Advanced Study in Princeton, New Jersey, with the cooperation of the Radio Corporation of America.

A very important part of the work of the Machine Development Laboratory consists in acting as a coordinating agency and an information exchange center for the Federal automatic digital computer program. To this end, bibliographies have been prepared and distributed, and an information and discussion section for the journal *Mathematical Tables and Other Aids to Computation* (published by the National Research Council) is being compiled and edited.

Much of the program of the National Applied Mathematics Laboratories (with the exception of that of the Statistical Engineering Laboratory) is not strictly classifiable as "applied mathematics" at all, since it is concentrated in the near-by field of numerical analysis. The immediate reason for this phenomenon should be apparent from the background and history of the organization. It is interesting to note in this connection that, some three years ago, a mathematical organization with a similar program and setting was established in England as the Mathematics Division of the National Physical Laboratory. Other countries are also setting up national mathematical centers with emphasis on computing an automatic computer development.

However, there is considerable reason to believe that as the National Applied Mathematics Laboratories mature and, in particular, as automatic equipment now under development comes into actual use in the Laboratories, the program will tend to conform more and more closely to a puristic interpretation of the name of the organization. Even now, plans are being made for a further strengthening of the work at the level of the applications of mathematics. Traditionally, a certain amount of basic research in applied mathematics has been carried forward in various scattered groups in the National Bureau of Standards, and it may be that later on a special section should be added to the Laboratories to consolidate and extend this activity. In the meantime, there is much to be done in the present areas of concentration of the work of the Laboratories, and it is believed that a substantial contribution to the national scientific effort will be made if the present program is effectively carried out.

References

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Obituary

Alfred North Whitehead

1861-1947

Alfred North Whitehead died in Cambridge, Massachusetts, on December 30, 1947. He was born in Ramsgate, England, on February 15, 1861.

He attended Trinity College, Cambridge, where he obtained the B.A. degree in 1884, the M.A. degree in 1887, and the D.Sc. in 1905. He also received the D.Sc. degree from the universities of Manchester, Harvard, Wisconsin, Yale, and McGill and an LL.D. from St. Andrews.

He was lecturer and later senior lecturer on mathematics in Trinity College, Cambridge, from 1885 to 1911; lecturer on applied mathematics and mechanics and later reader in geometry at University College, University of London, 1911–14; professor of applied mathematics and later chief professor of mathematics, Imperial College of Science and Technology, University of London, 1914–24; dean of the Faculty of Science, 1921; professor of philosophy, Harvard University, 1924–36; and professor emeritus, 1936 to the time of his death. He was a Fellow of the Royal Society and the British Academy and a member of the Mathematical Society, the British Association for the Advancement of Science, the Aristotelian Society, and the American Philosophical Association. He received the James Scott Prize from the Royal Society of Edinburgh in 1922, the Sylvester Medal from the Royal Society of London in 1925, and the Order of Merit in 1945.

His publications include *A treatise on universal algebra,* 1898; *Principia mathematica* (with Bertrand Russell), 1910; *An introduction to mathematics,* 1910; *The organization of thought,* 1916; *The principles of natural knowledge,* 1919; *The concept of nature,* 1920; *The principle of relativity,* 1922; *Science and the modern world,* 1925; *Religion in the making,* 1926; *Symbolism: its meaning and effect,* 1927; *The aims of education,* 1928; *Process and reality* (the Gifford Lectures) and *The function of reason,* 1929;

Adventures of ideas, 1933; *Nature and life,* 1934; and *Modes of thought,* 1938.

Few men since Leibnitz and Aristotle have touched so many fields with such originality, precision, and profundity. His *Principia mathematica,* written with Bertrand Russell, formulates deductively the modern theory of mathematics and formal logic after the manner in which Newton gave the first deductive formulation of modern physics. From mathematics proper he moved to the problem of the relation of mathematics to physics. He saw that Einstein's theory of relativity entailed not merely a reconstruction in our scientific and philosophic conceptions of space and time but also a reconstruction in the conception of the relation of scientific objects to space and time—a reconstruction which requires a completely new theory of what a scientific object is and what its relation is to the deliverances of sense awareness with which all scientific and philosophical knowledge begins. It was the latter type of inquiry, pursued in *The principles of natural knowledge, The concept of nature,* and *The principle of relativity,* which convinced Whitehead that a reconstruction in the basic concepts of philosophy is necessary even to achieve the required reconstruction in the concepts and methods of physics. This prepared the way for the acceptance of a call to the Department of Philosophy, Harvard University.

Although Whitehead was never trained professionally as a philosopher, he knew his Plato, Aristotle, Descartes, Locke, Berkeley, Hume, Leibnitz, Kant, Bradley, and James. This acquaintance with Western philosophy as well as mathematical physics enabled him to see that the basic difficulties in contemporary psychological and philosophical theory center in errors made at the very beginning of the modern world and that, as a consequence, contemporary problems can be solved, not by patching up or reconstructing recent traditional modern scientific and philosophical theories, but only by going back to the origins of modern scientific and philosophical thought to remove an initial error. He saw also that this error was introduced, not by the philosophers, but by the scientists, in particular by Galilei and Newton.

This error he located in the distinction first made by Galilei and later repeated by Newton between (a) apparent sensed qualities in apparent relative sensed space and time and (b) public or "real" scientific objects in "true, real, and mathematical" space and time. It is to be noted that this distinction introduced by Galilei and Newton involves two different assumptions: (1) the thesis that (a) scientifically conceived, indirectly observed, experimentally verified nature is not identical with (b) directly observed sensed nature, and (2) the theory that (a) is related to (b) by a three-termed relation of appearance in which the observer is the third, mediating term between (a) and (b).

The latter assumption necessitates the identification of the observer with Locke's mental substance. Forthwith all the subsequent theories of modern philosophy and psychology are generated, each one of which gets into difficulties with certain facts.

Whitehead's solution consisted in rejecting the first of the two assumptions of Galilei and Newton. The second one then becomes unnecessary, and Locke's dismissal of mind from nature ceases to be required. This rejection of the initial assumption appears in Whitehead's attack upon what he called "the bifurcation of nature."

This forced him to derive the concepts of mathematical physics from sensed nature. In order to do this, a new scientific method was required. This he called "the method of extensive abstraction." Its application results in the entities and relations of nature being quite different from those of traditional modern science or philosophy. The working out systematically of the new foundations for both science and philosophy which such a procedure entails becomes the topic of Whitehead's most mature and systematic work, his *Process and reality.* The new philosophical standpoint which it expresses is then pursued in the humanistic field in his later works.

Scientists, in reflecting on Whitehead's work, will eventually return to the problems concerning rotational motion raised by the acceptance of Einstein's theory of relativity. Whitehead saw very early that the explanation of rotational motion and the Foucault pendulum experiment by Mach's hypothesis, to which Einstein's treatment of rotational motion resorts, is by no means necessary or very satisfactory. Few people have seen these particular difficulties and the other basic problems on the frontier of 20th-century scientific and philosophical thought more clearly than did Whitehead. He made it clear that there is an essential connection between mathematics and logic and between science and philosophy.

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