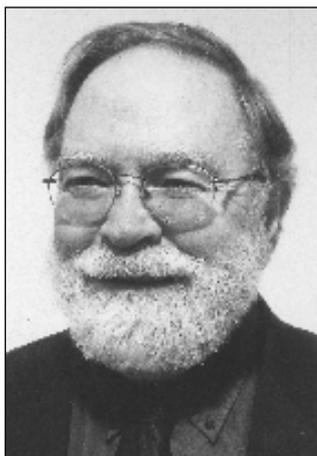


Mandelbrot and Yorke Receive 2003 Japan Prize



Benoit B. Mandelbrot



James A. Yorke

BENOIT B. MANDELBROT and JAMES A. YORKE were named Laureates for the 2003 Japan Prize for Science and Technology of Complexity. Awarded by the Japan Science and Technology Foundation, the Japan Prize carries a cash award of 50 million Japanese yen (about US\$400,000).

Citation

What follows is the full text of the citation for the prize.

The world we live in is so complex that it is an enormous challenge to understand the fundamental nature of its complexities. Modern science has so far been successful in explaining the world by breaking it down into its constituent elements and then analyzing their properties. However, there are phenomena which emerge only when elements are connected into systems, and which the elements do not have in themselves. Modern science has taken up the challenge to examine those properties, going beyond the reductionistic approach. This is called the science and technology of complexity.

Nature is filled with complex geometrical shapes such as seashore lines, branching patterns of rivers,

biological shapes, and even the curves of currency exchange rates. There is a common feature in such complex shapes: their self-similarity. This is the property that, when a part of a shape is enlarged, the same type of structure appears again. Dr. Mandelbrot discovered that self-similarity is the universal property that underlies such complex shapes, and he coined the expression “fractal”. Furthermore, he has illustrated its properties mathematically and founded a new methodology for analyzing complex systems.

Numerous time-varying, complex patterns of behavior are found in dynamic phenomena such as the motion of the planets, turbulence in water and air, variations of the populations of species in ecological systems, and many other instances. These patterns of behavior are described by nonlinear evolution equations. Dr. Yorke has found the universal mechanism underlying such nonlinear phenomena. He named it “chaos”, and he has elucidated its properties mathematically. He has played a leading role in further development of research into chaos, including its controls and applications.

It is still a challenge to understand complex phenomena. The two concepts—chaos and fractal—have been established as universal concepts underlying such phenomena, irrespective of specific fields. Their applicability has been extended even to modern technology, the arts, economics, and the social sciences.

Dr. Mandelbrot and Dr. Yorke found, respectively, that fractals and chaos are the universal structures existing in complex systems, and they elucidated their fundamental properties. They have furnished

us with new frameworks for understanding complex phenomena, and they have contributed both by establishing fundamentals and by providing us with applications. Therefore, Dr. Mandelbrot and Dr. Yorke deserve the 2003 Japan Prize.

Biographical Sketch: Benoit Mandelbrot

Benoit Mandelbrot was born November 20, 1924, in Warsaw, Poland. He studied at the École Polytechnique and the California Institute of Technology before receiving his doctorate from the Université de Paris in 1952. He worked in France before moving to the IBM T. J. Watson Research Center in 1958. Since 1987 he has also been on the faculty of Yale University. He is currently an IBM Fellow Emeritus and the Sterling Professor of Mathematical Sciences at Yale.

Mandelbrot has received numerous prizes and awards, including the Harvey Prize for Science and Technology (1989), the Wolf Foundation Prize for Physics (1993), and the Sigma Xi William Proctor Prize for Scientific Achievement (2002). He is a member of the U.S. National Academy of Sciences, a fellow of the American Academy of Arts and Sciences, and a foreign member of the Norwegian Academy of Science and Letters.

Biographical Sketch: James Yorke

James Yorke was born on August 3, 1941. He received his bachelor's degree at Columbia University (1963) and his Ph.D. from the University of Maryland (1966). He has spent his career at the University of Maryland, where he is currently Distinguished University Professor of Mathematics and Physics, Institute for Physical Sciences and Technology. He was the director of that institute from 1988 to 2001. Yorke is a fellow of the American Association for the Advancement of Science.

About the Prize

The Japan Prize is awarded to people from all parts of the world whose original and outstanding achievements in science and technology are recognized as having advanced the frontiers of knowledge and served the cause of peace and prosperity for mankind. The prize was established by the government of Japan in 1983. Previous recipients include Marvin Minsky (1990) and Jacques-Louis Lions (1991).

—*Allyn Jackson*