

in the United Kingdom.

Von Weizsäcker's comment was afterwards so elaborated by Robert Jungk in *Brighter Than a Thousand Suns* as to suggest that German physicists in contrast to their Allied counterparts had "kept their hands clean" and intentionally refrained on the grounds of conscience from working towards a bomb. No doubt there were some individuals such as Hahn who would have so refrained had they been asked to help make a bomb, just as there were others who, as patriots, would have joined a bomb project with enthusiasm. In these matters German physicists would have been hardly less divided than their Allied counterparts had the choice faced them.

The transcripts for all their interest and the insight they provide give little grounds for disputing what Heisenberg himself said (*Nature* 160, 214; 1947 — see box on previous page): "In the upshot they [the German physicists] were spared the decision whether or not they should aim at producing atomic bombs". What, though, the transcripts do provide, along with Frank's introduction no less than Bern-

stein's commentary, is enlightenment as to why the German physicists were spared the decision: it was too far beyond their technological vision in the conditions of the war.

To complete this review on a less sombre note, let me recall that the Farm Hall detainees were concerned about their future in Germany and whether they would be allowed to return to the pursuit of physics. The same question, of course, had been considered by the Allied authorities. I was present at an Anglo-American conference of military men and scientists when we decided that research in pure science should be allowed in Germany, but that applied research should be restricted. An American colonel then asked how we were to define 'pure' and 'applied'. After several of us had volunteered definitions that left the colonel confused, he said: "I see, we should define 'pure research' as 'research with no known objective!'" □

R. V. Jones, director of British scientific intelligence 1952–53, is at 8 Queen's Terrace, Aberdeen AB1 1XL, UK.

Apocalypse of our own making

Bernard Wood

The Day Before Yesterday: Five Million Years of Human History. By Colin Tudge. *Cape/Scribner's*: 1996. Pp. 390. £18.99, \$27.50. Published in the United States as *Time Before History: Five Million Years of Human Impact*.

Dominion: Can Nature and Culture Co-Exist? By Niles Eldredge. *Holt*: 1995. Pp. 190. \$25.

The 'rules' of the evolution game are well-known. The winners are the 'fittest', the losers are the 'less fit'. What makes the game so difficult for the players are two devilish twists to the rules. The first is that the criteria for fitness are in a state of flux — they are constantly being redefined. The second is that the nature of the competition is partly defined by who the competitors are. The only consolation to the participants is that all the players are equally likely to be disadvantaged.

That is until about 10,000 years ago when one of the competitors stumbled on 'culture'. Culture was like the introduction of the carbon-fibre racket into tennis. It enabled the average player to stay in the competition longer. But although it meant swift elimination for a few competitors, for a long time most players could stay in the game. Developments from this thing we call culture are, however, now beginning to threaten the survival of the game itself. Can culture find solutions fast enough to

the problems it creates, or should we forgo our cultural advantage for the benefit of all the players, ourselves included? There is little point in winning if we cannot survive to enjoy it. These are the broad themes explored in these two books.

One of the recent great achievements of science has been our deepening, but by no means comprehensive, understanding of past climates. Palaeoclimatology demonstrates the essential continuity between the biological and the physical sciences. It is, and always will be, impossible to 'prove' that climate was crucial in shaping evolutionary history, but there is a lot of circumstantial evidence to suggest that it was. If the rate of evolutionary change depended on some internal mechanism, why did a wide range of mammals adjust the way in which they processed their food at roughly the same time? It is more parsimonious to suggest that they were responding in different, but analogous, ways to an extrinsic stimulus, and the prime suspect is climate.

Although most of us are aware that it is the Earth's rotation that takes us away from the Sun's rays at night and towards them at dawn, fewer people appreciate the crucial influences on our climate of cycles caused by changes in the axis of that rotation and by deviation from circularity (or eccentricity) of the Earth's orbit around the Sun. These influences have been superimposed on a 40-million-year-old process of global cooling linked to the

buckling in the Earth's crust caused by continental movements.

As Colin Tudge shows, the increasing influence of two of these cycles combined with the cooling effect of the inexorable rise of the Tibetan plateau seems to have triggered some three million years ago the most recent acceleration of the trend towards cooler, drier climates. A million years ago, this trend culminated in the increasing dominance of the roughly 100,000-year eccentricity-driven cycles leading to regular episodes of extreme cooling. The 'savannah' hypothesis of human origins, in which the cooling begat the savannah and the savannah begat humanity, is now discredited, but there is compelling evidence that global climate change combined with local uplift was the trigger that eventually resulted in the emergence in Africa of culture-bearing hominids. So it is high irony that modern humanity is now threatening the viability of the global ecosystem through its effects on climate.

Tudge sets the events of human evolution in context. His knowledge of the evolutionary changes in the nonhominid components of the contemporary fauna is impressive and he is an equally effective guide to the mechanisms of human-induced climate change. Some may find his tendency to explore themes tangential to the main argument irritating, but this is more than compensated for by his ability to convey his own excitement about the elegance of much of the science involved, and he packs in a great deal of information.

Niles Eldredge could hardly offer a greater contrast in writing style. He could never be accused of being prolix, but readers may find his style so terse that the significance and meaning of parts of the text may elude them. His interpretation of the hominid fossil record does not always accord with my own understanding, but this does not detract from the burden of his argument. This is a 'single-issue' book that wastes no time on frills.

The message of both books is that the potency of modern technology is such that humanity now has the means to modify climate instead of being modified by it. We accord ourselves the status of being the 'first' of all the creatures on Earth. The terrible truth is that we are the first creatures to have the means to destroy habitats on a global scale. Our only hope is that our intellect will call a halt to our folly in good time. For this we need to redefine success as being long-term survival rather than short-term riches. We must all hope that our collective intelligence will rise to the challenge. □

Bernard Wood is in the Hominid Palaeontology Research Group, Department of Human Anatomy and Cell Biology, The University of Liverpool, Po Box 147, Liverpool L69 3BX, UK.