BOOKS: HIGHER EDUCATION

Course Changes for the Research University

Robert M. Rosenzweig

When it comes to universities, Frank Rhodes has pretty much seen it all. His vast experience covers the academic bases: professor, dean, academic vice president, long-time president of Cornell University. Rhodes knows the good, but he knows the bad and the indifferent as well. In his new book, *The Creation of the Future: The Role of the American University*, Rhodes draws on that experience to provide a tour d'horizon of the research university as it grew through the 20th century and moves into the 21st.

The Creation of the Future
The Role of the American University
by Frank H. T. Rhodes
Cornell University Press, Ithaca, NY, 2001. 286 pp. $29.95, £19.95. ISBN 0-8014-3937-X.

In his portrait of what is arguably the most successful of institutions in the United States, Rhodes depicts a university that has become dauntingly complex, flawed in significant ways, and more important than ever. "For all its shortcomings," he writes, "the American university has been an unambiguous influence for good." In short, he approves of the institution in which he has spent his adult life, and he is fully justified in doing so. If the influence has in fact not quite been unambiguously for good, it has certainly, on balance, been positive. This more modest conclusion is useful because it allows for a more candid consideration of ways in which the university has fallen short, and it helps to keep the discussion from becoming defensive, a tone that Rhodes sometimes falls into.

The successes of the research university since the end of World War II have been cataloged by nearly every observer of higher education. The university has played a key role in the explosion of knowledge through basic and applied research and, more recently, in speeding the results of research into the stream of commerce by collaborations with industry. It has linked faculty research and graduate education, thereby greatly enriching the education of Ph.D.'s and, in the process, making American graduate education a magnet for students around the world. And it has broadened access to higher education through its responses to the enormous growth produced by the G. I. Bill of Rights in the 1950s and to the demands that arose from the civil rights and feminist movements of the 1960s and 1970s. This is a proud record, and Rhodes chronicles it eloquently. The trouble is that every success has been accompanied by a new set of problems.

It is those problems that research universities now confront. Although Rhodes candidly identifies and describes them, he is less successful at pointing the way to address them in practical terms. For example, Rhodes correctly recognizes the fragmentation of university faculties, what he calls the "loss of community." He is also correct in naming the growth of science as a leading cause of the loss. He sees science more as a victim of a general collapse of traditional belief than as a villain. Nevertheless, he writes, "It is in science, both pure and applied, that the university now makes its major investment, building costly facilities, licensing its products, constructing research parks and incubation facilities for its exploitation, and often investing resources in its corporate ventures."

Science, one might add, has shifted the faculty's principal point of identification from their university to separate disciplines and to various research

patrons and decision-makers. As Rhodes believes (and I agree), this is a serious problem. But what should be done? A depreciation of the value and importance of science is unlikely and would be inadvisable in any case. That makes a reversal of the current situation difficult. Rhodes's solution is twofold. First, "faculty members must affirm that membership in a university—like American Express—has not only its privileges but also its price." Second, the university must generate campus discussion on matters of genuine importance, dialogue that will transcend disciplinary boundaries and engage the participation of faculty and students from all its parts. Both goals are worthy, but Rhodes does not specify the process that might move the university toward them. The absence of such details leaves only exhortation, a strategy that is said to have worked for Henry V before Agincourt but is unlikely to work with a faculty that is suffering from the very ailments the strategy is meant to cure.

Exhortation to do good, or at least to do better, is an important facet of *The Creation of the Future*. I cannot resist pointing out that Rhodes long presided over a fine university and nowhere does he claim that Cornell has avoided or solved the problems that he so clearly identifies. However, it would be unfair to put a burden on this book when few, if any, books on higher education do more than identify problems and either deplore them or exhort everyone to do better. Small improvements, such as modification of the undergraduate curriculum, are possible, and Rhodes identifies some from his own experience. But radical change is precluded, and attempts to accomplish it may well overwhelm the positive things that can be done.

This is not because of perversity or willful indifference of university people. Universities, more than most institutions, are deeply embedded in the society that surrounds them. The deficiencies that have drawn so much attention and criticism in recent years (most of which Rhodes discusses) are not the result of misfeasance or malfeasance on the part of faculties and administrations. Nor are they the result of universities ignoring what the public wants. On the contrary, they are the result of giving the public what it does want—namely, the social and economic benefits of research, high-quality professional training, and the career enhancement that goes with a college degree. Undergraduate education, for one, does not rank very high on the list, nor will it until the rewards that go with teaching are at least equal to those that research supplies. Similarly, restoring the lost sense of a university community will require more than symposia on broad topics. Faculties will reattach to their communities when the benefits from doing so are seen to be larger than the very substantial benefits they now enjoy.

Rhodes provides a road map of the challenges that face universities now and for the foreseeable future. Significant change in the direction that he lays out (assuming such a course is possible) could risk the approval of universities' political and financial patrons. But either universities will need to accept such disapproval or wait for a change in public priorities of the magnitude of the one that led to the supremacy of research as the primary university activity. Neither shift will happen

CREDIT: CORNELL UNIVERSITY

The author was formerly at the Association of American Universities. E-mail: robertmr@mindspring.com

soon, and in the meantime we must settle for smaller victories. But such changes may be hastened by the contributions of more statesmen like Frank Rhodes, who can remind us of the better angels of our natures.

BOOKS: STATISTICS

Casting Light on the Shadow of Doubt

Jane Hawkins

All animals that compete for their food are capable of some form of taking risks. Humans are distinct among creatures by their tireless quest for certainty and truth in an unpredictable world. One of the earliest records of written thought is an Egyptian document from 2200 B.C. that discusses a conflict between evidence and witnesses in the case of a contested will. Games of chance are also ancient; an Egyptian tomb painting from 3500 B.C. shows a nobleman in an afterlife game of chance. He plays a board game where pieces are moved around according to a throw of a symmetric animal bone.

Today, as evidence is gathered in 60 countries on the attacks on the World Trade Center and the Pentagon, only a few facts can be established with mathematical certainty. The perpetrators did not survive the crime, and the hijacked eyewitnesses perished as well. Therefore the search is for co-conspirators, and the conclusions about their involvement in the attacks will involve conjecture.

As James Franklin discusses in *The Science of Conjecture: Evidence and Probability before Pascal*, from the time of ancient Greece to the present, scholars have written copiously and rationally about proof, uncertainty, and risk. In 1654, the subject of chance was formalized by Pascal and Fermat with their establishment of the branch of mathematics called probability theory. Since then, probability has fanned out into many sophisticated areas of mathematics, science, and engineering through attempts to predict uncertain outcomes and to prove reliability; chaos theory is one of the popular great grandchildren of Pascal's original theory of dice. The author, a mathematician and philosopher at the University of New South Wales in Australia, claims that theory of evidence, originally intertwined with and indistinguishable from probability theory, developed more or less independently after Pascal. He argues convincingly that evaluation of certainty involves moral and philosophical issues not relevant in math, and likewise mathematical certainty is not required in law or religion.

The Science of Conjecture
Evidence and Probability before Pascal
by James Franklin
Johns Hopkins University Press, Baltimore, 2001. 511 pp. $55, £36.95. ISBN 0-8018-6569-7.

Mathematical certainty of Osama bin Laden's involvement in the recent attacks may never materialize. More than two weeks after 11 September, the *New York Times* asserted that not a single living person could be directly connected to the crime through "hard evidence." Recognizing that much evidence will be kept secret during the investigation, we are still left with the issue of what constitutes acceptable proof. The book offers a compendium of premodern alternatives to certainty.

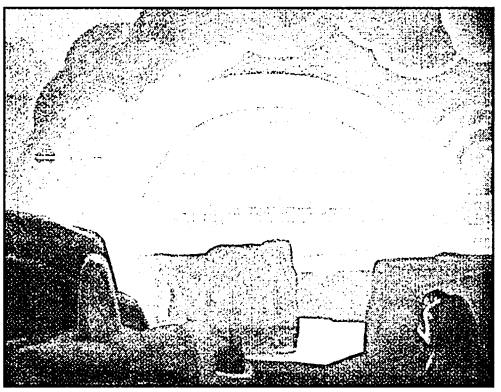
The first three chapters of *The Science of Conjecture* deal with the development of the law of evidence from ancient times to the mid 1600s. Franklin highlights a "consistent tradition of dealing explicitly with evidence that falls short of certainty." He presents a comprehensive treatment of the history of the relations between probability and methods of evidence. In the course of demonstrating that in many matters we should look beyond mathematical proof and quantitative analysis to consider evidence, Franklin provides an extensive sample of quotations and sources spanning several millennia.

Even though probability was not developed as a formal mathematical subject until Fermat and Pascal laid out the groundwork, the topic was discussed both qualitatively and quantitatively for many centuries before that. Franklin leads us through these discussions, demonstrating that rational evaluations of risks and games of chance, as well as an appropriate vocabulary, were in place long before the math. Furthermore, the legal, moral, philosophical, and business domains influenced the gradual development of the mathematical subject of probability, with the result that language frequently describes the certainty of evidence better than numbers can. In other words, "proof beyond a reasonable doubt" should never be assigned a number.

Franklin writes, "One of the pleasures of studying the ancient world is that a large proportion of what one has to read is of good quality, since the better works have enjoyed a higher survival rate...." Casting the widest possible net over risk, evidence, and probability of the past, he treats us to scholars' and religious leaders' views on gambling, insurance contracts, trial evidence, scientific theories, and proof of the existence of God. His helpful commentary is sprinkled with dry wit along the way.

Eventually, the data collection surrounding the events of 11 September will end and experts will announce the most likely scenario of the crimes and publish the "final" list of victims. Then we, as individuals, will have to decide how to find moral certainty in the unknowable. (Moral certainty, as Franklin discusses, was introduced in the 1400s to denote an acceptable level of uncertainty. It has since evolved into proof beyond a reasonable doubt.) *The Science of Conjecture* opens an old chest of human attempts to draw order from havoc and wipes clean the rust from some cast-off classical tools. These can now be reused to help build a framework for the unpredictable future.

The author is in the Department of Mathematics, University of North Carolina at Chapel Hill, Chapel Hill, NC 27599, USA. E-mail: jhawkins@email.unc.edu



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BROWSINGS

The Rainbow Bridge. Rainbows in Art, Myth, and Science. *Raymond L. Lee Jr., and Alistair B. Fraser.* Pennsylvania State University Press, University Park, PA, and SPIE Press, Bellingham, WA, 2001. 407 pp. $65. ISBN 0-271-01977-8.

Rockwell Kent's *Entrance of the Gods into Valhalla* (1927) (left) depicts Bifrost, the bridge between Earth and the home of the Norse gods. The colorful arc of the rainbow has also been seen as a sign of good fortune, a symbol of God's covenant in Judeo-Christian culture, and the bearer of the gods' messages of war and retribution to the ancient Greeks. It assumes countless, often unnatural, forms in art and advertising (where it has been used to sell items ranging from cars and motel rooms to chocolate chip cookies and detergents). And it has inspired research in optics, meteorology, and color theory. Lee and Fraser combine informative text, images, and diagrams in this eclectic survey of cultural and scientific perspectives on the interaction between sunlight and raindrops.