Book Reviews

The Forming of the Geological Survey

Government in Science. The U.S. Geological Survey, 1867–1894. THOMAS G. MANNING. University of Kentucky Press, Lexington, 1967. xiv + 257 pp., illus. $7.

The thesis of this book is that certain major contemporary issues regarding the operation of scientific agencies by the federal government were generated in the late 19th century, during the formative years of the Geological Survey. These issues are related to the control, scope, cost, quality, and social applications of government science.

As essential background to the founding of the Geological Survey in 1879, Manning sketches scientific exploration of the American West following the Civil War. Here the issue of military vs. civilian control of government science began to take shape after 1867 with the organization of the U.S. Geological Exploration of the Fortieth Parallel and the U.S. Geological and Geographical Survey of the Territories, the first directed by Clarence King as an operation of the Corps of Army Engineers, the second by F. V. Hayden under the sponsorship of the Department of the Interior. How the ensuing contest between soldiers and civilians for the management of scientific exploration in general and of topographic mapping in particular was resolved in favor of the civilians is a story of spirited political infighting well told in this book.

The issues of scope, cost, quality, and social applications came to the fore between 1881 and 1894, when John Wesley Powell was Director of the Survey. Clarence King, Powell's predecessor, had concentrated on economic geology, in particular on studies of mining camps in California, Nevada, and Colorado. Determined to broaden the scope of the Survey's investigations, Powell encouraged studies of paleontology, geomorphology, and other basic aspects of the geological sciences, while pushing ahead to complete the topographic mapping of the United States as quickly as possible. His appropriations, never adequate for the multidisciplinary program envisioned, were periodically cut back on grounds of economy or as reactions against Powell's seeming fondness for projects which promised no economic returns. Inaccuracies discovered in some of the topographic maps hastily produced during the Powell regime raised the question of the quality of government science—unfortunately at a time when the Survey needed more rather than less financial support.

The issue of applying government science to social reform came to a head between 1888 and 1890 in connection with Powell's proposals for an irrigation survey of the arid West. Powell envisioned the development, through topographic and hydrologic studies, of largely independent agrarian communities each controlling the water of its own drainage basin through systems of reservoirs and canals. Reaction against this scientific collectivism led to the abandonment of the irrigation project and to Powell's resignation.

Although this is a work of political history, references to pertinent scientific publications of the Survey and to letters and biographical accounts of the principal characters appear throughout the text. The book ends with a sketch of recent developments within the Survey to 1963, an essay on source materials, and a detailed index. Four maps locate the principal geographic areas discussed.

Few would disagree with the author's appraisal of the Geological Survey as "the government's most productive research agency during the nineteenth century." That this was so is all the more amazing in view of the alleged pettiness, selfishness, hypocrisy, and plain cussedness on the part of many who attended the drawing of the plans, the laying of the keel, and the launching of the ship.

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Doing and Knowing

The Co-ordination and Regulation of Movements. Papers translated from Russian and German. N. BERNSTEIN. Pergamon, New York, 1967. xii + 196 pp., illus. $8.

"The motor activity of organisms is of enormous biological significance—it is practically the only way in which the organism not only interacts with the surrounding environment, but also operates on this environment with respect to particular results. The theoretical lag in this area in comparison with the physiology of receptors or of internal processes is therefore very puzzling."

So wrote Nicholas Bernstein near the end of a long career of exploration into the structural organization of human movements. This translation of selected articles and essays of three decades certainly provides moral support for those of us in the West who keep insisting—each in his lonely corner—that the study of what animals *do* merits at least as much experimental attention as what they *see*. Western psychology remains so stubbornly Greek in character that most of us never imagine any entrée to the mind but through the eyes or ears. It is not surprising that a Soviet scientist should study motor skills, since the Leninist epistemology stresses "knowing" by manipulating and transforming the world. No doubt there is official enthusiasm for any project that could increase muscular efficiency of workers, athletes, or cosmonauts. Bernstein's emphasis on the motor system is far from dreary propagandism, however—his ideas are refreshingly modern, and his pitch is directed toward down-to-earth research in neurology, child development, or brain physiology.

Along with neuropsychologists such as Lashley and Hebb, Bernstein sets aside the simplistic idea that integrated movements can best be described as a chain of interlocking reflexes. Although he does not deny that postural support and certain synergies of joint movement often have a reflexive basis, he emphasizes the more abstract underlying "plan of movement." Sequences of movement can be considered as *Gestalt* entities as well as visual groupings. For example, we can write our name large or small, quickly or slowly, on horizontal or on vertical surfaces. There is a large variety of human skills whose essential organization cannot be described in terms of the par-