industry. The juicy stories are about Gates, the Rajneesh of the computer world. They range from metaprogramming, to shipping software filled with bugs, to his queuing for some ice cream while fumbling for a 50-cent discount coupon, holding everyone up until someone eventually gives him the 50 cents (which he takes without a pause). Variations of the ice-cream story, and others like it, have become the litany of the computer world. But this does not distract from the prescience of Gates, who organized Microsoft into a business that works, even if the company's software often enters the market filled with bugs (the third versions usually work).

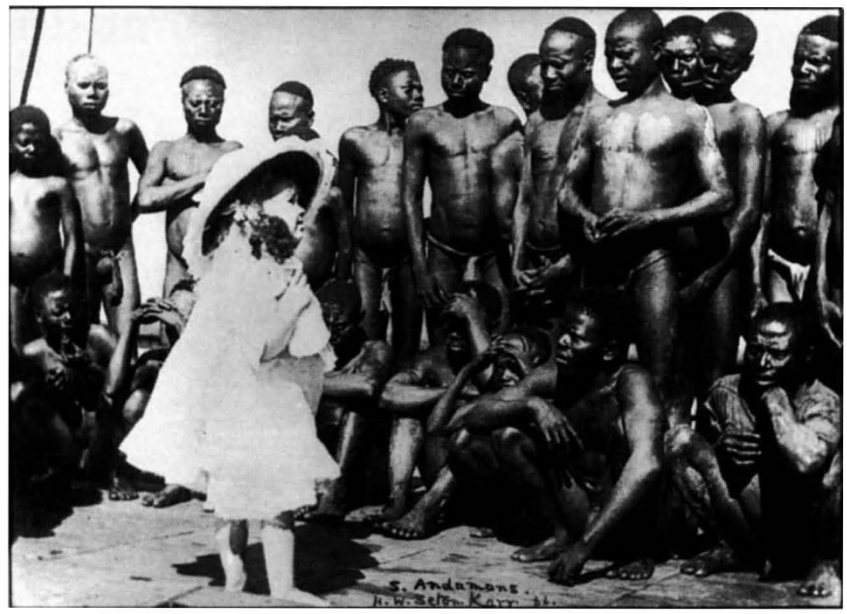
Cringely also vividly describes the recent, and to him continued, decline of IBM. IBM feared the competition that the personal computer presented to its mainframe business and as a result underestimated the growing power and popularity of the personal computer. There is a need for a new standard, however: many of the players today will not be there in the future because, as Cringely emphasizes, standards are based more on accident and increasing returns than on quality. He writes:

> To Engineers — really good ones, interested in making progress — the best of all possible worlds would be one in which technologies competed continuously and only the best ones survived . . . . [But] the real world, the one we live in, is a world of dollars, not sense. It's a world where commercial interests are entrenched and consumers pay more attention to what everyone else is buying than to whether what they are buying is any good.

Cringely does not believe that the future belongs to IBM or to Japanese manufacturers. He recognizes an important shift now in personal computing, citing four notable trends: the growth of standard-based computing, RISC (reduced instruction set computing) processors and advanced semiconductors, and the death of the mainframe. These trends will create a wealth of opportunities in the development of software and microprocessors. Whether the paradigm of accidental empires continues to characterize the nature of the next shift will be fascinating to see. I, for one, cannot help but wonder what the title of Cringely's sequel will be. □

Betty A. Toole is a consultant for Critical Connection, PO Box 452, Sausalito, California 94966, USA.

■ Computer experts, high-tech millionaires and teenage whiz-kids are also a few of the subjects of Bruce Sterling's *The Hacker Crackdown: Law and Disorder on the Electronic Frontier*, which claims to be the first full look at computer hacking. Bantam/Viking, $22.50, £16.99.



Ethnic minorities — Mary Deane, daughter of the census officer, on board a government steamer with a group of Onges, Little Andaman, 1911. The picture is one of 157 remarkable photographs reproduced in *Anthropology and Photography, 1860–1920* edited by Elizabeth Edwards. Yale University Press, $35, £19.50.

Black holism

John D. Barrow

Black Holes. By Jean-Pierre Luminet. *Cambridge University Press: 1992. Pp. 312. £30, $59.95 (hbk); £10.95, $22.95 (pbk).*

BLACK holes are the simplest things in nature. Attempt to give a complete description of something even as mundane as this page and you would be faced with amassing countless pieces of information about atomic numbers, bindings and so on, together with all manner of large-scale properties such as temperature and size. But find yourself a black hole and there are only three things about it that you can know: its mass, its spin and its electric charge. It is not that the material within the horizon of the hole has no other properties or becomes transformed into some mysterious anonymous form unlike the stuff of the world around us; indeed, nothing at all unusual happens to it on entering the hole. It is simply that these three properties of the totality of material encompassed by the space–time boundary of the black hole are the only pieces of information about the interior that are accessible to outside observers.

This elegant minimalism is one reason for the attraction of black holes to gravitation physicists. But astronomers are enticed by the apparent inevitability of black holes as the final resting places of sufficiently massive stars that have exhausted their reserves of nuclear fuel, and by the seeming ubiquity of black holes in the most interesting places in the Universe. The strong gravitational field gradients surrounding them can liberate quantities of radiant energy far in excess of the energy produced by any other known force. As a result, they are prime candidates to explain a plethora of phenomena in the realm of high-energy astrophysics. There is compelling evidence that black holes lie at the heart of the quasar phenomenon, lurk in the centres of active galaxies, and orbit in tandem with luminous stars whose fragile outer layers are dragged down into the whirlpool of the black hole amidst a flux of tell-tale X-rays.

There have been many books about black holes at a popular low level and there are several mathematical treatises for specialists. In between, there is something of a vacuum. Filling it is a challenge, because black holes are studied in a variety of ways by specialists interested in quite different aspects: some workers are attracted by the clues that these objects give to the intrinsic properties of gravity; others build intricate computer simulations of the collapse of material that leads to their formation; still others seek to model complicated astronomical observations by combinations of black holes, stars and gas. The wide range of expertise required to bring all this together is perhaps why it is rare to encounter a single unified exposition of black-hole properties.

Yet Jean-Pierre Luminet has managed