BOOK REVIEWS

Correlates of Creativity

Striking the Mother Lode in Science. The Importance of Age, Place, and Time. PAULA E. STEPHAN and SHARON G. LEVIN. Oxford University Press, New York, 1992. xiv, 194 pp., illus. $29.95.

The notion that creativity in science declines with advancing age is both familiar and controversial—not surprisingly, given its relevance for all of our professional lives. Less familiar are the scholarly origins of the "age decrement" concept. In the 1950s H. C. Lehman tried to establish the facts of the matter on the basis of lists of major breakthroughs or discoveries in science, which could then be associated with the ages of their principal authors. This led to generalizations regarding the age at which such work was typically done and to the notion of a creativity peak somewhere around 35, though varying somewhat from discipline to discipline. Both method and conclusions were criticized from the start, not least by Lehman's fellow psychologists. Subsequently sociologists of science, including Harriet Zuckerman and Robert K. Merton, pointed out that various factors intervene in this relationship, not least the typical changes in tasks that come with age and advancement. Only those scientists who are widely acknowledged to be highly productive are likely to continue to do research.

Stephan and Levin have taken these studies as their starting point and, on the basis of literature review and some original empirical work, have gone considerably further. Most intriguingly, they have taken a step back, in first asking how any relationship between age and scientific creativity or productivity might come about. What does a scientist need in order successfully to engage in research? How does his or her access to material resources (suitable employment, equipment, colleagues, and so on) change with age? How does motivation change as a scientist ages? These essential inputs are further broken down and analyzed. Drawing in part on the sociological literature, Stephan and Levin argue that a scientist's motivation can be understood as deriving from three distinct types of incentive: financial reward; the urge to solve puzzles; and the urge to secure the approval of one's peers. The authors' economic expertise is deployed intriguingly and originally in their attempt to compare the personal costs and benefits of engaging in research at different points in the career. A successful older scientist, for example, may have little to gain in publishing one more paper, and remaining in the laboratory may be associated with considerable opportunity costs (no time for that lucrative consultancy, for example). The overall argument, however, far transcends the purely economic.

To be young and talented is not enough, for opportunities are unequally distributed through time and space. Best of all is to be young and talented *and* doing one's Ph.D. in a laboratory and a field in which a major new approach, theoretical breakthrough, or research technology is emerging. The fortunate few will acquire skills appropriate to the new approach before they have become widespread. Luckier still if they happen to do so at a time in which academic jobs are readily available. The model that Stephan and Levin try to articulate is a complex one. Being young in the 1960s, say, when universities were expanding, was a different matter from being young in the 1980s. Generational effects, so understood, intervene in the relationship between age and achievement. There are disciplinary effects, too, since the possibility of mastering a new approach (plate tectonics, chaos theory) or research technology (lasers, gene splicing) before it has become widespread depends upon the state of the science in question at the time. All this is summarized by saying that what matters is to be in the Right Place at the Right Time ("RPRT").

In the penultimate chapter of the book, the attempt is made empirically to investigate, separately, the effects of "pure aging" (by which is meant age corrected for motivation, resources, and so on) and generation ("vintage") on scientific creativity and productivity. This was done by linking up data drawn from the National Research Council's Survey of Doctorate Recipients with data drawn from the Science Citation Index. The method allows the authors to look independently at the publication patterns of individuals over time, from the year in which they obtained their doctorates, and also to compare "vintages" with one another. Three areas of physics and three areas of earth science were chosen. "Vintages" were then defined in relation to the periods, in each specialty, at which major conceptual or methodological changes took place. The conclusion, roughly speaking, is that age matters, although not very much. Scientists publish somewhat less as they age, and they are less likely to do path-breaking work. These effects are more noticeable in the physical sciences than in other disciplines. The significance of "vintage" proved elusive: in any event it was not the case that more recent vintages were always more productive.

For any sociologist of science this work has to be seen as a major advance on most studies of scientific productivity. Stephan and Levin have recognized that scientific research is a collective activity (so access to colleagues is an important input to anyone's work) and that its practice is specialty-dependent. But I wonder if they have fully appreciated the implications of accepting these central sociological tenets. The ultimate objective of the book is to draw conclusions regarding the effectiveness with which the U.S. scientific community carries out research. Since research in the physical, biological, and earth sciences is nowadays principally carried out *by* (not

Prices of Books

Average per-volume prices of books reviewed in *Science* 1987–1992. The average prices per page for the technical books in the natural sciences for the years covered were 12.5¢, 16.1¢, 16.9¢, 17.8¢, 17.0¢, and 17.2¢. (Data are for hard-cover books except where books were available only in paperback.) For earlier data from *Science* and other relevant information see *Science* **211**, 933 (1981); **235**, 95 (1986); **239**, 81 (1987); **243**, 99 (1989).

Category	Price (dollars)					
	1987	1988	1989	1990	1991	1992
All books	47.37	54.05	54.58	54.43	54.08	57.58
Technical books in natural sciences	59.06	71.70	73.73	75.57	73.19	76.78

just *in*) groups, was it proper to approach the matter through the examination of individual aging? Would the productive research group not have been the wiser starting point? Thanks to careful sociological work (by Shinn and others) we know that such a group displays complex divisions of labor. Drawing out the full implications of research data, in some disciplines, may require the distinctive contribution of a laboratory's most senior members. Given expected disciplinary variation, how much sense does it make to generalize about the scientific community as a whole? Though no statistician, I am also a little worried at the use of data regarding individual scientists to draw conclusions regarding the scientific community.

Just because of the authors' concern with diminished (relative to what?) national scientific productivity the book ends disappointingly. Though I agree with all they have to say here about the effects of excessive competitiveness and pressures to secure grants and to publish, I still regret the superficial way in which these effects are introduced in the final chapter. The final polemic does detract from the scientific quality of an interesting book.

Stuart Blume
Department of Science Dynamics, University of Amsterdam, 1018 WV Amsterdam, The Netherlands

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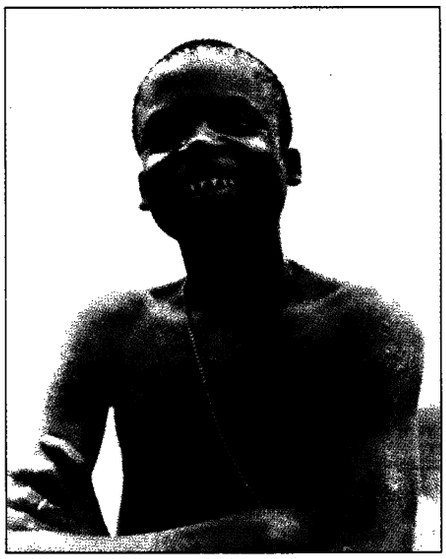
Human Curiosity

Ota. The Pygmy in the Zoo. PHILLIPS VERNER BRADFORD and HARVEY BLUME. St. Martin's Press, New York, 1992. xxii, 281 pp. + plates. $22.95.

On a late summer day in 1906, a crowd gathered in front of the monkey cage at the Bronx Zoo. They laughed, gawked, and applauded at the sight of a 23-year-old African pygmy, Ota Benga, who had been put on display with the monkeys by New York Zoological Society authorities. In this crisply written and moving narrative, Phillips Verner Bradford and Harvey Blume tell Ota Benga's story as "one man's degradation in turn-of-the-century America" (jacket) and make clear that those who sought to debase Ota debased themselves as well. By detailing the conjunction of turn-of-the-century imperialism, anthropology, and popular culture, Bradford and Blume have written an important book that will interest an audience of specialists and non-specialists alike.

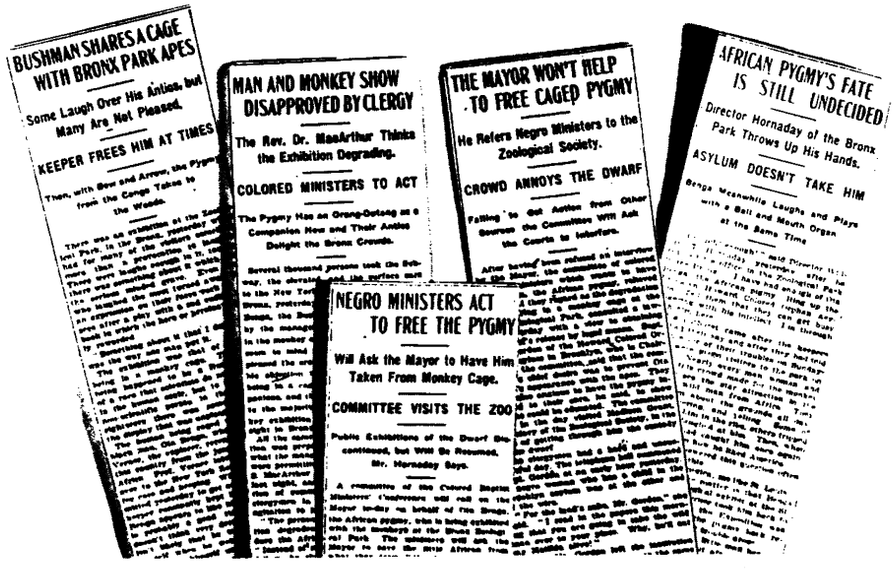
There is no easy way to summarize their fascinating story. In part, it seems to be an



"Ota Benga displays filed teeth at the St. Louis Fair, probably for the agreed upon fee of a nickel or dime, payable in advance. Fairgoers—and anthropologists—liked to think filed teeth were a sign of cannibalism. In fact, such cosmetic dentistry is still practiced in many parts of Africa and has no relation to man-eating." [From *Ota: The Pygmy in the Zoo*; American Museum of Natural History]

effort by Bradford to come terms with his personal—and America's collective—history. It was Bradford's grandfather, Samuel Phillips Verner, the missionary-cum-imperial-broker, who brought Ota to the United States to be featured in the anthropology exhibits at the 1904 St. Louis world's fair. Verner's own exploits would shortly become legendary: his career as "an industrial developer of central Africa" (photo caption) carried him to western Europe's "heart of darkness," the Belgian Congo, and into an imperialist web that included close contacts with Belgium's grossly foul Leopold II, American imperialist outfitters Daniel Guggenheim and Bernard Baruch, and a bevy of America's leading scientific popularizers, including the American Museum of Natural History's Fairfield Osborn and the New York Zoological Society's William Temple Hornaday. Unlike his sponsors, Verner never found fortune; indeed, in an ironic double twist of fate, he joined the ranks of the exploited. Abandoned by his millionaire sponsors, Verner returned to the American South, where he lived out his life trying to serve as a mediator between whites and African Americans.

What about the man Verner brought to the United States? When Verner first encountered Ota Benga, the latter had been captured and enslaved by Leopold's collaborationist forces, which had viciously murdered Ota's family. Verner, carrying a "shopping list" from St. Louis world's fair officials for Africans who could be displayed at the exposition, purchased Ota, who in turn persuaded nearly 20 additional Africans to accompany them to the fair. Once at the fair, Ota, according to the authors, was of two minds about being exhibited in an imperial show that featured nearly one thousand Filipinos from America's newly acquired overseas colony and numerous Native Americans, including Geronimo. At the close of the fair, Ota, like the other Africans in Verner's company, emphatically chose to return to Africa. Unlike the others, Ota, once in Africa, decided to accompany Verner back to the United States, where



Newspaper clippings about the display of Ota Benga at the Bronx Zoo. [From *Ota: The Pygmy in the Zoo*; *New York Times* 9, 10, 11, 12, and 18 September 1906]