

How to skin an elephant

John A. J. Gowlett

Making Silent Stones Speak: Human Evolution and the Dawn of Technology.

By Kathy D. Schick and Nicholas Toth. *Simon and Schuster: 1993. Pp. 351. \$25.*

LOUIS Leakey, famed for his discoveries at Olduvai Gorge, was also one of the first to bring the stone age to life with dramatic experimental studies. Two American researchers who have greatly developed this tradition are Kathy Schick and Nick Toth. Experimenting and writing two academic generations on from Leakey, they pay generous tribute to their own inspiring teachers at Berkeley in a lively book that aims to evaluate the role of technology in human evolution. This is a timely emphasis: as archaeology strove to give itself a social face in the 1970s and '80s, technology was often overlooked, largely because earlier studies had been excessively typological; but now there is a broader reappraisal.

There is nothing dull in the approach taken by Schick and Toth, who hardly hesitate even to skin an elephant with stone flakes. They do admit that "the sight of a twelve-thousand-pound animal carcase the size of a Winnebago can be quite intimidating", but in a bold experiment small lava flakes proved up to the task. Such work illustrates one of the niches that may have been open to tool-using hominids, who were probably able to cut into carcasses whose tough hides held other carnivores at bay. Their studies have led the authors to a respectful interpretation of the early hominids, whose activities show considerable foresight — "not a simple story of the most expedient technology".

Much of the book is a straightforward and up-to-date account of human evolution, but the authors have found several ways of enlivening it. They use italicized chapter introductions to give an 'early-hominids'-eye' view of the world, pithy quotations to reinforce their points, and numerous action photographs of their own experiments. Each author makes a substantial personal contribution in terms of experimental archaeology. Schick is mainly concerned with how early sites were formed, including the element of human behaviour that can be isolated behind many natural factors. Toth is the replicator of stone artefacts, and thus a discoverer of the routines that govern their manufacture. These complementary approaches give a refreshingly balanced view of human evolution,

with special insights where the authors' own work is concerned.

One such area is early hominid use of the landscape. Schick has developed the late Glynn Isaac's food-sharing model into a more neutral 'favoured place' hypothesis. This involves hominids returning frequently to places that offer both good food supplies and suitable protection from predators. Another remarkably exciting line of enquiry concerns the abilities of tool-using chimpanzees. To operate their comparative framework, anthropologists have to evaluate any overlaps in ape and human behaviour. Since 1990 the authors have collaborated with Sue Savage Rumbaugh in exploring just how far a chimp can go. A certain Kanzi proves able to appreciate sharp cutting edges and to strike flakes from stones. Chimpanzees are the only primate species apart from humans that regularly make tools. Some recent work has suggested that their ability to do this is on a par with early hominid technology, but this research seems more likely to pinpoint the distinctions that exist. Kanzi, it turns out, is principally employed in communication studies, "so he could only engage in these experiments from time to time". He is evidently more in de-

mand than the poor old robust australopithecine of Toth's lament, consigned to the fringes of human evolution:

I got the Zinjanthropus blues
My name's been abused
They call me dumb, they call me thick
My tools don't even do the trick, oh no
I just can't take it no more
I may just do myself in
Down on the FLK floor

Palaeoanthropology is a controversial and often hotly contested field, but there is no edge to this book, other than that of its stone tools. Schick and Toth's pleasure in their work shines through, an enthusiasm that is infectious. They have great confidence that technology is an inescapable part of our heritage, and no scepticism about its role in the present and future. When those silent stones are made to speak, they seem to tell not just of the past but also of those who study them now — like the early hominids, Schick and Toth have taken up stone tools and taken on the world. In this fascinating account they show that stone tools do not just endure, but also have an enduring relevance. □

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The tangled bank revisited

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Genes in Ecology. Edited by R. J. Berry, T. J. Crawford and G. M. Hewitt. *Blackwell Scientific: 1992. Pp. 534. £50, \$109.95 (hbk); £25, \$52.95 (pbk).*

IN ending his most famous advocacy for evolution by natural selection on a lyrical but pertinent note of "... the tangled bank... clothed with varied plants... birds singing... insects flitting... worms crawling... dependent on each other in so complex a manner...", Darwin firmly tied evolution to its ecological roots. For the ensuing theoretical high priests of evolution spiralling off into other-worldliness, tangled maths replaced tangled banks. Happily, a reversal in attitude is unfolding, following hard on the heels of new molecular and ecological insights that are wresting the study of evolution from its 'Heath Robinson' theoretical contraptions and placing it back firmly in life, as we recognize it, on Earth.

Why did ecologists abandon evolution to the geneticists? Was it because of the perceived difference in timescale between ecological and evolutionary dynamics or because the near-theological battles waged by population geneticists over selection versus neutrality, and other

huffs and puffs, left them bemused and generally disenchanted? Ecologists view life as more than balanced polymorphisms, the myth of constant selective values, the selfish-generosity of big *A* versus little *a*, just-so adaptationism and stable equilibria of large single-species populations harmoniously occupying ready-made niches. Ecologists were down on their knees in the tangled bank, rooting for cause-and-effect, dissecting the chaotic fluctuations of multi-species interactions, deconstructing the confounding duality of the organism-niche phenomenon, and decomposing the idealized population into its metapopulation substructure; whilst not forgetting for one moment that the individual organism, in all its prime and glory, was the central unit of evolution determining the subsequent fate of each of its thousands of fractious genes. If ever two disciplines were destined to pass each other like ships in the night, they were ecology and evolution, notwithstanding the joint kickstart they got from Darwin.

I exaggerate (of course) in order to polarize the extremes and to give credence to the thrust behind this unusual book and last year's meeting of opposites, in Norwich, England, from which it sprang. The editors rightly judged that

the time was ripe to knock ecological and genetical heads together for the grand reckoning, to force distinguished strangers to present and write joint papers, breaking down what J. Turner points out as 'cognitive particularism' in science: the inability on the part of one group to conceive that what the opposition is saying makes any sense whatsoever! By this device, no one individual could hide for long behind the comfort of esoteric jargon or enjoy the luxury of personally imploding on a microspecialization. Refreshingly, we are treated to honest dialogue, some of it still smouldering from fires not quite extinguished (J. Turner: "My own view is that there is no good evidence in favour of the neutral theory"), but all with the sense of urgency that the two disciplines need to merge, with more than a backward glance to the approaching charge of the new breed of molecular ecology imperialists (well represented here by M. Kreitman, P. Young and T. Burke).

A *Who's Who* of leading investigators spiritedly lay out their working philosophies with R. May, B. Clarke, B. Shorrocks, S. Stearns, P. Harvey, B. Levin, M. Begon, M. Hassell, J. Endler, R. Koehn and W. Watt and many other friends and foes taking as much interest in each other's perspectives as they can currently muster. One major gap in the listings is the absence of house-trained molecular biologists with first-hand experience of the fluidity of the genome and its contributions *per se* to standing levels of molecular diversity at the population level. Many molecular probes are not well-behaved mendelian elements obligingly evolving in a clock-like manner: they have a life of their own which we ignore at our peril.

W. Provine, A. Cain, S. Berry and A. Bradshaw provide the historical background, showing that blame for the schism that almost isolated the study of evolution from the college of scientific disciplines has to be laid at the door of some influential theoretical geneticists. Wrapped within the *a priori* belief in universal selective determinism they fought against neutrality and the molecular clock, constraints, trends and stasis, sympatric speciation, genetic revolutions, chaos, nonadaptive evolution, the stochasticity of metapopulations, probability refuges, hierarchies of selection, reaction norms, exaptations, suggestive directed mutagenesis, and (I would add) the ubiquitous mechanisms of genomic flux that underpin evolution by means of molecular drive. Wielding their equations and algorithms, they flay all such phenomena either to marginalize them or tame them within the high moral ground of panselectionist theory. "Ecology is what organisms do when they are doing nothing interesting" might sound

amusing from the mouth of E. B. Ford but is disastrous as a scientific attitude (realized or not) in those who assumed the mantle of Darwin.

There is a constructive place for theory in all sciences but if evolutionary theory is to be brought back to Earth, then a deep re-examination of its assumptions and parameters is in order; "How actually" must replace "how possibly" (as R. Sibly and J. Antonovics point out) no matter how tangled, complex, irrational and haphazard real organisms are in their real environments. M. Feder and W. Watt, in particular,

provide a comprehensive and persuasive pointer on how to reach this "Holy Grail".

Evolutionary theory needs to move on from naive caricature and application of darwinian selection in the same way that physics moved on from newtonian mechanics. By embracing the internal dynamics of the genome and the external dynamics of the ecology, there is hope for it yet. □

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Imperfect unities of knowledge

John Ziman

Common Sense, Science and Scepticism: A Historical Introduction to the Theory of Knowledge. By Alan Musgrave. Cambridge University Press: 1993. Pp. 310. £35, \$54.95 (hbk); £12.95, \$17.95 (pbk).

Reading the Book of Nature: An Introduction to the Philosophy of Science. By Peter Kosso. Cambridge University Press: 1992. Pp. 198. £22.95, \$34.95 (hbk); £7.95, \$10.95 (pbk).

The Disorder of Things: Metaphysical Foundations of the Disunity of Science. By John Dupré. Harvard University Press: 1993. Pp. 308. \$35, £27.95.

THE 'Two Cultures' thesis of the 1960s challenged the narrowness of science education. So science students were coaxed into courses on the history and philosophy of science as a natural bridge into the humanities and as a background to their own specialized studies. This didn't work.

One reason was that history and philosophy of science, as normally taught, turned out to be just as specialized and dry-as-dust as any scientific discipline. Another was that it all seemed very remote from what the students were learning to do in their science courses. Instead of illuminating scientific practice, philosophy merely made it seem vaguely questionable.

The first two of these books are typical products of this educational fiasco. Alan Musgrave does the conventional round of gurus — Aristotle, Descartes, Kant *et al.* — and their epistemological doctrines — scepticism, empiricism, rationalism and so on. For no obvious reason he then takes the popperian exit, which he labels "fallibilist realism". Surely, for a science student, that's like Omar Khayyam in his youth, going out "by that same door as I went in".

On the other wing, it's all 'common sense', with no damned nonsense about

rigour. That's obvious from Peter Kosso's title, which he keeps repeating as if he meant it. In the seventeenth century people genuinely believed in a benevolent, omniscient Author. Nowadays, we describe scientists as *writing* books about nature rather than *reading* a pre-ordained text. Tush!

With the philosophy of knowledge in such doldrums, monocultured scientists do better to concentrate on the philosophy of nature. Instead of asking questions such as 'how is it we know?' and 'how do we know it?', it is more fruitful to ask 'what is it we know?' and 'what do we know about it?'. John Dupré's book is original, lucid and confident, without being eccentric, polemical or arrogant. It deserves close attention.

To the average scientist, especially on the physical side, the unity of science seems indisputable. But it is clearly a metaphysical principle, beyond scientific verification. Dupré's thesis is both an assertion of how the world is and a denial that science constitutes, or could ever constitute, a single unified project.

His central target is obviously reductionism. Dupré takes this to mean the belief that the world can be classified hierarchically, and that the laws operating at higher levels can be derived for those at lower levels. If this were completely valid, then the world described or explored by science would be united by the laws of the lowest level. This is why some theoretical physicists look forward confidently to the discovery of a 'Theory of Everything'. But even if complete physicalism could never rule in practice, piecemeal reductionism is often presented as desirable, and feasible in principle, at every interface between levels — molecule to atom, cell to molecule, organism to cell and so on.

Dupré disputes this on deep-rooted theoretical grounds. He is not talking about the practical limitations of insufficient computer power, inadequate knowl-