there were not enough people to support it. It is at this point that a couple of places in Africa—one in the southernmost tip of the continent and one in eastern Congo—yield signs of jewellery, art and modern weapons. But then they go away again. That, Dr Thomas suggests, corresponds with a period when human numbers shrank. Climate data provides evidence this shrinkage did happen.

According to Dr Thomas, therefore, culture was not invented once, when people had become clever enough, and

then gradually built up into the edifice it is today. Rather, it came and went as the population waxed and waned. Since the invention of agriculture, of course, the population has done nothing but wax. The consequences are all around you.