

Essay Review

DAVID GOODING, TREVOR PINCH, AND SIMON SCHAFFER (eds.), *The uses of experiment: studies in the natural sciences*, Cambridge University Press, 1989, 8vo, pp. xvii, 481, illus., £17.50, \$29.95 (paperback).

FRANK A. J. L. JAMES (ed.), *The development of the laboratory: essays on the place of experiment in industrial civilization*, Houndmills and London, Macmillan Press, 1989, 8vo, pp. xvi, 260, illus., £37.50.

During the last few years, a few historians and sociologists of science have made the discovery that experiment and measurement are important and problematic parts of the scientific enterprise. The dazzle of this illumination carried conviction of its novelty; and the editors of *The uses of experiment* open their preface with the astonishing claim that “experiment is a respected but neglected activity”. A few lines later they specify not experiment, but “the process of experimentation” as the neglected subject, only to return immediately to their gambit: “the neglect of experiment is symptomatic of a prejudice against practical activity and in favour of speech acts”. Being editors, however, they are condemned to commit speech acts. These include calling attention to rhetorical devices by which scientists put forward arguments based on experiments and emphasizing the logical and epistemological difficulties of confirmation and corroboration of results of experiments and instrumental tests. These themes are important; they receive incisive treatment; but they do not have the freshness advertised.

The editor of *The development of the laboratory* also has the idea that he and his colleagues are among the very first to approach their subject. He remarks the “paucity of serious historical analysis” and the “neglect of the laboratory as a historical phenomenon worthy of investigation”. The narrow reading suggested by this judgement also informs the general organization of the volume, which has three sections: “chemical laboratories”, “the extension of laboratories to physics”, and “the large physics laboratories.” This arrangement does violence to history. Physics laboratories did not descend from chemistry laboratories: indeed, in continental universities, a *cabinet de physique* often existed before any special provision for instruction in chemistry, and included apparatus that chemistry later claimed as its own. It is a commonplace that Liebig, as professor of chemistry at Giessen invented the *teaching laboratory*; but that particular blend of pedagogy and practical work was a late entry among the laboratory types in European institutions.

Several contributions to *The development of the laboratory* suggest a reason why the literature on experiments and laboratories, ample as it is, has not the allure of writings on theory or personalities. The reason: it is easily made dull. Mari Williams and David Cahan give solid and detailed descriptions of the buildings of Pulkawa Observatory and the Physikalisch-Technische Reichsanstalt: but they do not say what use it is to know the sizes, costs, and places of things. William Brock’s essay on the architecture and furnishings of the Finsbury Technical College indicates how such details can have a wider significance and greater interest: Finsbury’s educational programme and its material manifestations, like long blackboards on pulleys, influenced much later construction in British technical institutes and teaching laboratories. An example of the dullness to which accounts of experiments are prone is David Gooding’s description of his repetition of Faraday’s early observations of the interactions of magnetic needles and current-carrying wires. Gooding rightly observes that Faraday’s notes of the observations are already at a considerable remove from the first groping, fumbling, and playing with the phenomena; but he does not show that anything more useful than this proposition results from placing his own detailed account beside Faraday’s.

These examples come from the second section of *The development of the laboratory*, which also includes essays on Harvard’s Jefferson Physical Laboratory by Lawrence Aronovitch, who follows and swallows the rhetoric of the laboratory’s promoters, and on J. J. Thomson as the leader of the Cavendish Laboratory by Isobel Falconer, who does not treat him very gently.

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The first section has a note by June Fullmer on Humphry Davy as a fund-raiser, an account of chemistry at the University of Glasgow from 1747 to 1818 by David Fenby, and a nice essay by Brian Gee on chemical amusement chests and portable laboratories. The third section contains an irrelevant and derivative piece by Andrew Pickering on the effect of military money on the direction of theoretical physics in the United States during the 1950s; a competent and informed retelling of the fight to site and build Fermilab by Catherine Westfall; and two episodes from the institutional history of CERN by John Krige and by Dominique Pestre.

The uses of experiment is a richer mixture than *The development of the laboratory*. It starts with a useful difference of opinion between W. D. Hackmann and J. A. Bennett about ways to categorize eighteenth-century scientific instruments (retrospectively, by sorts of use, or contemporaneously, by division of the trade), and a very nice essay by Simon Schaffer on the difficulties experienced by people who first tried to reproduce Newton's prism experiments. The problem contemporaries experienced in reproducing the apparatus of early-modern physics on the basis of written reports (and of which Schaffer and Steven Shapin have supplied another example in their *Leviathan and the air pump*) has its parallel in our century in the construction of the instruments of high-energy physics. In other restatements of developed positions, Geoffrey Cantor shows that rhetoric about the rhetoric of experiment is often mere rhetoric; John Krige rehearses the various reasons why Britain joined CERN; and Allan Franklin retells his arguments for the rationality of the procedures by which high-energy physicists decide whether their experiments confirm their theories.

Gooding and Pickering appear to better advantage in *The uses of experiment* than in *The development of the laboratory*. Gooding gives a plausible and useful account of the interaction between Faraday's theories and the methods—especially magnetic lines of force—he devised to describe his ideas and discoveries to others. Pickering develops his general analysis of the logic and sociology of modern physics. Taking as his case Giacomo Morpurgo's search for quarks, Pickering arrives at a recommendation of pragmatic realism: it is reasonable to take as real the concepts that make possible a three-way stabilization of the experimenters' material procedure (how they proceed in the laboratory), instrumental model (how they understand their apparatus), and phenomenal model (their conceptual understanding of the phenomena they are studying).

In the three remaining papers in this miscellany, James Secord examines with no particular result early Victorian arguments about the possibility of creating mites by electricity; Donald MacKenzie questions the relevance of flight tests of unarmed ICBM's over the Pacific Range to their likely performance on the itinerary to Moscow; and Peter Galison and Alexi Assmus chronicle C. T. R. Wilson's path from student of Scotch fogs to inventor of the cloud chamber. They observe that Wilson's work started in an effort to "mimic" nature in the laboratory—an old inspiration, incidentally, which has brought such notable instrumentation as the air pump—and ended, under the "analytic" impulse of Cambridge, in a device to study elementary particles.

Galison and Assmus quote from a letter by G. P. Thomson congratulating Wilson on receiving the Nobel prize. "Your work has always seemed to me the *beau ideal* of an experiment, carrying such immediate and complete conviction, and making real and visible what was before only, after all, a theory." There are few other places in *The uses of experiment* and *The development of the laboratory* that capture these fundamental elements of the experimenters' art and enthusiasm. It is not that historians, philosophers, and sociologists have not tried to capture the essence of experiment. It is that most of us are not good at it.

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